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West Indian Mammals from the Albert Schwartz Collection: Biological and Historical Information

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CONTENTS

ABSTRACT In the period 1954–1976, Albert Schwartz and several students working with him made extensive collections of mammals (ca. 2,000 specimens), reptiles and amphibians, birds, and butterflies in the West Indies. Schwartz's private collection of mammals from the West Indies is among the most comprehensive and important mammal collections from the region, yet much of it has never been reported in the scientific literature. Schwartz's original intent was to fully document all of the terrestrial mammals of the West Indies. In 1989, Schwartz transferred his mammal collection of some 6,500 specimens to the University of Kansas, and included in that collection were more than 1,400 specimens from the West Indies. It is our purpose herein to present a catalogue of the West Indian mammals assembled by Albert Schwartz, to offer critical comments on the taxonomic status of several species, as well as to report new biological information based on his specimens and field observations.

The Albert Schwartz Collection represents a unique sample of West Indian mammals that includes new island records and significant series of poorly known species that contribute to systematic and zoogeographic studies of the region. Detailed measurements and ecological information are presented in accounts of the following species: one species of marsupial, one species of noctilionid bat, five species of mormoopids, 18 species of phyllostomids, three species of natalids, three species of vespertilionids, five species of molossids, three species of capromyid rodents, two species of dasyproctid rodents, and one herpestid carnivore. Discussions are focused primarily on the Antillean populations of these taxa and when sufficient material is available taxonomic recommendations are presented.

KEY WORDS: West Indies; Mammalia; Chiroptera; Carnivora; Didelphimorphia; Rodentia; Systematics; Taxonomy; Biogeography.

INTRODUCTION

Albert Schwartz (1923–1992) amassed what is almost certainly the most important private collection of mammals from the West Indies that has ever been assembled. For more than two decades, from 1954 through 1976, a time period when travel and collecting were easy in many areas, Schwartz was able to collect throughout the islands of both the Greater and Lesser Antilles. In the West Indies, he collected nearly 2,000 mammal specimens with associated locality data, standard field measurements, and field observations. Schwartz's original intent was to document fully all of the terrestrial mammals of the West Indies so as to update G. M. Allen's (1911) classic work on the mammals of the West Indies. Remarkably Schwartz's efforts in the West Indies were focused primarily on reptiles and amphibians, and nearly 80,500 specimens were obtained over this time period, in addition to collections of mammals, birds (7,200 specimens), and butterflies. Duellman et al. (1993:927) considered Schwartz to be "the greatest contributor to West Indian zoology" that ever worked in the region and reported that he had published more than 230 papers on the West Indian biota.

Albert Schwartz was born in Cincinnati, Ohio, in 1923. He attended private schools and was well trained in the classics. He was fluent in German, French, and Spanish and could read Latin and Greek. Schwartz's M.S. studies were completed at the University of Miami, where his thesis was on the parasites of sharks. His Ph.D. work was undertaken at the University of Michigan under William H. Burt. His dissertation was *The land mammals of southern Florida and the upper Florida keys*. Schwartz was financially independent as a graduate student and used his resources to fund scientific collecting trips with fellow students. He loved Florida and lived in Miami for much of his life, both for the climate and the easy access it provided him to the West Indies. For additional details on Albert Schwartz's life and scientific endeavors, see Duellman et al. (1993), who provided an informative overview.

As a Ph.D. student in the mid-1940s, Schwartz began assembling a personal collection of mammals, amphibians, and reptiles, a labor of love that he would continue for the next four decades. In building his collections to be as broadly representative as possible, Schwartz exchanged specimens with a number of colleagues. Specimens he obtained from the West Indies are deposited now at the Academia de Ciencias de Cuba; the Royal Ontario Museum (ROM; these specimens originally exchanged to Russell E. Mumford then at Purdue University and later transferred to ROM); the University of Florida (UF); the University of Michigan (UMMZ); the University of Utah (UMNH); the Reading Public Museum, Reading, Pennsylvania (RPM); the U.S. National Museum of Natural History (USNM), in addition to the material at Kansas (KU). We have been unable to locate a few of the specimens clearly marked in his catalogs as exchanged. Schwartz obtained some bats from the Virgin Islands collected by Harry A. Beatty who had deposited them in the Reading Public Museum; this exchange took place when Schwartz was teaching at Albright College in Reading. Beatty was stationed at Christiansted, St. Croix, and employed by the Wildlife Research branch of the United States Department

of Interior in the 1940s. Schwartz allowed researchers, especially doctoral students, to study specimens in his collections, and a number of publications resulted; often new taxa and generic treatments were handled as collaborative papers (e.g., de la Torre and Schwartz, 1966; Jones and Schwartz, 1967; LaVal and Schwartz, 1974).

Schwartz stored his collections at his home in Miami. In 1989 he transferred the mammal collection of some 6,500 specimens to the University of Kansas. Included in that collection were more than 1,400 specimens from the West Indies. Herein we document the West Indian mammals assembled by Albert Schwartz between 1954 and 1976 and provide critical comments and suggestions on the taxonomic status of several species; furthermore, we report new ecological information that resulted from his field work based on his specimens, personal recollections, and field notes. The reptiles and amphibians he collected are now deposited at the University of Kansas as well. The birds are deposited at Louisiana State University, Batton Rouge.

The extant mammals of the Antilles are relatively few and are predominantly bats, so the region did not attract great attention by mammalogists until the 1950s and early 1960s with the advent of mist nets. The first and classic comprehensive discussion of the mammalian fauna of the West Indies was that of G. M. Allen (1911). Following the publication of Allen's list, and especially immediately following, a number of smaller papers dealing with the descriptions of new taxa and reports on collections from various islands appeared. More thorough studies were few, with the notable exceptions of Anthony's (1918) report on the mammals of Puerto Rico, Shamel's (1931a) analysis of the status of the American members of the free-tailed bat genus *Tadarida*, and Mohr's (1939) revision of the endemic capromyid rodents *Capromys* and *Plagiodontia*.

Beginning in the late 1950s with such publications as those of Simpson (1956), Koopman et al. (1957), Koopman (1958, 1959, 1968), Hall and Bee (1960), Jones and Schwartz (1967), Schwartz and Jones (1967), Choate and Birney (1968), and Jones and Phillips (1970), there was an explosion of descriptive work on West Indian mammals, especially bats. Varona's (1974) comprehensive work on living and extinct, terrestrial and marine Antillean mammals contains some generic reassignments that are not well documented; probably this is because only Cuban specimens were accessible to him. By far the most significant single contribution is Silva Taboada's *Los Murciélagos de Cuba* (1979), the authoritative compendium on Cuban bats. Other significant contributions include the revisions by Smith (1972) of the family Mormoopidae, LaVal (1973) on Neotropical *Myotis*, Jones and Phillips (1976) on Antillean *Sturnira*, Swanepoel and Genoways (1978) on *Brachyphylla*, Ottenwalder and Genoways (1982) on *Natalus micropus*, and a series of papers on *Artibeus jamaicensis* (Jones, 1978; Pumo et al., 1988, 1996; Phillips et al., 1989, 1991). A number of papers have dealt with the bats of several of the islands, including the Bahamas (Buden, 1975a, 1975b, 1976, 1977, 1985, 1986; Andersen, 1990; Clark and Lee, 1999), Dominica (Genoways et al., 2000), Haiti (Klingener et al., 1978; Woods, 1986), Grenada (Genoways et al., 1998), Guadeloupe (Baker et al., 1978), Marie-Galante (Masson et al., 1990), Montserrat (Jones and Baker, 1979; Pedersen et al., 1996), St. Vincent (Vaughan and Hill, 1996), and the Virgin Islands (Koopman, 1975). Baker and Genoways (1978), MacPhee et al. (1983, 1989), Morgan and Woods (1986), Jones (1989), Koopman (1989), Morgan (1989), Woods (1989), MacPhee and Iturralde-Vinent (1995), Hedges (1996), MacPhee (1996), Rodríguez-Durán and Kunz (2001), and Woods and Sergile (2001) presented major zoogeographic analyses of West Indian mammals. Morgan (2001) provided a useful overview of the zoogeography of the West Indian fossil bats.

Although the Chiroptera is the major group of mammals in the West Indies, there also are many extinct (and a few living) rodents and insectivores, especially on Cuba. Much of our knowledge of these mammals comes from the work of Luis S. Varona and Orlando H. Garrido. Varona (1974; and papers cited therein) recognized seven species of *Capromys* on Cuba and its islets. Garrido (1971) suggested a taxonomic arrangement in *Capromys* based on the size, shape, color, and texture of fecal pellets. Woods (1986) discussed the data on the Hispaniolan capromyid rodent *Plagiodontia* and the insectivore *Solenodon* and later the zoogeography of West Indian rodents (Woods, 1989). Most intriguing are Woods' (1986) suggestions that other "extinct" Hispaniolan insectivores and rodents may still be extant. Relatively recent (1983–1984) sightings of "unknown" mammals and "unknown" fecal pellets add substance to Woods' contentions.

Unfortunately, much of Schwartz's material has not been reported previously. At the time it was obtained, it was truly unique, but in the intervening years some of it has been superceded by other collections. Nevertheless, the Albert Schwartz Collection represents a unique sample of West Indian mammals that will not be duplicated. It is appropriate to report on the collection as a unit in order to document its unique nature and Schwartz's vision of a survey of West Indian mammals.

It is not our intention here to produce a *Mammals of the West Indies*, although a thorough revision of Allen's (1911) outdated work is sorely needed. Schwartz did amass a quantity of valuable data, including new island records and new and confirmatory information on several species. Specimens of four genera in the collection (*Ardops*, *Monophyllus*, *Myotis*, and *Sturnira*) already have been utilized for reviews and descriptions (see de la Torre, 1966; de la Torre and Schwartz, 1966; Jones and Schwartz, 1967;

Schwartz and Jones, 1967; LaVal, 1973; LaVal and Schwartz, 1974), but most of the collection has not been reported. The major contribution of this collection is in systematic and zoogeographic analyses, and the emphasis herein is directed to those two disciplines. Discussions are restricted to specimens from the Antilles wherever possible and little reference is made to specimens from mainland except where decidedly pertinent. We have limited ourselves in most cases to information from material in the Schwartz Collection, although we have studied comparative material in most other major North American collections. Where the collections are sufficiently comprehensive, we make taxonomic decisions when warranted.

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METHODS AND MATERIALS

In the following species accounts, detailed measurements (in millimeters) are given whenever possible for specimens in the collection. All external measurements were taken in the field from fresh animals with the exception of length of forearm in bats, which was taken later in the laboratory from preserved specimens. Cranial measurements are those customarily used; the measurement of greatest length of skull includes upper incisors, and length of upper toothrow includes the canines. In instances where there are only one to three individuals of a taxon, the individual measurements are listed. We have studied the specimens listed under "Specimens examined." The specimens listed under "Additional specimens" were studied by Schwartz and not us. In most cases these are specimens that he collected and we include his morphological and ecological data herein. All formal color designations are from Maerz and Paul (1950).

Our nomenclature follows Hall (1981), Wilson and Reeder (1993), and Koopman (1994). However, it should be noted that Schwartz, as a Latin scholar, would have

adamantly disagreed with a few points. He would have followed Varona (1974) and Silva Taboada (1979) in the spelling of the names of some species and used *blainvillei* rather than *blainvillii*, *macleayii* rather than *macleayi*, *parnelli* rather than *parnellii*, and *waterhousei* rather than *waterhousii*.

Through some undetermined misfortune, many of the skulls of Schwartz's Cuban material collected from 1956 to 1957 have been lost. Additionally, a sizable number of Cuban skins and skulls collected during this same time period were exchanged long before it seemed likely that these Cuban bats would be the subject for research. Consequently, data on several Cuban species (which Schwartz never did recollect in any numbers in subsequent years) are less comprehensive.

SYSTEMATIC ACCOUNTS

FAMILY DIDELPHIDAE

Didelphis marsupialis marsupialis Linnaeus, 1758
Southern Opossum

Southern opossums are well known to residents of those Lesser Antillean islands where it occurs—Grenada, St. Vincent, St. Lucia, Martinique, and Dominica, as well as on some of the Grenadines (Mustique, Bequia, Cannouan, Union, Carriacou, Isle Ronde—G. M. Allen, 1911; Varona, 1974). It is locally known as the *manicou*. We follow Varona (1974) and Husson (1978) in treating *Didelphis marsupialis insularis*, originally described based on material from Trinidad, as a junior synonym of *D. m. marsupialis*, as opposed to Hall (1981), who considered it to be a valid taxon. A male from Grenada has the following external and cranial measurements: total length, 715; length of tail, 375; length of hind foot, 61; length of ear, 46; greatest length of skull, 86.8; condylobasal length, 85.7; zygomatic breadth, 46.9; postorbital constriction, 11.6; mastoid breadth, 26.0; length of maxillary toothrow, 36.3.

Southern opossums are not especially common throughout the Lesser Antilles. Schwartz observed them occasionally crossing roads at night on Martinique (in the Pitons du Carbet near Deux Choux) and in the mountains and in similar situations near Fresh Water Lake on Dominica. Schwartz also observed a live-captured individual on Carriacou in the Grenadines.

De Vos et al. (1956) considered that *Didelphis* originally was introduced into the Lesser Antilles from Trinidad. As G. M. Allen (1911) pointed out, this notion apparently originated with J. A. Allen (1902:260), who at the time of the description of *D. m. insularis*, stated "St. Vincent, Grenada, and Dominica specimens...were most likely derived from the Trinidad stock, having doubtless been introduced into these islands from Trinidad." The lack of mention of the opossum by Du Tertre (who published on the fauna of several of the Lesser Antillean islands in 1667) on islands other than Grenada possibly means they did not occur elsewhere at that time. Evenso, the current Antillean distribution of *D. m. marsupialis* (Grenada to Dominica), and the presence of the species on several of the Grenadines, suggests to us that opossums are native to these southern Antillean islands. Alternatively, if opossums were introduced, this may have occurred during pre-Columbian times.

Specimen examined (1).—GRENADA. *St. George Parish*: Beausejour, 1 (KU 147047).

FAMILY NOCTILIONIDAE

Noctilio leporinus mastivus (Vahl, 1797)
Greater Fishing Bat

We follow Davis (1973), who considered all circum-Caribbean greater fishing bats (including those on the Central American and northern South American mainland) as *Noctilio leporinus mastivus*. The type locality for *N. l. mastivus* is St. Croix, U.S. Virgin Islands. Fishing bats are known to occur from Cuba and Jamaica east to St. Thomas and St. Croix, and then southward through the Lesser Antilles; they are known from St. Martin, Barbuda, St. Kitts, Antigua, Montserrat, Dominica, Martinique, St. Lucia, St. Vincent, Barbados, Grenadines, and Grenada (Jones, 1989; Koopman, 1989; Genoways et al., 2000).

The Schwartz Collection includes specimens taken by Richard Thomas, who collected nine *N. leporinus* at 1 km W of Copey on 12 September 1963. This series includes one male (skull not available) and eight females. External measurements for the nine specimens are: total length, 109–123 ($\bar{x}$ = 115.3); length of tail, 20–28 ($\bar{x}$ = 23.7); length of hind foot, 28–36 ($\bar{x}$ = 31.6); length of tragus, 6–7 ($\bar{x}$ = 6.2); length of forearm, 81.7–85.3 ($\bar{x}$ = 83.6). Cranial measurements for the eight females are: greatest length of skull, 24.6–27.8 ($\bar{x}$ = 26.7); condylobasal length, 24.4–25.6 ($\bar{x}$ = 24.9); zygomatic breadth, 18.7–19.9 ($\bar{x}$ = 19.3); postorbital constriction, 7.3–7.7 ($\bar{x}$ = 7.5); mastoid breadth, 16.8–18.5 ($\bar{x}$ = 17.6); length of upper toothrow, 10.2–10.5 ($\bar{x}$ = 10.4).

Five *N. leporinus* (2 males, 3 females) from the cave at Salt Pond Hill, Great Inagua Island, represent the first specimens of this genus from the Bahamas; this series was collected by Richard Thomas on 9–10 February 1967 and was reported by Buden (1986). External measurements for the series are: total length, 114–130 ($\bar{x}$ = 121.6); length of tail, 25–31 ($\bar{x}$ = 28.4); length of hind foot, 28–33 ($\bar{x}$ = 29.6); length of ear, 26–27 ($\bar{x}$ = 26.6); length of tragus, 6–7 ($\bar{x}$ = 6.2); length of forearm, 82.7–87.1 ($\bar{x}$ = 85.4). Cranial measurements for one male and three females are: greatest length of skull, 25.8–27.6 ($\bar{x}$ = 26.5); condylobasal length, 24.7–26.1 ($\bar{x}$ = 25.3); zygomatic breadth, 19.3–20.4 ($\bar{x}$ = 19.7); postorbital constriction, 6.9–7.4 ($\bar{x}$ = 7.2); mastoid breadth, 17.4–19.0 ($\bar{x}$ = 17.9); length of upper toothrow,

10.1–10.6 ($\bar{x}$ = 10.4). Both external and cranial measurements of these two series of fishing bats are quite comparable, and, despite slight differences in means and extremes, we assume them to represent the same taxon.

Specimens of *N. leporinus* from Hispaniola agree, with some exceptions, in size with those reported by Anthony (1918) from Puerto Rico; the Hispaniolan bats are somewhat smaller in total length (118–135 in Puerto Rican; 109–123 in Hispaniolan) and length of tail (30–35 in Puerto Rico; 28–36 in Hispaniola). Forearms are similar in length. The greatest length of skull in bats from Puerto Rico is slightly greater, and the postorbital constriction is distinctly smaller, than in the Hispaniolan bats. When data from the Bahamas series are combined with those from Hispaniola, differences between these two samples and that from Puerto Rico are even less pronounced. The concordance of measurements between the two lots of specimens is remarkable given the geographic distance and insular distribution.

The Hispaniolan bats are a sample of many individual found in both living and dead royal palms (*Roystonea hispaniolana*) adjacent to a small cattle pond in a stand of fairly mesic woodland in an otherwise xeric region in the western end of the Valle de Cibao. In one of the snags, the bats inhabited an abandoned West Indian Woodpecker (*Melanerpes superciliaris*) nest-hole; when burning material was stuffed into the opening of the cavity, the *Noctilio* quickly poured forth with their strong and deliberate flight in the bright sun of the afternoon, and after circling the roost tree and flitting about the pond, they quickly disappeared. A single *Molossus molossus* also inhabited the same cavity, but when this bat left the opening, it merely sidled down the side of the trunk and halted, where it was captured. The presence of fishing bats in this particular snag was indicated by a conspicuous V-shaped (with its apex at the hole) stain of fecal material and urine along the side of the trunk.

In a second tree at the same locality, *Noctilio* were visible from the ground; the bats were packed into an open slit in the side of the dead trunk about 3 m above the ground and were more or less exposed to daylight. At this tree, the bats were collected by shooting with .22 dust shot. A few of the many other living and dead *Roystonea* at this locality also were examined cursorily, but none was found to be occupied by *Noctilio* [from Schwartz's field notes].

The series from Inagua was collected in a cave at Salt Pond Hill, where the bats were in a cavity in the ceiling near the entrance. No other *Noctilio* were seen, but *Artibeus jamaicensis* was extremely abundant there. A female *N. leporinus* taken on 9 February 1967 contained a single fetus with a crown-rump length of 12 mm.

Klingener et al. (1978) took four greater fishing bats at Charlier and 1 km W of Miragoane in southwestern Haiti. The two fishing bats from Charlier were netted over a shallow stagnant pond where small fishes were active at the surface. The two specimens from Miragoane were taken over a marine lagoon. Ottenwalder (1978) reported a colony of about 60 *Noctilio* on Isla Beata (off the southern coast of Dominican Republic) in the Cueva de Duran, where three males were netted. The bats were in a narrow cavity in the form of a vertical tunnel with an oval opening about 20 by 28 cm. Ottenwalder (1979) also reported an adult female from 4 km E of La Descubierta, Dominican Republic, between 0130 and 0200 hr along the shore of Lago Enrquillo.

Despite the relatively few Hispaniolan locality records, *N. l. mastivus* is not uncommon, especially along the coasts. Schwartz saw them foraging over the ocean at Monte Cristi, over a slowly flowing pool in a lowland rushing stream near Paraíso, and over a placid lowland stream near Otra Banda, all in the Dominican Republic. The locality where they were by far the most common was in Pétionville in Haiti, where they came to a hotel swimming pool to drink immediately after dusk. Schwartz tried to secure specimens by various means (shooting was out of the question). His most complex net arrangement used four nets: two horizontal ones the length of the pool side-by-side with perhaps ten cm separating them and about five cm above the water, and one vertical net at each end of the pool. Despite this elaborate arrangement, Schwartz secured no specimens. The bats flew over the vertical nets and drank from the small space between the two flat nets, without any obvious hesitation.

A single Cuban experience of Schwartz's is worth recounting. Several *Noctilio* were seen coursing along a slowly flowing stream through a pasture. An old cement bridge about three m in length crossed the stream, and the bats regularly flew under it. A single net, suspended from the bridge caught nothing; the bats merely shifted their tactics and flew over (rather than under) the bridge so as to avoid the net.

The Hispaniolan specimens have a prominent cream to pale orange (depending on the intensity of the dorsal pelage color) median dorsal stripe. The dorsal pelage itself varies in intensity of color from dull orange-brown (P1. 14E9) to pale tan (Pl. 14B3), whereas venters vary from bright orange (P1. 11F10) to pale tan (P1. 11C3). The single male and two females are at the brighter extreme, and the remaining females form a graded series from this bright condition to the pale coloration. No obvious sexual dichromatism is present. Ottenwalder (1978) described the coloration of males from Isla Beata as grayish brown to brown or orange. Schwartz's five specimens from Inagua are distinctly more drab in pelage color than those from Hispaniola; the middorsal line is white, and the dorsal pelage is grayish tan with no evidence of orange.

A pair of fluid-preserved *Noctilio* are from 7 km SW of

San José de las Lajas, Provincia de La Habana, Cuba; these specimens, collected on 24 February 1955 by Gilberto Silva Taboada, are part of a larger series taken from a cavity in a *Roystonea*. The forearms of these two bats measure 89.7 (male) and 89.1 (female). We examined three fluid-preserved *N. l. mastivus* (1 male, 2 females) from Le Carbet, Martinique, through the courtesy of Père Pinchon. Pinchon (1967) also reported the species from Desirade.

Specimens examined (16).—BAHAMAS. *Great Inagua*: Salt Pond Hill, 5 (KU 150728–32). CUBA. *Provincia de La Habana*: 7 km SW San José de las Lajas, 2 (KU 151198–99). DOMINICAN REPUBLIC. *Provincia de Monte Cristi*: 1 km W Copey, 9 (KU 150733–40, KU 151757).

Additional specimens (3).—MARTINIQUE. Le Carbet, 3 (SCFF).

FAMILY MORMOOPIDAE

Mormoops blainvillii Leach, 1821

Antillean Ghost-faced Bat

We follow Smith (1972) in the use of the name *Mormoops blainvillii* for this species rather than *Aello cuvieri*, as used by Hall (1981). *Mormoops blainvillii* is found throughout the Greater Antilles.

External measurements of eight males and eight females from Cuba are: total length, 77–86 ($\bar{x}$ = 80.0); length of tail, 23–30 ($\bar{x}$ = 27.0); length of hind foot, 8–11 ($\bar{x}$ = 9.1); length of ear, 11–14 ($\bar{x}$ = 12.3); length of tragus, 4–7 ($\bar{x}$ = 5.5); length of forearm (16 males, 13 females, 2 unsexed), 43.4–47.5 ($\bar{x}$ = 45.9). Cranial measurements from a series of five males, four females, and two unsexed specimens are: condylobasal length, 13.1–14.0 ($\bar{x}$ = 13.6); zygomatic breadth, 8.2–8.8 ($\bar{x}$ = 8.5); postorbital constriction, 4.2–4.8 ($\bar{x}$ = 4.5); mastoid breadth, 7.2–7.5 ($\bar{x}$ = 7.4); length of upper toothrow, 7.3–7.8 ($\bar{x}$ = 7.5). A female from the Dominican Republic has the following external and cranial measurements: total length, 86; length of tail, 28; length of hind foot, 10; length of ear, 12; length of tragus, 5; length of forearm, 47.3; condylobasal length, 13.8; zygomatic breadth, 8.6; postorbital constriction, 4.4; mastoid breadth, 7.4; length of upper toothrow 8.0. A fluid-preserved male from Haiti has a length of forearm of 48.7.

The bats from Cuba are more or less dichromatic, although most of the specimens are a rich orange-brown above. Two individuals are pale tan above. An adult male (KU 150662) is unique in that the wing tips lack the customary dark pigment and are white; also there are unpigmented areas on the uropatagium and elsewhere on the wing membranes. Other bats from this same locality are normally pigmented. The color of Hispaniolan specimens differs strongly from the Cuban specimens; Hispaniolan animals are dark mahogany brown above with no trace of the bright orange pigment typical of Cuban *M. blainvillii*. The hair bases, which in bright Cuban specimens, are deep orange, are buffy, grading to medium brown tips.

We found no differences in morphological measurements between five specimens (two males, two females, one unsexed) from Jamaica, which is the type locality of *M. blainvillii*, and the corresponding measurements of a series from Cuba, for which the name *cinnamomeum* is available. Ranges of the measurements of Jamaican specimens are: length of forearms, 46.3–47.2; condylobasal length, 13.3–13.8; postorbital constriction, 4.2–4.5; mastoid breadth, 7.3–7.4; length of upper toothrow, 7.4–7.8. The single skin available to us from Jamaica is a rich orange-brown, like most Cuban specimens, and not so dark (mahogany) as specimens from the Dominican Republic. These data support Smith's (1972) conclusion not to recognize *cinnamomeum*. Varona (1974) and Silva Taboada (1979) also did not use the subspecific designation *M. b. cinnamomeum*.

Comparisons of our measurements of Cuban bats with those of a series of five females from Puerto Rico as given by Anthony (1918) demonstrate that these two samples are quite similar both in means and extremes, although in most external and cranial measurements, the Puerto Rican series averages slightly larger. Earlier Rehn (1902) had differentiated *cinnamomeum*, on the basis of the form of the first upper premolar, but Anthony (1918) commented that this character was inconsistent and of little value as far as differentiating this subspecies. Our examination of skulls of both forms confirms Anthony's conclusion. Based upon these data we are in agreement with Smith (1972) that *M. blainvillii* should be considered a monotypic species.

Most of the Cuban specimens were taken from, or at the entrances of, caves. The species was abundant in Cueva del Río at San Vicente and equally so at a cave near Guanajay. At the former locality, *M. blainvillii* occurs with *Pteronotus macleayii, P. parnellii, P. quadridens,* and *Phyllonycteris*, and at the latter with *Natalus lepidus, P. parnellii,* and *P. quadridens*. One specimen from Pan de Guajaibon was netted in open hardwood forest at night. The single Hispaniolan individual, examined through the courtesy of Père Pinchon, was captured by a local resident at an elevation of 610 m in an unknown situation.

Specimens examined (45).—CUBA. *Provincia de Pinar del Río*: Cueva de William Palmer, Guanajay, 11 (KU 150668, KU 151156–60, KU 152319–23); Cueva del Río, San Vicente, 12 (KU 150667, KU 150669–71, KU 151148–55); north side Pan de Guajaibon, 1 (KU 152324); *Provincia de Sancti Spíritus*: Cuevas de los Masones, Trinidad, 6 (KU 150662–66, KU 152318). DOMINICAN REPUBLIC. *Provincia de La Vega*: 12 km NE Jarabacoa, 2000 ft, 1 (KU 150672); *Provincia de Pedernales*: 8 km N, 2 km E Cabo Rojo, 12 (KU 150673–83, KU 151147). JAMAICA. Moneague, 1 (USNM 96197); Kingston, 1 (USNM 113254).

Additional specimens (7).—CUBA. *Provincia de Pinar del*

Río: Cueva de William Palmer, 5 (UMNH 16504–05 [= AS 4691–92]; RPM 2002C-5-223 [=A 4695]; AS 4693–94 exchanged Mumford); *Provincia de Santiago de Cuba*: Frank Crest, Sierra de Cristal, 1 (YPM). HAITI. *Dépertement de l'Ouest*: Port-au-Prince, 1 (SCFF).

Pteronotus davyi davyi Gray, 1838
Davy's Naked-backed Bat

Smith (1972; see also G. M. Allen, 1911) summarized the previous records of Davy's naked-backed bat in the West Indies, whence it has been known from the islands of Dominica since 1892 and Grenada since 1894 (Jones, 1951). Through the courtesy of Père Pinchon, Schwartz was able to examine five fluid-preserved specimens of *Pteronotus davyi* from the islands of Marie-Galante and Martinique, reported by Jones and Phillips (1970). The four specimens (one subsequently donated to Schwartz) from Marie-Galante were taken at Trou-a-Diable on 23 August 1964, and the one specimen from Martinique was captured from the village of Tartane on the Presqu'ile de la Caravelle on 18 April 1964. Martinique is the island just south of Dominica in the Lesser Antilles, and Marie-Galante, although contiguous with Guadeloupe, lies just north of Dominica and between that island and Guadeloupe. Thus, *P. davyi* has a fairly compact distribution in the Lesser Antilles; probably it will be found on other islands in the chain, at least between Martinique and Grenada.

Schwartz visited the large cave at Trou-a-Diable on Marie-Galante; the entrance to the moist cave is in a mesic, forested ravine. No bats were seen. Although Schwartz also had been to Tartane on Martinique, he did not visit the cave there. The countryside in general was arid, with xeric forest in undisturbed regions. Apparently, from the distinct contrast in habitat of these two regions, *P. davyi* occupies suitable caves regardless of their environs. Schwartz found the cave at Trou-a-Diable also closely agreed with the statement by Goodwin and Greenhall (1961) that on Trinidad *P. davyi* roosts in large, dark, damp caves where the air is humid. Schwartz never collected *P. davyi* on Dominica, perhaps because the only cave visited there was a sea cave adjacent to the ocean and thus not at all comparable to the cave at Trou-a-Diable.

The five *P. davyi* reported here are three males and two females. The forearm measurements vary from 45.8 to 47.4. Goodwin and Greenhall (1961) gave extremes of 46.8 and 48.4 for six topotypical *P. davyi* from Trinidad.

Specimen examined (1).—MARIE-GALANTE. Trou-a-Diable, 1 (KU 150684).

Additional specimens (4).—MARIE-GALANTE. Trou-a-Diable, 3 (SCFF). MARTINIQUE. Tartane, 1 (SCFF).

Pteronotus macleayii macleayii (Gray, 1839)
Macleay's Mustached Bat

Pteronotus macleayii is known from Cuba and Jamaica, but we have no material from the latter island for comparisons with the series of 17 specimens from Cuba. External measurements (14 males, 3 females) are: total length, 63–70 ($\bar{x}$ = 66.8); length of tail, 19–25 ($\bar{x}$ = 22.3); length of hind foot, 9–11 ($\bar{x}$ = 10.0); length of ear, 16–18 ($\bar{x}$ = 17.0); length of tragus, 5–7 ($\bar{x}$ = 6.1); length of forearm, 40.5–43.7 ($\bar{x}$ = 42.0). Cranial measurements for two males are: greatest length of skull, 16.0, 16.0; condylobasal length, 15.1, 15.4; zygomatic breadth, 8.0, 7.9; postorbital constriction, 3.3, 3.3; mastoid breadth, 8.2, 8.4; length of upper toothrow 6.8, 6.7.

As far as our series is concerned, *P. m. macleayii* does not show quite the variation in dorsal color as does *P. quadridens torrei*, with which it may be easily confused (see account of latter for methods of differentiation). The dorsal pelage is always some shade of brown, commonly with a distinctly grayish cast, so that *P. m. macleayii* generally is paler (more gray) than the brown phase occurring in *P. q. torrei*. None of the *P. macleayii* shows the orange or reddish phase that occurs in *P. quadridens*. Rehn (1904) presented data for recognition of the Jamaican subspecies, *P. m. grisea*, although his sample size was not large. Smith (1972) accepted both subspecies because he found that *P. m. macleayii* were significantly smaller than *P. m. grisea* in all but one of 11 cranial measurements and in length of forearm.

Pteronotus macleayii macleayii was especially abundant in the Cueva del Río at San Vicente, where most of the specimens were taken. The specimen from Soledad was taken in a mist net stretched across a decorative pool in a grove of royal palms.

Specimens examined (17).—CUBA. *Provincia de Cienfuego*: Guajimico, 1 (KU 152325); Harvard Gardens (Jardín Botánico), Soledad, 1 (KU 152325); *Provincia de Pinar del Río*: Cueva del Río, San Vicente, 15 (KU 151161–65, KU 152326–35).

Additional specimens (5).—CUBA. *Provincia de Pinar del Río*: Cueva del Río, San Vicente, 5 (ROM 77756 [= AS 4716]; RPM 2002C-5-225 [= AS 4717]; UMNH 16501–02 [= AS 4712–13]; AS 4715 exchanged to Mumford).

Pteronotus parnellii (Gray, 1843)
Parnell's Mustached Bat
Pteronotus parnellii parnellii (Gray, 1843)

Pteronotus parnellii occurs in Mexico, Central America, and much of northern South America. In the Antilles, it is known from throughout the Greater Antilles and has recently been reported from St. Vincent in the Lesser Antilles (Vaughan, 1995; Vaughan and Hill, 1996). *Pteronotus parnellii parnellii* is represented in the Schwartz Collection

by a series from one locality on Jamaica and from three localities on Cuba. The specimens from Jamaica are darker dorsally those from Cuba. External measurements of the seven individuals (4 males, 3 females) from Jamaica are: total length, 80–86 ($\bar{x}$ = 82.7); length of tail, 18–20 ($\bar{x}$ = 19.6); length of hind foot, 11–14 ($\bar{x}$ = 12.4); length of ear, 17–20 ($\bar{x}$ = 18.4); length of tragus, 7–9 ($\bar{x}$ = 8.0); length of forearm, 52.5–54.0 ($\bar{x}$ = 53.4). Cranial measurements (3 males, 2 females) are: greatest length of skull, 19.7–20.7 ($\bar{x}$ = 20.2); condylobasal length, 19.1–19.6 ($\bar{x}$ = 19.4); zygomatic breadth, 11.0–11.5 ($\bar{x}$ = 11.3); postorbital constriction, 3.9–4.3 ($\bar{x}$ = 4.1); mastoid breadth, 10.5–10.8 ($\bar{x}$ = 10.7); length of upper toothrow (1 specimen), 8.9.

Koopman and Williams (1951) regarded this species to be common on Jamaica. Windsor Cave, where Schwartz obtained his series of bats, opens from a small entrance in mesic forest on the limestone hillside above the old Windsor plantation house. The cave is large and extensive, but the bats were not common; the specimens were shot as they flew near the high ceiling in the darker and deeper portions of the cave.

Schwartz also found *Pteronotus p. parnellii* at three localities in Cuba; at Cueva del Río in Provincia de Pinar del Río, it was a common, whereas at two other localities it appeared to be less abundant. External measurements (8 males, 4 females) from Cuba are: total length, 74–86 ($\bar{x}$ = 78.3); length of tail, 18–24 ($\bar{x}$ = 20.8); length of hind foot, 10–13 ($\bar{x}$ = 12.2); length of ear, 19–22 ($\bar{x}$ = 20.2); length of tragus, 5–9 ($\bar{x}$ = 6.4); length of forearm, 50.0–52.3 ($\bar{x}$ = 51.2). Cranial measurements (2 males, 1 female) are: greatest length of skull, 19.3–20.5 ($\bar{x}$ = 20.0); condylobasal length, 18.6–20.1 ($\bar{x}$ = 19.6); zygomatic breadth, 10.9–11.6 ($\bar{x}$ = 11.2); postorbital constriction, 4.0–4.3 ($\bar{x}$ = 4.2); mastoid breadth, 10.2–10.7 ($\bar{x}$ = 10.5); length of upper toothrow, 8.8–9.0 ($\bar{x}$ = 8.9).

All of the Cuban specimens were associated with caves. Cueva del Río at San Vicente is a large, complex cavern in the Mogote section of the province. As its name implies, an underground stream passes through the lower galleries. The cave generally is moist and is inhabited by several species of bats, of which *P. parnellii* is one of the more common. Specimens from Guanajay and Trinidad were taken from caves that are similar in that both open to the surface via large and vertical flues. Mustached bats were collected by stretching either brown wrapping paper or mist nets across the opening when the bats returned to the caves.

Specimens examined (18).—CUBA. *Provincia de Pinar del Río*: Cueva del Río, San Vicente, 9 (KU 150686–87, KU 151166–67, KU 152339–43); Cueva de William Palmer, Guanajay, 1 (KU 152338); *Provincia de Sancti Spíritus*: Cueva de los Masones, Trinidad, 1 (KU 150685). JAMAICA. *Trelawny Parish*: Windsor Cave, 7 (KU 150688–93, KU 152344).

Additional specimens (3).—CUBA. *Provincia de Pinar del Río*: Cueva del Río, San Vicente, 3 (ROM 77751 [= AS 4705]; RPM 2002C-5-224 [= AS 4706]; UMNH 16500 [= AS 4704]).

Pteronotus parnellii pusillus (G. M. Allen, 1917)

Pteronotus parnellii pusillus, which is confined to Hispaniola, is the smallest of the living subspecies (Smith, 1972). External and cranial measurements of a male from the Dominican Republic are: total length, 70; length of tail, 15; length of hind foot, 11; length of ear, 17; length of tragus, 5; length of forearm, 50.8; greatest length of skull, 19.0; condylobasal length, 17.2; zygomatic breadth, 10.2; postorbital constriction, 3.8; mastoid breadth, 9.8; length of upper toothrow, 8.0. Two females captured on 1 and 3 July 1974 in Grotte de Paudin were pregnant with single embryos measuring 28 in crown-rump length.

Specimens examined (5).—DOMINICAN REPUBLIC. *Provincia de Pedernales*: 7 km N Cabo Rojo, 1 (KU 150694). HAITI. *Dèpartement de l'Artibonite*: Grotte de Paudin, 2.2 mi E Carrefour Marmelade, 3400 ft, 4 (KU 152200–1, KU 152336–7).

Pteronotus quadridens (Gundlach, 1840)
Sooty Mustached Bat

Sooty mustached bats, *Pteronotus quadridens*, are known only from the Greater Antilles, with two subspecies currently recognized—*P. q. fuliginosus* from Jamaica, Hispaniola, and Puerto Rico, and *P. q. quadridens* from Cuba.

Pteronotus quadridens fuliginosus (Gundlach, 1840)

Smith (1972) considered the taxon *Chilonycteris macleayii inflata* described from Puerto Rico by Rehn (1904) as a junior synonym of *Pteronotus f. fuliginosus*. With the current use of name *P. quadridens* for this species, *inflata* is now a junior synonym for *P. q. fuliginosus*. This bat is currently known to occur on Puerto Rico, Hispaniola, and Jamaica (Rodríguez-Durán and Kunz, 1992).

External and cranial measurements of three specimens (1 male from Sosúa, RD; 1 female from 6 mi NW of Oviedo, RD; and 1 female from 7.5 km E of Guánica, Puerto Rico, respectively) are: total length, 65, 65, 66; length of tail, 18, 20, 19; length of hind foot, 7, 10, 9; length of ear, 15, 17, 15; length of tragus, 5, 6, 5; length of forearm, 38.5, 40.7, 38.7; greatest length of skull, 14.5, 14.9, 14.5; condylobasal length, 14.1, –, 13.7; zygomatic breadth, 7.5, 7.8, 7.4; postorbital constriction, 3.3, 2.9, 3.4; mastoid breadth, 7.9, 8.1, 7.9; length of upper toothrow, 6.0, 6.0, 5.8. Two of these three specimens are the dark blackish brown phase, and the other is a reddish brown phase. The differences in coloration are due to the triple banding of the individual hairs—a dark base, a wide pale band, and a dark tip. In the reddish brown phase, the intermediate band has a buffy or orange hue,

whereas in the dark phase this intermediate band is cream. Additionally, the bases and tips differ in the intensity of brown in the two phases; the dark-phase bats have the bases and tips nearly black rather than brown.

The single individual from Sosúa was netted in a small patch of mesic forest near the coast, and the individual from near Oviedo was shot in xeric coastal forest. In both instances, large numbers of these bats were seen well before dark in the late afternoon. At Boca de Yuma, La Altagracia Province, RD, Schwartz observed them to be abundant in the forest covering the limestone hills above the ocean, but none was secured. The specimen from Guánica was taken in a mist net across a seldom-used dirt road in xeric forest in extreme southwestern Puerto Rico. A female from Pétionville, Haiti was lactating when captured on 9 June 1974.

One female was reported from Zapoti, Dépt. de la Grand Anse, Haiti by Klingener et al. (1978), and one gravid female was taken on 27 May in a mist net at 1250 m on the north slope of Pic Macaya in the Massif de la Hotte, Haiti (Woods, 1986).

Specimens examined (6).—DOMINICAN REPUBLIC. *Provincia de Pedernales*: 6 mi NE Oviedo, 1 (KU 152345); *Provincia de Puerto Plata*: Sosúa, 1 (KU 150695). HAITI. *Dépertement de l'Ouest*: Pétionville, 1500 ft, 3 (KU 150696–97, KU 152346). PUERTO RICO. *Guánica*: 7.5 km E Guánica, 1 (KU 150698).

Pteronotus quadridens quadridens (Gundlach, 1840)

We follow Silva Taboada (1976) in using the specific name *Pteronotus quadridens* for this species, which had previously been known as *P. fuliginosus*. Smith (1972) treated the taxon *P. (Chilonycteris) torrei* from Cuba, previously recognized as a distinct species, as a subspecies of *fuliginosus*. With the recognition of *quadridens*, also described based on bats from Cuba, as the appropriate name for this species, *P. f. torrei* G. M. Allen, 1916, now becomes a junior synonym of *P. q. quadridens*.

On Cuba, *Pteronotus q. quadridens* is most easily confused with its congener, *P. macleayii*. However, the two species are readily differentiated in the structure of the muzzle as detailed and illustrated by G. M. Allen (1916). *Pteronotus q. quadridens* has four to six small round warts above the nostrils, whereas *P. macleayii* has a pair of flat and unadorned plates in this same region. Furthermore, in *P. q. quadridens* the length of the forearm is 35.7–38.6, and that of *P. macleayii* is 40.5–43.7. The geographic distributions of these two small Greater Antillean *Pteronotus* form an interesting pattern, with *P. quadridens* on Cuba, Jamaica, Hispaniola, and Puerto Rico, and *P. macleayii* on Cuba and Jamaica. The two species thus occur together on two islands, whereas *P. quadridens* occurs alone on Hispaniola and Puerto Rico.

Schwartz collected five males and 14 females, all from Provincia de Pinar del Río, Cuba. External measurements of this series are: total length, 58–66 ($\bar{x}$ = 63.0); length of tail, 15–22 ($\bar{x}$ = 18.4); length of hind foot, 7–10 ($\bar{x}$ = 8.4); length of ear, 14–17 ($\bar{x}$ = 15.1); length of tragus, 4.9 (4–5); length of forearm, 35.7–38.6 ($\bar{x}$ = 37.1). Cranial measurements from one male and nine females are: greatest length of skull, 13.5–14.4 ($\bar{x}$ = 14.1); condylobasal length, 13.1–13.8 ($\bar{x}$ = 13.6); zygomatic breadth, 7.3–7.5 ($\bar{x}$ = 7.4); postorbital constriction, 2.8–3.1 ($\bar{x}$ = 3.0); mastoid breadth, 7.3–7.9 ($\bar{x}$ = 7.7); length of upper toothrow, 5.7–6.0 ($\bar{x}$ = 5.9). Dorsally, two specimens are bright orange, whereas most others are brown. The shade of brown varies, from plain or medium brown to a much darker hue. The variation in color is similar to that seen in *P. q. fuliginosus*. A female from Cueva del Río, Cuba, carried a single near term embryo when captured on 24 June 1957.

All specimens were taken within or at the entrances of caves in Cuba. At San Vicente, *P. quadridens* was extremely abundant, and well before dusk a stream of these bats regularly left the cave and followed an apparently identical course between palms and hardwood trees for a distance of about 0.5 km, where the bats dispersed as they came to a paved road. This pattern of behavior was noted whenever Schwartz and his students visited San Vicente between 1956 and 1960; the number of *Pteronotus* involved in the stream was not calculable. The same streaming phenomenon for *P. q. fuliginosus* was observed at Boca de Yuma, La Altagracia Province, Dominican Republic. The early departure from its diurnal retreat aids in detecting the presence of *P. quadridens*. Sampedro Marín et al. (1977) reported thousands of these bats in a "hot cave" (Cueva de Guanagasa, Cuba) on 20–21 April. The first bat left the cave at 1842 hr (11 min before sunset); after 1947 hr no more bats were netted leaving the cave. Returnees began arriving at 1941 hr and continued until 0547 hr, 17 min before sunrise.

Specimens examined (18).—CUBA. *Provincia de Pinar del Río*: Cueva de los Indios, 0.5 mi S San Vicente, 1 (KU 150707); Cueva del Río, San Vicente, 16 (KU 150699–06, KU 151168–72, KU 152348–50); Cueva de William Palmer, Guanajay, 1 (KU 152347).

Additional specimens (2).—CUBA. *Provincia de Pinar del Río*: Cueva del Río, San Vicente, 2 (ROM 77754, 77755 [= AS 4906, 4909]).

FAMILY PHYLLOSTOMIDAE

Ardops nichollsi nichollsi (Thomas, 1891)
Lesser Antillean Fig-eating Bat

The four Antillean endemic stenodermatine genera, *Ardops*, *Ariteus*, *Phyllops*, and *Stenoderma* were all placed in the genus *Stenoderma* by Varona (1974); however, all subsequent authors have regarded these genera as distinct. Four

species in the genus *Ardops* endemic to the Lesser Antilles were recognized prior to the taxonomic revision by Jones and Schwartz (1967), who arranged these taxa as the subspecies of a single species and described one additional subspecies based in part on specimens in the Schwartz Collection. *Ardops nichollsi nichollsi*, the subspecies on Dominica, are the smallest members of the species. This bat is represented in the Schwartz Collection by the skin of an adult male taken in a mist net over a stream in rainforest on Dominica by R. F. Klinikowski on 15 February 1962. External measurements are: total length, 60; length of hind foot, 11; length of ear, 16; length of tragus, 5; length of forearm, 43.2.

Specimen examined (1).—DOMINICA. *St. Paul Parish*: 6 mi NE Roseau, 1 (KU 152362).

Ariteus flavescens (Gray, 1831)
Jamaican Fig-eating Bat

Richard Thomas netted a single male at Long Bay, 6.5 km N of Negril, Jamaica on 3 July 1967. The immediate vicinity was coastal woods (*Coccoloba, Terminalia*) on sandy soil, and there are probably no caves in the vicinity for several kilometers. Measurements of this individual are: total length, 52; length of hind foot, 10; length of ear, 16; length of tragus, 6; length of forearm, 39.1; greatest length of skull, 18.9; condylobasal length, 15.5; zygomatic breadth, 12.9; postorbital constriction, 4.5; mastoid breadth, 10.7; length of upper toothrow, 5.2. The adult male is tan above with small white epaulettes and only slightly paler tan below. Wing membranes and uropatagium are concolor with the dorsum.

Specimen examined (1).—JAMAICA. *Hanover Parish*: Long Bay, 4 mi N Negril, 1 (KU 151327).

Artibeus

Three members of the large Neotropical stenodermine genus *Artibeus* currently are recognized as occurring in the West Indies—*A. glaucus, A. jamaicensis,* and *A. lituratus. Artibeus glaucus* is much smaller than the other two species and, although widely distributed in northern South America, is known in the West Indies only from Grenada at the southern-most tip of the Lesser Antilles. This species is represented by one specimen in the Schwartz Collection. *Artibeus jamaicensis* is represented in the Schwartz Collection by four subspecies. *Artibeus lituratus* is the largest of the three species, although it is often confused with *A. jamaicensis*. *Artibeus lituratus* also has a very limited distribution in the West Indies, being known only from Grenada and St. Vincent (Genoways et al., 1998), and it is not represented in the Schwartz Collection.

Artibeus glaucus bogotensis Andersen, 1906
Small Fruit-eating Bat

Koopman (1958; also Jones and Phillips, 1970) reported a single specimen of this species from Grenada and regarded it as possibly an accidental record, because it otherwise is unknown from the Lesser Antilles. However, Genoways et al. (1998) reported five specimens from Grenada, including the specimen from the Schwartz Collection, a male that was netted at a locality 8 mi NE of St. George's on 19 November 1961. This locality is on the exposed southwestern slopes of the mountains on the road to Grand Étang. The net was placed across a small grassy clearing adjacent to cut-over forest; one *Artibeus jamaicensis* was the only other bat netted at this locality.

External and cranial measurements of this specimen are: total length, 60; length of hind foot, 12; length of ear, 15, length of tragus, 7; length of forearm, 40.5; greatest length of skull, 21.2; condylobasal length, 18.8; zygomatic breadth, 11.8; postorbital constriction 5.4; mastoid breadth, 10.7; length of upper toothrow, 6.9. Genoways et al. (1998) compared the measurements of their sample from Grenada with a sample from Trinidad and found that there were no significant differences. The pelage is brown above with the hairs buffy gray basally. The ventral fur is brown, paler than that of the back, and the hairs lack grayish bases. Two pairs of buffy facial stripes are prominent.

Specimen examined (1).—GRENADA. *St. George Parish*: 8 mi NE St. George's, 1 (KU 151328).

Artibeus jamaicensis Leach, 1821
Jamaican Fruit-eating Bat

Jamaican fruit bats are among the most widely distributed and locally abundant of all Neotropical bats (Ortega and Castro-A., 2001). *Artibeus jamaicensis* occurs from Mexico to Central and tropical South America and is common throughout much of the West Indies. Generally, it is by far the most common bat encountered, either during the day in caves or in mist nets at night. In many instances, it is taken to the exclusion of any other species. Because it is represented by large numbers of specimens in most collections from the West Indies, various names have been proposed for presumably distinct insular populations. The geographic ranges ascribed to the Antillean subspecies recognized herein are: *A. j. grenadensis* (Grenada), *A. j. jamaicensis* (Jamaica, Isla San Andrés, Isla Providencia, Hispaniola [including Ile de la Gonâve], Puerto Rico, and eastward and southward through the Virgin Islands and the Lesser Antilles as far south as St. Lucia and Barbados), *A. j. parvipes* (Cuba, Isla de la Juventud, Mayaguana, and Great Inagua), and *A. j. schwartzi* (St. Vincent and some of the Grenadines). Recent molecular studies strongly support this taxonomic arrangement within *A. jamaicensis* (Phillips et al., 1989, 1991; Pumo et al., 1988, 1996).

Artibeus jamaicensis grenadensis Andersen, 1906

Genoways et al. (1998) demonstrated that *Artibeus jamaicensis grenadensis* Andersen is worthy of distinction

Table 1. External and cranial measurements (in mm) of Antillean populations of *Artibeus jamaicencis*. In each column, the mean is followed by the range.

Island and Statistics	Total length	Length of hind foot	Length of ear	Length of tragus	Length of forearm	Greatest length of skull	Condylo-basal length	Zygo-matic breadth	Post-orbital constriction	Mastoid breadth	Length of upper toothrow
Jamaica	87.6	17.7	21.7	7.6	60.6	28.5	25.5	17.6	7.3	15.2	10.1
(*N* = 1 ♂, 8 ♀)	84.0–91.0	16.0–20.0	20.0–23.0	7.0–9.0	57.1–64.3	27.9–29.2	24.8–26.3	17.1–17.8	6.6–7.7	14.8–15.8	9.8–10.7
Cayman Islands	77.8	15.8	19.7	6.9	57.5	27.3	24.2	16.5	7.0	14.4	9.5
(*N* = 11 ♂)	74.0–82.0	15.0–17.0	19.0–21.0	6.0–8.0	56.3–59.2	26.8–28.1	23.5–25.0	16.3–16.8	6.8–7.1	14.0–14.7	9.2–9.9
Cuba	79.8	16.2	18.7	6.6	56.3	26.9	24.2	16.5	7.0	14.4	9.4
(*N* = 22 ♂, 29 ♀)	74.0–90.0	14.0–20.0	16.0–21.0	5.0–8.0	52.5–59.6	26.2–27.8	23.0–24.6	15.7–17.3	6.8–7.1	13.9–14.9	8.9–9.8
Great Inagua	75.3	14.0	20.0	6.0	55.6	27.0	24.2	16.0	7.1	14.6	9.6
(*N* = 12 ♂, 5 ♀)	70.0–80.0	14 .0–14.0	19.0–21.0	6.0–6.0	53.0–58.2	26.2–28.4	23.4–25.1	15.3–17.0	6.8–7.3	14.0–15.3	9.4–10.1
Isla Juventud	—	—	—	—	56.7	27.1	24.0	16.0	7.1	14.8	9.4
(*N* = 4 ♂, 16 ♀)	—	—	—	—	52.5–59.7	26.4–28.0	23.4–25.0	15.8–16.5	6.6–7.7	14.1–15.5	9.1–9.6
Hispaniola	80.2	15.1	19.9	7.0	57.5	28.0	25.1	16.7	7.3	15.2	9.8
(*N* = 35 ♂, 24 ♀)	74.0–89.0	13.0–17.0	18.0–21.0	6.0–8.0	54.4–62.5	26.8–29.3	24.0–26.1	14.7–18.1	7.0–7.6	14.8–15.6	9.2–10.1
Puerto Rico	85.5	15.8	19.7	7.4	59.7	28.8	25.5	17.3	7.3	15.2	10.2
(*N* = 3 ♂, 15 ♀)	80.0–90.0	13.0–17.0	16.0–21.0	7.0–8.0	57.4–62.0	27.3–30.1	24.3–26.8	16.7–17.9	7.0–7.7	14.9–15.5	9.7–10.7
Guadeloupe	81.4	15.7	19.9	7.7	60.6	29.1	25.9	17.6	7.5	15.2	10.2
(*N* = 6 ♂, 5 ♀)	78.0–86.0	13.0–17.0	19.0–21.0	7.0–8.0	59.0–62.8	28.6–30.0	25.1–26.9	17.0–18.1	7.1–7.7	14.9–15.5	9.8–10.6
Dominica	82.8	15.7	20.7	6.8	60.5	28.9	26.0	17.8	7.2	15.3	10.4
(*N* = 7 ♂, 11 ♀)	75.0–90.0	14.0–18.0	18.0–23.0	6.0–8.0	57.5–62.7	28.2–29.6	25.3–27.0	17.1–18.6	7.0–7.4	14.9–15.9	10.0–11.0
St. Vincent	92.6	20.0	22.8	8.7	63.9	30.8	27.7	19.6	7.3	16.3	11.4
(*N* = 3 ♂, 10 ♀)	88.0–97.0	17.0–23.0	21.0–24.0	8.0–9.0	60.8–66.6	30.2–31.3	27.0–28.2	18.9–20.1	7.0–7.7	15.7–16.7	11.0–11.7
Barbados	82.2	16.0	19.8	6.8	59.0	28.8	25.4	17.2	7.3	15.2	10.3
(*N* = 5 ♂, 1 ♀)	78.0–87.0	13.0–18.0	18.0–22.0	6.0–8.0	57.3–60.9	28.1–29.5	24.9–26.1	16.6–17.8	7.2–7.4	14.9–15.5	9.8–10.5
Grenada	83.0	13.9	21.1	8.0	59.6	28.6	25.7	17.4	7.2	15.3	10.4
(*N* = 3 ♂, 6 ♀)	80.0–87.0	12.0–16.0	20.0–22.2	8.0–8.0	56.8–61.1	27.7–30.2	24.6–27.6	16.1–18.7	7.0–7.4	14.6–16.2	10.2–11.0

from both *A. j. jamaicensis* and *A. j. trinitatis*; in a large sample from Grenada, they found that this population was intermediate in size between the significantly larger *A. j. schwartzi* to the north on St. Vincent and the significantly smaller *A. j. trinitatis* to the south on Trinidad. Of four skulls in the Schwartz Collection, three have M3 present, whereas the fourth lacks this minute tooth. *Artibeus j. trinitatis* usually has M3 present (Goodwin and Greenhall, 1961), whereas specimens from St. Lucia north regularly lack M3 (Jones, 1978).

Five females taken on 2 March 1961 at Ft. Frederick on Grenada were gravid; each carried a single fetus. The field collector noted two as having small embryos, two as medium, and one as "near term."

Specimens examined (9).—GRENADA. *St. George Parish*: Fort Frederick, 8 (KU 151616–23); 8 mi NE St. George's, 1 (KU 151624).

Artibeus jamaicensis jamaicensis Leach, 1821

Topotypical specimens of *Artibeus jamaicensis jamaicensis* are noticeably larger than *A. j. parvipes*; significant measurements are forearm (57.1–64.3), greatest length of skull (27.9–29.2), and length of upper toothrow (9.6–10.7) (Table 1). *Artibeus jamaicensis* from Puerto Rico to St. Lucia and Barbados resembles *A. j. jamaicensis* in all measurements. Hispaniolan *A. jamaicensis* tend to be intermediate between *A. j. parvipes* to the west and *A. j. jamaicensis* on Puerto Rico and Jamaica (Table 1). The species has not been reported previously from Desirade, and only recently has it been reported from Marie-Galante (Masson et al., 1990).

Netting in almost any mesic or wooded situation in the Antilles yields varying numbers of *A. jamaicensis*. At times this species is taken to the exclusion (or virtual exclusion) of all other species. At Sosúa on the north coast of

the Dominican Republic, a mist net set between two trees in a small patch of forest behind a hotel cottage yielded large numbers of *Artibeus*, but only limited numbers of other genera. Northeast of Jarabacoa near the eastern face of the Cordillera Central in the Dominican Republic, many *Artibeus* (also *Monophyllus*, *Phyllops*, and *Nyctinomops macrotis*) were taken in a mist net set in open pine forest. However, in the xeric forest of southwestern Puerto Rico near Guánica, *Artibeus* was distinctly uncommon; it was far outnumbered by *Brachyphylla*. Woods (1986) took one male and two females at 975 m in the Massif de la Hotte, and Ottenwalder (1979) reported a lactating female (21 April) taken between 0300 and 0600 h.

Two females collected 18 July 1968 at 12 km northeast of Jarabacoa on the northeastern slope of the Dominican Cordillera Central were gravid, the fetuses near term, whereas a female taken nearby at La Vega was lactating on 21 July 1974. Two females obtained at Los Patos on 1 August 1974 carried embryos 36 and 45 in crown-rump length. At Worthy Park Estate, Jamaica, a gravid female was obtained on 9 August 1970. In Haiti, pregnant females carrying single embryos that measured 39 and 37 in crown-rump length were taken at Pétonville on 8 and 13 July 1974, respectively. Two volant juvenile *A. jamaicensis* were collected at Grotte la Foret, Haiti, on 16 March. Klingener et al. (1978) took one gravid female on 13 June, four (embryos 6–10 mm) on 6 August, and eight (embryos 3–18 mm) from 21 December to 9 January. On Guadeloupe, Baker et al. (1978) collected one lactating female, two with minute embryos, and six with embryos 10–35 mm in crown-rump length in July.

Specimens examined (165).—BARBADOS. *St. Thomas Parish*: Jack-in-the-box Gully, 3 (KU 151349–51); 2 mi S Lammings, 2 (KU 151352–53). DOMINICA. *St. Paul Parish*: 2.5 mi S Layou, 5 (KU 151354–58); 6 mi NE Roseau, 14 (KU 151359–72). DOMINICAN REPUBLIC. *Provincia de Barahona*: Los Patos, 7 (KU 151402–03, KU 151405–09); 8 km W Paraíso, 500 ft, 1 (KU 151404); *Provincia de El Seibo*: Cuevas de Caño Hondo, Bahia de San Lorenzo, 5 (KU 151373–76); *Provincia de La Vega*: 12 km NE Jarabacoa, 2000 ft, 19 (KU 151378–96); La Vega, 21 km SW Jarabacoa, 2100 ft, 5 (KU 151397–401); *Provincia de Puerto Plata*: Sosúa, 26 (KU 151410–35). HAITI. *Département de l'Artibonite*: Grotte de Paudin, 2.2 mi E Carrefour Marmelade, 3400 ft, 4 (KU 151436–39); *Département de l'Ouest*: Pétionville, 1500 ft, 6 (KU 151440–45); 5 km SE Pétionville, 1332 m, 1 (KU 151468); Trouin, 1 (KU 151469); *Département du Sud*: Paillant, 1900 ft, 7 (KU 151446–51, KU 151760); Grotte de Counou Bois, 5 (KU 151452–56); Les Cayes, 11 (KU 151457–67); Grotte la Forêt, 9 km WSW Jérémie, 3 (KU 151640–42). JAMAICA. *Hanover Parish*: Long Bay, 4 mi N Negril, 2 (KU 151470–71); *Portland Parish*: Port Antonio, 5 (KU 151473–77); *St. Catherine Parish*: Worthy Park Estate, 1000 ft, 1 (KU 151472); *Trelawny Parish*: Kinloss, 4 (KU 151478–81). MARIE-GALANTE. Petite Anse, 7 (KU 151482–88). PUERTO RICO. *Aguas Buenas*: Cueva de Aguas Buenas, 3.5 mi SW Aguas Buenas, 6 (KU 151489–94); *Cidra*: 1 km NE Cidra, 1300 ft, 1 (KU 151495); *Mayagüez*: Isla Mona; Anclaji Sardinero, 3 (KU 151496–98); 5 mi SE Mayagüez, 4 (KU 151503–06); *Ponce*: Isla Caja de Muertos, 2 (KU 151507–08); *Río Grande*: Loíza Aldea, 4 (KU 151499–502); *Utuado*: 17.7 km NE Utuado, 1100 ft, 1 (KU 151509).

Additional specimens (5).—GUADELOUPE. *Basse-Terre*: Sofaïa, 1 (SCFF); *La Desirade*: Voute Blanche (Baie Mahault), 1 (SCFF). MARIE-GALANTE. Trou-a-Diable, 2 (SCFF). MARTINIQUE. Le Carbet, 1 (SCFF).

Artibeus jamaicensis parvipes Rehn, 1902

Clearly identifiable populations of *Artibeus jamaicensis* are those occurring on Cuba, Isla de la Juventud, Cayman Islands, and Great Inagua, to which *A. j. parvipes* Rehn applies. Mensurally, *A. j. parvipes* is distinguishable by its short forearm (52.5–59.7), small skull (greatest length 26.2–28.4), and short length of upper toothrow (8.9–10.1), and by generally smaller measurements in all cranial dimensions (see Table 1). Specimens of *A. jamaicensis* from the Cayman Islands (Grand Cayman, Cayman Brac) are the first records of the species from these islands. Shamel (1931b) reported this subspecies from Mayaguana Island in the southern Bahamas.

Goodwin and Greenhall (1961:260) gave a list of the habitats of *Artibeus jamaicensis trinitatis* on Trinidad; these include "roosting under palm leaves and in the dark foliage of shade trees, such as mango and bread fruit . . . The species is also found under the eaves of buildings; less frequently in hollow trees and occasionally in well lighted caves." Our observations in the West Indies are quite different; we have never encountered *Artibeus* hanging in palms or in foliage. Invariably, where these bats are collected during the day, they are taken from caves, and most often from well-lighted entrance galleries. If the cave ceiling is pocked with avon solution cavities of varying diameters, these cavities are commonly inhabited by small to large, densely-packed clusters of *Artibeus*, which are typically harem groups. On Cayman Brac, *Artibeus* was collected in very shallow "caves" along the southern side of the interior limestone plateau. Here the "caves," which in actuality are little more than shallow (no deeper than 2 m) overhangs along the edge of the limestone interior, were flooded with daylight during the afternoons, and the bats secreted themselves behind or near irregularities in the ceiling and walls. *Artibeus* seems to shun caves that are dark, damp, and hot; in such situations on Cuba, at least, it is replaced by *Brachyphylla*. Cole's Cave on Barbados, although rather damp, is not particularly hot and not well-lighted; Schwartz did not find *Artibeus* there, but he did

find large numbers of *Brachyphylla*. Kunz and McCracken (1995) found harem groups in leaves and apparent defense of these roosts from other harem males.

On Great Inagua, a nursing juvenile male (length of forearm 34.4) and a subadult male (50.6) *Artibeus j. parvipes* were collected on 6 February 1967; a gravid female taken on the same date had a fetus 32 mm in crown-rump length. Adult males from Cayman Brac, collected on 24 March, had enlarged testes (7–9 by 10–11 mm). Buden (1974) recorded a gravid female (fetus crown-rump length 12.8) on 25 February.

Specimens examined (95).—BAHAMAS. *Great Inagua*: Salt Pond Hill, 18 (KU 151510–24, KU 151526–28); 2 mi N Matthew Town, 1 (KU 151525). CAYMAN ISLANDS. *Cayman Brac*: south shore, 3.5 mi NE West End, 5 (KU 151529–33); southern escarpment, 10.5 mi NE West End, 1 (KU 151534); southern escarpment, 8.4 mi NE West End, 1 (KU 151535); southern escarpment, 2.8 mi NE West End, 3 (KU 151536–38); *Grand Cayman*: Georgetown, 1 (KU 151539). CUBA. *Provincia de Cienfuegos*: 4.5 mi E Soledad, 5 (KU 151565–69); Guajimico, 12 (KU 151572–83); *Provincia de La Habana*: Cueva de Cotilla, 9 km SW San José de las Lajas, 11 (KU 151540–50); *Isla de Juventud*: Cueva de los Indios, near Nueva Gerona, 14 (KU 151551–64); *Provincia de Holguín*: Banes, 7 (KU 1515595–601); Cueva de los Americanos, 5 (KU 151590–94); *Provincia de Pinar del Río*: north side of Pan de Guajaibon, 1 (KU 151602); Cueva de Santo Tomas, 10 km N Cabezas, 2 (KU 151603–04); *Provincia de Sancti Spíritus*: Cueva de los Masones, Trinidad, 6 (KU 151584–89); *Provincia de Villa Clara*: 6 mi S Manicaragua, 1 (KU 151570); Playa de Ingles, 1 (KU 151571).

Additional specimens (12).—CUBA. *Provincia de Cienfuegos*: Guajimico, 2 (UMNH 16481–82 [= AS 3046–47]); 4.5 mi E Soledad, 1 (ROM 78590 [= AS 3015]; *Provincia de La Habana:* Cueva de Cotilla, 9 km SW San José de las Lajas, 2 (RPM 2002C-5-274-75 [AS 4743-44]); *Isla de la Juventud*: Paso de Piedras, 1 (YPM); Finca La Abra, 5 (YPM); *Provincia de Pinar del Río*: Río Los Palacios, 1 (YPM).

Artibeus jamaicensis schwartzi Jones, 1978

Jones (1978) described the distinctive subspecies *Artibeus jamaicensis schwartzi* from St. Vincent based upon specimens in the Schwartz Collection, and it now is known from islands in the Grenadines. This subspecies is easily distinguished by its large size, massive skull, and the fact that it almost always lacks M3. It exceeds specimens of some populations of *Artibeus lituratus* in size, but it can be distinguished from *A. lituratus* by having conspicuously less fur on the uropatagium and forearm. Measurements of 13 individuals are given in Table 1. Although slight variation exits in the intensity of the color of the dorsal pelage, all specimens are dark gray or brown. Silvery gray to white tips of the ventral hairs are characteristic of all specimens from St. Vincent; most specimens lack any indication of the supraorbital pale line, whereas in some the line is weakly indicated. Genetically, the sequenced mitochondrial DNA in *Artibeus* from St. Vincent is identical to the mtDNA sequenced from South American *A. planirostris*, rather than other *A. jamaicensis* from the Antilles (Pumo et al., 1996). This remarkable finding suggests the origin of the unique St. Vincent population lies at least in part with the South American *A. planirostris*.

Twelve individuals were netted above a swimming pool at the Sugar Mill Inn at Ratho Mill, St. Vincent by D. R. Paulson; the area is cultivated and generally rather mesic. Two *Molossus molossus* were collected at the same time, but no other bats were secured. Jones (1978) noted the capture of *Artibeus j. schwartzi* in mist nets set in banana groves, near fruit trees in a residential area, and in clearings near trees or banana plants. No reproductively active females were collected in August by Jones or in December by Paulson. However, in August, one juvenile and two subadult animals were collected. In August, adult males had testes 8.5–11 mm in length.

Specimens examined (13).—ST. VINCENT. *St. George Parish*: Ratho Mill, 13 (KU 112005, KU 151605–15; USNM 395029 [= AS 5328]).

Brachyphylla cavernarum Gray, 1834
Antillean Fruit-eating Bat

Until 1970, four nominal species of the genus *Brachyphylla* were recognized in the West Indies: *B. cavernarum* Gray, 1834, from Puerto Rico, throughout the Virgin Islands, and south to St. Vincent (type locality) in the Lesser Antilles; *B. nana* Miller, 1902, from Cuba (type locality) and Isla de la Juventud; *B. minor* Miller, 1913, from Barbados; *B. pumila* Miller, 1918, from Hispaniola. Jones and Phillips (1970) placed *B. minor* as a subspecies of *B. cavernarum*, and Varona (1974) considered all named taxa to be subspecies of *B. cavernarum*. This arrangement also was followed by Buden (1977). However, Swanepoel and Genoways (1978) considered *B. nana* to be specifically distinct from *B. cavernarum*; they distinguished the species by the much larger external and cranial size of *B. cavernarum*. In samples studied by Swanepoel and Genoways (1978), there was no overlap in length of maxillary toothrow and mandibular length between the two species; and also there was no overlap in palatal length, breadth across upper molars, or condylobasal length in males of the two species. Swanepoel and Genoways (1978) recognized three subspecies in *B. cavernarum*—*B. c. cavernarum*, *B. c. minor*, and a new subspecies, *B. c. intermedia*; all three are represented in the Schwartz Collection.

Brachyphylla cavernarum cavernarum Gray, 1834

Brachyphylla cavernarum is the only Antillean endemic bat that occurs on both the Greater and Lesser Antilles.

Brachyphylla cavernarum cavernarum is the most widely distributed subspecies of Antillean fruit-eating bat; it has been reported from St. Croix (in the Virgin Islands), Saba, St. Eustatius, Monserrat, St. Martin, Barbuda, Anguilla, Antigua, Guadeloupe, Dominica, Martinique, St. Lucia, and St. Vincent (the type locality). Pinchon (1967) reported the species from Desirade. We have examined material from St. Croix (8 specimens), Dominica (3), St. Martin (4), Desirade (2), and Martinique (3), as well as from Marie-Galante (1), whence the species has not been reported previously.

Brachyphylla cavernarum cavernarum is the largest member of the species in all cranial measurements. The individuals from Dominica were taken in a mist net set across a stream in dense rainforest.

Specimens examined (4).—DOMINICA. *St. Paul Parish*: 6 mi NE Roseau, 3 (KU 150743–45). VIRGIN ISLANDS. *St. Croix*: no specific locality, 1 (KU 150746).

Additional specimens (17).—GUADELOUPE. *La Desirade*: Ravine Kikali, 2 (SCFF). MARIE-GALANTE. Trou-a-Diable, 1 (SCFF). MARTINIQUE. Fort-de-France, 1 (SCFF); Fond Cremeau, Tratane, 2 (SCFF). ST. MARTIN. Terre Basse, 4 (SCFF). VIRGIN ISLANDS. *St. Croix*: no specific locality, 7 (RPM).

Brachyphylla cavernarum intermedia Swanepoel and Genoways, 1978

This subspecies is common on Puerto Rico, as well as on three of the Virgin Islands (St. John, St. Thomas, and Norman Island); it is replaced on St. Croix by the nominate subspecies. On Puerto Rico it occurs throughout the island, from the arid region about Guánica in the southwest to the Cordillera Central in the central portion of the island.

As the name of this subspecies indicates, these are populations of *B. cavernarum* that are intermediate in size between individuals representing *B. c. cavernarum* and *B. c. minor*. External measurements of 22 specimens (7 males, 15 females) are: total length, 84–95 ($\bar{x}$ = 89.2); length of hind foot, 16–23 ($\bar{x}$ = 20.8); length of ear, 19–23 ($\bar{x}$ = 21.0); length of tragus, 8–9 ($\bar{x}$ = 8.5). Cranial measurements of 18 specimens (6 males, 12 females) are: greatest length of skull, 29.9–32.3 ($\bar{x}$ = 31.3); condylobasal length, 27.8–29.1 ($\bar{x}$ = 28.6); zygomatic breadth, 16.6–18.0 ($\bar{x}$ = 17.2); postorbital constriction, 6.4–6.9 ($\bar{x}$ = 6.7); mastoid breadth, 14.3–16.6 ($\bar{x}$ = 15.0); length of upper toothrow, 10.3–11.2 ($\bar{x}$ = 10.9).

All of Schwartz's specimens were taken in mist nets. Specimens from near Utuado were taken in the same net as *Stenoderma rufum* in a mesic coffee grove on the Cordillera Central. Those from near Guánica were netted in lowland xeric forest. A female taken 15 March 1965 near Utuado was gravid with a single fetus; Anthony (1918) noted nursing females taken on 5 July.

Specimens examined (22).—PUERTO RICO. *Guánica*: 7.5 km E Guánica, 12 (KU 150747–58); *Utuado*: 17.7 km NE Utuado, 1100 ft, 10 (KU 150759–64, KU 151201–03, KU 152363).

Brachyphylla cavernarum minor Miller, 1913

Known only from the island of Barbados, *Brachyphylla cavernarum minor* is represented by 12 topotypes in the Schwartz Collection taken in Cole's Cave, St. Thomas Parish. External measurements (2 males, 10 females) are: total length, 85–94 ($\bar{x}$ = 90.2); length of hind foot, 19–23 ($\bar{x}$ = 20.7); length of ear, 20–23 ($\bar{x}$ = 22.0); length of tragus, 9–10 ($\bar{x}$ = 9.3); length of forearm, 59.9–62.8 ($\bar{x}$ = 61.4). Cranial measurements of one male and eight females are: greatest length of skull, 29.4–31.0 ($\bar{x}$ = 30.3); condylobasal length, 27.2–27.9 ($\bar{x}$ = 27.6); zygomatic breadth, 16.2–17.1 ($\bar{x}$ = 16.6); postorbital constriction, 6.2–6.7 ($\bar{x}$ = 6.4); mastoid breadth, 14.0–14.6 ($\bar{x}$ = 14.3); length of upper toothrow, 10.9–11.3 ($\bar{x}$ = 11.0).

Individuals of this subspecies are the smallest in cranial size of any population of the species. In the analyses by Swanepoel and Genoways (1978), the samples of *B. c. minor* averaged the smallest in all cranial characteristics except palatal length for females and postorbital breadth in males. The bases of the dorsal hairs are cream colored in *B. c. minor* as they are in the nominate subspecies.

Schwartz's specimens from Cole's Cave represent a small sample of the large numbers he observed therein. The bats were extremely abundant at the time of Schwartz's visit (14 February 1961) and were scattered throughout much of the cave in small groups in solution holes and crevices in the ceiling. The cave is moist and somewhat humid, but not so extremely hot as are caves inhabited by *Brachyphylla nana* on Cuba. *Myotis martiniquensis* was also taken in a net placed across the entrance of Cole's Cave at night, but none was observed within the cave in daytime.

Specimens examined (12).—BARBADOS. *St. Thomas Parish*: Cole's Cave, 12 (KU 150765–74, KU 152364–65).

Brachyphylla nana Miller, 1902
Cuban Fruit-eating Bat

Remarkably, *Brachyphylla nana*, and *B. pumila* considered herein to be conspecific with *B. nana*, originally were described on the basis of fragmentary cave remains. This is especially surprising for *B. nana* because, on Cuba, it is an exceptionally common bat. Living *B. nana* were found and the external features were clarified by Miller (1902b). *Brachyphylla pumila*, described by Miller (1918) from material from Hispaniola, was later found living (Goodwin, 1933) and its external features were described.

We examined 20 specimens of *B. nana* from Cuba and eight from the Dominican Republic. Measurements of the Cuban bats (7 males, 11 females) are: total length, 80–90 ($\bar{x}$

$\bar{x}$ = 82.9); length of hind foot, 17–21 ($\bar{x}$ = 18.9); length of ear, 20–23 ($\bar{x}$ = 21.3); tragus 8–11 ($\bar{x}$ = 9.0); forearm 55.1–62.4 ($\bar{x}$ = 58.2); greatest length of skull, 27.0–28.9 ($\bar{x}$ = 28.2); condylobasal length, 24.7–26.3 ($\bar{x}$ = 25.7); zygomatic breadth, 14.0–15.7 ($\bar{x}$ = 14.8); postorbital constriction, 6.0–6.6 ($\bar{x}$ 6.2); mastoid breadth, 13.0–14.3 ($\bar{x}$ = 13.5); length of upper toothrow, 9.0–9.8 ($\bar{x}$ = 9.5). Measurements of seven Hispaniolan specimens (4 males, 3 females) are: total length, 76–85 ($\bar{x}$ = 79.6); length of hind foot, 16–19 ($\bar{x}$ = 17.6); length of ear, 17–21 ($\bar{x}$ = 18.3); length of tragus, 8–10 ($\bar{x}$ = 8.8); length of forearm, 56.3–59.7 ($\bar{x}$ = 58.1); greatest length of skull, 28.1–29.4 ($\bar{x}$ = 28.7); condylobasal length, 25.1–26.3 ($\bar{x}$ = 25.9); zygomatic breadth, 14.8–15.6 ($\bar{x}$ = 15.4); postorbital constriction, 6.2–6.9 ($\bar{x}$ = 6.5); mastoid breadth, 13.5–14.0 ($\bar{x}$ = 13.8); length of upper toothrow, 9.5–10.0 ($\bar{x}$ = 9.7).

Externally, the dorsal pelage of Hispaniolan *B. nana* is cream basally, in contrast to the yellow bases of Cuban bats; there seems to be no difference in the depth of dark brown pigment on the dorsal hair tips. As mentioned previously, *B. nana* is distinguished from *B. cavernarum* by its much smaller cranial size, the two species do not overlap in length of maxillary toothrow and mandibular length. *Brachyphylla nana* and *B. pumila* were considered to be either distinct species or subspecies until the work of Swanepoel and Genoways (1978), who did not concur with the characters used by previous authors to distinguish the taxa. They found that variation in size of individuals from Cuba encompassed the range of variation within the species, and that other characters used previously were individually variable or not present.

On Cuba, *B. nana* is abundant in hot, moist caves. None of the females was lactating or gravid. *Brachyphylla nana* has been rarely collected on Hispaniola. Seven specimens from near Sosúa, RD, were caught in a mist net set for seven nights in a small patch of trees near a hotel (no longer extant) on the coast. Other bats taken in the same net were *Artibeus, Phyllonycteris, Phyllops,* and *Pteronotus*; of these, *Brachyphylla* was outnumbered only by *Artibeus*. None of the three females was lactating or gravid.

Specimens examined (25).—CUBA. *Provincia de Camagüey*: 12 mi E Moron, 3 (KU 150775–77); *Provincia de La Habana*: Cueva de Cotilla, 9 km SW San José de las Lajas, 8 (KU 152366–73); Cueva de los Indios, San Vincente, 1 (KU 152374); *Provincia de Sancti Spíritus*: Finca de Morales, 8 mi NW Trinidad, 5 (KU 150778–82). DOMINICAN REPUBLIC. *Provincia de Barahona*: 8 km W Paraíso, 500 ft, 1 (KU 152375); *Provincia de Puerto Plata*: Sosúa, 7 (KU 150783–89).

Additional specimens (3).—CUBA. *Provincia de La Habana*: Tapaste, Cueva de los Indios, 3 (ROM 78442 [= AS 4652]; RPM 2002-5-226 [= AS 4653]; AS 4651 marked in Schwartz's catalogue as exchanged to D. A. Stock).

Erophylla

Until the work of Buden in 1976, two species of *Erophylla* were recognized—*E. bombifrons*, with two subspecies, and *E. sezekorni*, with four subspecies. Buden (1976) considered *E. bombifrons* to be a subspecies of *E. sezekorni*. Hall (1981) continued to recognize two species, as did Koopman (1989, 1993). In his authoritative *Chiroptera of the World*, Koopman (1993:182) stated "Based on differences in size of ears, shape of rostrum, inflation of braincase, and certain dental characters, *E. bombifrons* (Hispaniola and Puerto Rico) probably should be regarded as a distinct species." We have chosen to follow this arrangement.

Erophylla bombifrons
Brown Flower Bat

Both currently recognized subspecies—*E. b. bombifrons* and *E. b. santacristobalensis*—are represented in the Schwartz Collection.

Erophylla bombifrons bombifrons (Miller, 1899)

Three males and three females of *Erophylla bombifrons bombifrons* were collected on 30 August 1962 in a cave on the northern flank of the Cordillera Central, Puerto Rico. *Erophylla* were greatly outnumbered by *Tadarida brasiliensis*; at the same cave in February 1965, only the latter was collected. Measurements for the series are: total length, 74–77 ($\bar{x}$ = 75.2); length of tail, 11–14 ($\bar{x}$ = 12.8); length of hind foot, 13–15 ($\bar{x}$ = 13.5); length of ear, 17–18 ($\bar{x}$ = 17.2); length of tragus, 7–8 ($\bar{x}$ = 7.5); length of forearm, 43.5–48.8 ($\bar{x}$ = 46.9); greatest length of skull, 23.5–24.3 ($\bar{x}$ = 23.9); condylobasal length, 21.6–22.3 ($\bar{x}$ = 22.0); zygomatic breadth, 10.9–11.4 ($\bar{x}$ = 11.2); postorbital constriction, 4.5–4.9 ($\bar{x}$ = 4.7); mastoid breadth, 10.5–10.9 ($\bar{x}$ = 10.6); length of upper toothrow, 7.6–7.9 ($\bar{x}$ = 7.8). Anthony (1918:358) described the adult pelage of *E. b. bombifrons* as "...above hairs distinctly bicolor, being white for rather more than half the basal length, then tipped with chestnut-brown; from shoulders posteriorly the color is darker than on the foreparts where white of the basal part shows through; rather lighter on head and face, the hairs unicolor and shorter; below uniform wood-brown, the bases of the hairs whitish." Our specimens agree with this description and are consistent in the hue of the dorsal brown hair tips; none shows any tendency toward the pale reddish tan coloration of specimens from the Bahamas.

Specimens examined (6).—PUERTO RICO. *Utuado*: 5.5 mi NE Utuado, 6 (KU 107873, KU 150909–13).

Erophylla bombifrons santacristobalensis Elliot, 1905

Erophylla bombifrons santacristobalensis has never been diagnosed properly; in the original description, where it was named as a full species of *Phyllonycteris, santacristobalensis* was differentiated from "all others of the ge-

nus and from *P. poeyi* in addition in having a complete zygomatic arch" (Elliot, 1905:236). This is a character that is currently regarded as separating *Phyllonycteris* (arch incomplete) and *Erophylla* (arch complete). We examined 35 specimens (USNM and 16 in Schwartz's collection—19 males, 15 females, 1 unsexed). Length of forearms of 29 *E. b. santacristobalensis* is 42.3–49.4 ($\bar{x}$ = 47.5). Cranial measurements of 18 specimens are: greatest length of skull, 23.0–25.1 ($\bar{x}$ = 24.2); condylobasal length, 21.5–24.0 ($\bar{x}$ = 22.4); zygomatic breadth, 11.2–12.0 ($\bar{x}$ = 11.7); postorbital constriction, 4.6–4.9 ($\bar{x}$ = 4.7); mastoid breadth, 10.5–11.5 ($\bar{x}$ = 11.1); length of upper toothrow, 7.5–8.2 ($\bar{x}$ = 7.9).

Comparison of these data with those of six *Erophylla b. bombifrons* from Puerto Rico leads us to suspect that *E. b. santacristobalensis* may not be subspecifically different from the Puerto Rican bats. In our samples, length of forearms in *E. b. bombifrons* are completely encompassed by those of *E. b. santacristobalensis*; means and ranges of cranial measurements are comparable, and parameters overlap broadly. One exception is zygomatic breadth (10.9–11.4 in *E. b. bombifrons*, 11.2–12.0 in *E. b. santacristobalensis*). In pelage, specimens of *E. b. santacristobalensis* collected in 1968 are quite different from those of *E. b. bombifrons* collected in 1962; the former are much more reddish than the pale tan *E. b. bombifrons*. For the present, we accept *E. b. santacristobalensis* as a valid subspecies because of its greater zygomatic breadth and more reddish brown coloration. The single cranial difference seems tenuous at best, but the pelage hues are constant, and even older (1928) specimens of *E. b. santacristobalensis* have the same color as more recent specimens. Given these relatively small differences based on our restricted samples, we encourage others to thoroughly analyze the systematic relationships of the populations of this species.

The cave near Boca de Chavon, RD, where the series of *E. b. santacristobalensis* was taken, lies on a wooded but xeric limestone ridge that parallels the coast. The cave is extensive and an inner chamber, opening by a flue to the outside, harbored large numbers of *Erophylla* and a few *Macrotus waterhousii*. Klingener et al. (1987) took five specimens near Lebrun on the Haitian Tiburon Peninsula. Woods (1986) collected two males at 975 m on the Haitian Massif de la Hotte.

Specimens examined (52).—DOMINICAN REPUBLIC. *Provincia de Barahona*: 12 km SW Barahona, 1400 ft, 2 (KU 150792–93); Los Patos, 12 (KU 150794–805); 8 km W Paraíso, 500 ft, 8 (KU 150806–13); no specific locality, 7 (KU 150814–18, KU 150827–28); *Provincia de La Romana*: 1 mi N Boca de Chavon, 16 (KU 150819–26, KU 150829–34, KU 152376–77). HAITI. *Département de l'Artibonite*: St. Michel de l'Atalyae, 7 (USNM 252618–21, USNM 252634–36).

Erophylla sezekorni
Buffy Flower Bat

Three of the four currently recognized subspecies of *E. sezekorni* are represented in the Schwartz Collection—*E. s. planifrons*, *E. s. sezekorni*, and *E. s. syops*.

Erophylla sezekorni planifrons (Miller, 1899)

This subspecies was described from Nassau, New Providence Island, and has since been reported from the islands of Great Abaco, Eleuthera, Long Island, Cat Island, Great and Little Exuma, San Salvador, Crooked Island, Acklin's Island, and Great Inagua, as well as three islands in the Caicos group (Buden, 1976). We have five specimens from New Providence, 12 from Eleuthera, 29 from Andros, one from Long Island, 12 from Cat Island, and two from San Salvador.

External measurements of 19 specimens (3 from New Providence, 12 from Eleuthera, 4 from Cat; 10 males, 9 females) are: total length, 69–83 ($\bar{x}$ = 76.3); length of tail, 11–16 ($\bar{x}$ = 12.8); length of hind foot, 13–17 ($\bar{x}$ = 14.7); length of ear, 17–22 ($\bar{x}$ = 18.3); tragus, 7–9 ($\bar{x}$ = 8.1); length of forearm, 44.6–49.9 ($\bar{x}$ = 47.2). Cranial measurements (same series as above but including 5 additional males from Cat and 13 males, 10 females, and 5 unsexed from Andros) are: greatest length of skull, 23.3–25.4 ($\bar{x}$ = 24.7); condylobasal length, 21.9–23.6 ($\bar{x}$ = 22.8); zygomatic breadth, 10.9–12.0 ($\bar{x}$ = 11.4); postorbital constriction, 4.3–4.9 ($\bar{x}$ = 4.6); mastoid breadth, 10.0–11.8 ($\bar{x}$ = 11.0); length of upper toothrow, 7.7–8.8 ($\bar{x}$ = 8.1). In contrast to our sample of *Erophylla bombifrons bombifrons*, the series of *E. sezekorni planifrons* is extremely variable in dorsal color; some specimens are as dark dorsally as the Puerto Rico specimens, and others have the dorsal hairs tipped with pale reddish fawn. Koopman et al. (1957) commented on the extreme variation in series from Little and Great Exuma islands, but none of our specimens has the gray dorsum that they describe.

Three females collected on 13 June 1966 from the cave at Cave Junction on New Providence were lactating, and two young collected on 22 October 1961 on Eleuthera Island were volant. One of these young (KU 150885; forearm 46) was molting from the soft juvenile/subadult pelage into the adult pelage; the anterior third of the body is the typical adult pelage, whereas the posterior two-thirds is a uniformly light brown, soft, fluffy juvenile coat. Two gravid females from Andros (Mangrove Cay) were taken on 27–28 April 1968. A female from San Salvador was lactating when captured on 26 June 1966. The specimens from Eleuthera and Andros were taken from caves, whereas the two from San Salvador were netted in a formal garden. Bats from Cat Island were taken from a cave with two entrances, at one of which were found the *Erophylla* and at the other *Macrotus*; the *Erophylla* were roosting in diffuse clumps over a semi-permanent pond in the cave floor.

At Cave Junction they also were roosting over a semi-permanent pond.

Shamel (1931b) named a new subspecies of *E. planifrons* (= *E. sezekorni*) from Mariguana (= Mayaguana) Island in the southern Bahamas. Shamel's subspecies, *E. s. mariguanensis*, was stated to differ from *E. s. planifrons* by its larger size, darker coloration, and smaller teeth. *Erophylla s. mariguanensis* has been reported from Mayaguana and East Caicos Island, in the extreme southeastern portion of the Bahaman archipelago; Shamel had 50 specimens (but only 8 skulls from this lot of fluid-preserved specimens) from Mayaguana and 16 from East Caicos. Of his material, we have examined two skulls from East Caicos (USNM 255636–37) and 13 specimens (USNM 255586–87, 255589, 255591, 255594–96, 255599, 255601–2, 255604, 255607, 255609; 7 males and 6 females; only 2 skulls) from Mayaguana. The length of the forearm in *E. s. mariguanensis*, 46.5–50.8 ($\bar{x}$ = 48.0), is slightly greater than in *E. s. planifrons*, 44.6–49.9 ($\bar{x}$ = 47.2). Cranial measurements likewise are close, except that the average measurements of *E. s. mariguanensis* are slightly greater than those of *E. s. planifrons* except mastoid breadth. This is especially true of length of upper toothrow, which is 7.7–8.8 ($\bar{x}$ = 8.4) in *E. s. planifrons* and 8.1–8.9 ($\bar{x}$ = 8.4) in *E. s. mariguanensis*. *Erophylla s. mariguanensis* has smaller teeth than *E. s. planifrons*; Shamel (1931b) gave upper toothrow measurements of 7.6–8.2 for *E. s. mariguanensis* and 8.2–8.8 for *E. s. planifrons*. So far as color differences are concerned, specimens of *E. s. planifrons* from any single locality are quite variable; this, plus the fact that Shamel's color data were derived from dried fluid-preserved specimens, makes us suspicious that no reasonably constant chromatic differences exist between these two taxa. We doubt that *E. s. mariguanensis* is separable from *E. s. planifrons* on the basis of any characters or combinations of characters, but refrain from making this taxonomic change because fresh topotypes of both are needed before proper comparisons can be made.

We have not included measurements of two specimens of *E. sezekorni* from San Salvador within the computations of measurements for more northern bats. San Salvador is on its own bank about 75 km east of the southern tip of Cat Island, about 100 km east-northeast of the northern tip of Long Island, and about 200 km northeast of Mayaguana. Considering its isolation, we entertained the notion that *Erophylla* on San Salvador might be referable to *E. s. mariguanensis*, if such a taxon is recognized. The length of forearm of one specimen (44.2) is less than the lower extreme of length of forearm for both subspecies, whereas that of the other (48.3) falls within the ranges of length of forearm of both subspecies. The bats from San Salvador have upper toothrow lengths of 8.2 and 8.5; these are within the ranges of both subspecies. Chromatically, the two bats from San Salvador are like other *E. s. planifrons*. Possibly these two specimens are intergrades between *E. s. planifrons* and *E. s. mariguanensis*; however, because we are uncertain of the status of the latter taxon, we herein consider them *E. s. planifrons*.

Specimens examined (60).—BAHAMAS. *Andros Island*: 2.5 mi S airstrip, Mangrove Cay, 29 (KU 150835–63); *Cat Island*: E end of Cutlass Bay, Bain's Town, 12 (KU 150864–75); *Eleuthera Island*: Hatchet Bay Plantation, 12 (KU 107874, KU 150876–86); *New Providence*: Cave Junction, Nassau, 5 (KU 150887–91); *San Salvador Island*: 6.9 mi NE Cockburn Town, 1 (KU 150892); 4.2 mi N Cockburn Town, 1 (KU 150893).

Additional specimens (2).—BAHAMAS. *Cat Island:* E end of Cutlass Bay, Bain's Town, 1 (AS 5704, exchanged); *Long Island*: Pinder's Settlement, 24 mi NW Clarence Town, 1 (exchanged).

Erophylla sezekorni sezekorni (Gundlach, 1861)

Nine bats taken by Ronald F. Klinikowski on 26 August 1961 5.6 km NE of West End, Cayman Brac, Cayman Islands are assigned to the nominate (Cuban) subspecies of *Erophylla sezekorni*. These were collected from an open "cave" along the escarpment of the central plateau; the bats were found in the company of *Macrotus waterhousii minor* in the well-lighted and shallow openings in the limestone cliff forming the escarpment. Schwartz also examined a specimen (YPM 241) from Santa Fe, Isla de la Juventud, collected by George E. Watson on 14 November 1935.

The bats from Cayman Brac (6 males, 3 females) have the following measurements: total length, 79–84 ($\bar{x}$ = 81.3); length of tail, 10–15 ($\bar{x}$ = 12.4); length of hind foot, 12–16 ($\bar{x}$ = 14.8); length of ear, 18–21 ($\bar{x}$ = 19.9); length of tragus, 8–9 ($\bar{x}$ = 8.6); length of forearm, 47.5–49.7 ($\bar{x}$ = 48.5); greatest length of skull, 24.3–24.8 ($\bar{x}$ = 24.5); condylobasal length, 22.4–23.3 ($\bar{x}$ = 23.0); zygomatic breadth, 10.3–11.8 ($\bar{x}$ = 11.3); postorbital constriction, 4.4–4.7 ($\bar{x}$ = 4.5); mastoid breadth, 10.3–11.1 ($\bar{x}$ = 10.7); length of upper toothrow, 7.5–8.4 ($\bar{x}$ = 8.1). The skull of the specimen from Isla de la Juventud is badly broken, and there are no measurements from life for the skin; the forearm has a length of 48.3, the postorbital constriction is 4.8, and the upper toothrow is 7.8. The specimens from Cayman Brac show the same sort of pelage variation as does *E. s. planifrons*. The color of the dorsal hair tips varies from dark brown to reddish tan, although none is so pale as some of the Bahaman specimens.

In order to determine the differences between *Erophylla s. sezekorni* on Cuba and *E. s. syops* on Jamaica, we examined 12 specimens from Cuba (5 males, 5 females, 2 unsexed) and 18 specimens from Jamaica (2 males, 10 females USNM; 6 females in Schwartz's collection from 3 mi SE of Whitehouse, St. Elizabeth Parish). According to G. M. Allen (1917), the skull of *E. s. syops* has a conspicu-

ously wider rostrum with the molar rows nearly parallel rather than converging anteriorly and the profile is less elevated than in *E. s. sezekorni*, but with a narrower palate, more swollen lachrymal region, and teeth slightly broader. Measurements were given only for the holotype; presumably, from Allen's comment, the balance of his original series of eight specimens was in spirits also as was the holotype. Measurements of 12 *E. s. sezekorni* are: length of forearm, 43.0–49.3 ($\bar{x}$ = 47.0); greatest length of skull, 23.9–25.0 ($\bar{x}$ = 24.3); condylobasal length, 21.9–22.9 ($\bar{x}$ = 22.3); zygomatic breadth, 10.7–11.4 ($\bar{x}$ = 11.0); postorbital constriction, 4.4–4.8 ($\bar{x}$ = 4.6); mastoid breadth, 10.4–10.8 ($\bar{x}$ = 10.6); length of upper toothrow, 7.6–8.0 ($\bar{x}$ = 7.8). Eighteen *E. s. syops* have the following data: length of forearm, 46.5–49.7 ($\bar{x}$ = 48.3); greatest length of skull, 23.6–25.2 ($\bar{x}$ = 24.6); condylobasal length, 21.6–23.4 ($\bar{x}$ = 22.6); zygomatic breadth, 10.1–11.0 ($\bar{x}$ = 10.8); length of upper toothrow, 8.0–8.2 ($\bar{x}$ = 8.1). The two samples are extremely close in both means and parameters in all measurements taken. Allen's characteristics of the skull of *E. s. syops*, based on a single specimen, do not seem to be valid when a series of either *E. s. sezekorni* or *E. s. syops* is studied. Clearly the relationships of Jamaican and Cuban populations need to be analyzed further with large samples from both islands.

Specimens examined (20).—CAYMAN ISLANDS. *Cayman Brac*: South Shore, 3.5 mi NE West End, 9 (KU 150894–902). CUBA. *Provincia de Guantánamo*: Guantánamo, Guaso, cave near power plant, 7 (USNM 300513–17, USNM 300519–20); *Provincia de Santiago de Cuba*: Seborni, 1 (USNM 200863); *Province Unknown*: San Germán, 1 (USNM 254715); cave at Siboney, 2 (USNM 300509, USNM 300512).

Additional specimen (1).—CUBA. *Isla de la Juventud*: Santa Fe, 1 (YPM 241).

Erophylla sezekorni syops G. M. Allen, 1917

Six females were taken by Schwartz and Richard Thomas on 13 July 1967 at 4.8 km SE Whitehouse, Jamacia. Measurements of two of these individuals are: total length, 77, 78; length of tail, 15, 12; length of hind foot, 20, 21; length of ear, 14, 15; length of tragus, 8, 8; length of forearm, 45.0, 47.9; greatest length of skull, 24.4, 25.1; condylobasal length, 22.4, 23.2; zygomatic breadth, 11.1, 11.5; postorbital constriction, 4.4, 4.6; mastoid breadth, 10.8, 11.0; length of upper toothrow, 8.0, 8.3.

Specimens examined (15).—JAMAICA. *St. Elizabeth Parish*: 3 mi SE Whitehouse, 6 (KU 150903–08); *St. James Parish*: Montego Bay, 9 (USNM 172428–30, USNM 172433–38).

Glossophaga longirostris rostrata Miller, 1913
Miller's Long-tongued Bat

Glossophaga longirostris rostrata was described from Grenada, and has been reported from three islands in the Grenadines (Union, Mustique, Carriacou), St. Vincent, and Tobago (Webster and Handley, 1986). The Schwartz Collection contains specimens from Grenada and St. Vincent. A male taken at Belmont, on Bequia, the northernmost of the Grenadines, establishes the presence of *Glossophaga* on another of the Grenadine islands.

On St. Vincent, *G. longirostris* was collected by netting over a swimming pool in cultivated land at Ratho Mill, and by netting in a cacao grove at Lower Bellewood. On Grenada, Miller's long-tongued bats were taken in the French ammunition tunnels at St. George's (where they also had been reported by G. M. Allen [1911]), which they shared with *Artibeus jamaicensis*, and in an abandoned shack near the ocean at Salt Pond on xeric Point Saline. Of two females taken on 25 December 1961 on St. Vincent, one was carrying a single young, and the other was gravid with a single fetus. Adult females from Grenada (February and March) and others from St. Vincent (28 December) were neither gravid nor carrying young.

Three males and five females from Grenada have the following external and cranial measurements: total length, 60–67 ($\bar{x}$ = 64.3); length of hind foot, 10–12 ($\bar{x}$ = 10.6); length of ear, 12–15 ($\bar{x}$ = 13.9); length of tragus, 6–7 ($\bar{x}$ = 6.4); length of forearm, 37.8–40.3 ($\bar{x}$ = 38.8); greatest length of skull, 22.6–23.5 ($\bar{x}$ = 23.1); condylobasal length, 21.2–22.4 ($\bar{x}$ = 21.8); zygomatic breadth, 9.6–10.2 ($\bar{x}$ = 9.9); postorbital constriction, 4.7–5.0 ($\bar{x}$ = 4.9); mastoid breadth, 9.3–9.7 ($\bar{x}$ = 9.5); length of upper toothrow, 7.7–8.4 ($\bar{x}$ = 8.0). Seven males and six females from St. Vincent have the following external and cranial measurements: total length, 59–83 ($\bar{x}$ = 64.4); length of tail, 4–9 ($\bar{x}$ = 6.6); length of hind foot, 11–12 ($\bar{x}$ = 11.6); length of ear, 13–15 ($\bar{x}$ = 14.1); length of tragus, 6–7 ($\bar{x}$ = 6.8); length of forearm, 36.3–40.0 ($\bar{x}$ = 37.5); greatest length of skull, 21.2–22.9 ($\bar{x}$ = 22.3); condylobasal length, 19.9–22.4 ($\bar{x}$ = 21.3); zygomatic breadth, 9.0–10.0 ($\bar{x}$ = 9.7); postorbital constriction, 4.4–5.1 ($\bar{x}$ = 4.8); mastoid breadth, 8.8–9.6 ($\bar{x}$ = 9.3); length of upper toothrow, 7.4–8.2 ($\bar{x}$ = 7.7). The two series are identical in coloration; the hairs are tipped with dark brown and have pale tan to buffy bases dorsally, and ventrally are paler brown with paler buffy to tan bases.

Specimens examined (22).—GRENADA. *St. George Parish*: French Ammunition Tunnels, 6 (KU 150936–41); Salt Pond, 1 (KU 150942); Fort Frederick, 2 (KU 150943–44). GRENADINES. *Bequia*: Belmont, 1 (KU 150923). ST. VINCENT. *St. George Parish*, Ratho Mill, 10 (KU 150924–33); *St. Patrick Parish*: Lower Bellwood, 2 (KU 150934–35).

Glossophaga soricina antillarum Rehn, 1902
Pallas' Long-tongued Bat

Koopman and Williams (1951) regarded *Glossophaga soricina antillarum* as rare and localized by habitat on Jamaica and did not find the genus represented by fossil material despite the abundance of chiropteran fossils avail-

able to them. The only previously published locality for this bat on Jamaica is Port Antonio, on the northeastern coast. Schwartz's specimens are from three additional localities, two of which (Negril and Portland Cottage) are xeric, in contrast to the mesic conditions at Port Antonio. The population of Pallas' long-tongued bats on Jamaica is the only Antillean representative of this species, which is widely distributed in the mainland tropics and subtropics.

External and cranial measurements of four males and four females are: total length, 57–67 ($\bar{x}$ = 61.4); length of tail, 7–8 ($\bar{x}$ = 7.6); length of hind foot, 10–11 ($\bar{x}$ = 10.1); length of ear, 14–21 ($\bar{x}$ = 16.0); length of tragus, 5–6 ($\bar{x}$ = 5.5); length of forearm, 37.2–38.7 ($\bar{x}$ = 37.7); greatest length of skull, 21.8–23.0 ($\bar{x}$ = 22.2); condylobasal length, 20.5–21.5 ($\bar{x}$ = 20.8); zygomatic breadth, 9.2–9.8 ($\bar{x}$ = 9.6); postorbital constriction, 4.4–4.9 ($\bar{x}$ = 4.7); mastoid breadth, 8.9–9.2 ($\bar{x}$ = 9.0); length of upper toothrow, 7.4–7.7 ($\bar{x}$ = 7.5). The dorsal pelage is some shade of brown, varying from dark to pale brown; on some specimens there is a faintly reddish tinge, and the dorsal hairs are cream to pale buffy basally. Ventrally, the fur is grayish tan distally with bases ranging from buffy to grayish.

Glossophaga soricina antillarum can be differentiated externally from *Monophyllus redmani redmani* Leach, which also occurs on Jamaica, in that the former is much paler than the latter and the tail in *Monophyllus* extends beyond posterior edge of the uropatagium, whereas in *Glossophaga* it does not (Baker et al., 1984). *Glossophaga* has a shorter upper toothrow (7.4–7.7 in *Glossophaga*, 8.3–8.9 in *Monophyllus*; Schwartz and Jones, 1967) and relatively larger lower incisors.

One male and two females were collected in an open, well-lighted, cave near Portland Cottage; the interior of the cave was distinctly moist. A few other bats were seen in the entrance chamber where the *Glossophaga* were taken; they may have been *Macrotus*, which was abundant at this site. Three males and one female from Whitehouse were secured in the same cave in semi-xeric forest as *Macrotus waterhousii*.

Specimens examined (8).—JAMAICA. *Clarendon Parish*: 5.6 mi SE Portland Cottage, 3 (KU 150945–47); *St. Elizabeth Parish*: 3 mi SE Whitehouse, 4 (KU 150948–51); *Westmoreland Parish*: Negril, 1 (KU 150952).

Macrotus waterhousii Gray, 1843

Waterhouse's Leaf-nosed Bat

Macrotus waterhousii occurs from southern California and Nevada and northern Arizona through Mexico and into Guatemala and eastward through the Greater Antilles and Bahamas as far east as Hispaniola (Anderson and Nelson, 1965). Choate and Birney (1968) reported the species from Puerto Rico based on sub-Recent fossils. Seven subspecies were recognized by Anderson and Nelson (1965) with the forms *M. w. compressus, M. w. jamaicensis, M. w. minor,* and *M. w. waterhousii* occurring in the Antilles. However, Buden (1975b) recognized only two subspecies on the islands, *M. w. minor* and *M. w. waterhousii*, with *M. w. compressus* and *M. w. jamaicensis* as junior synonyms respectively. We follow Koopman's (1994) recognition of four subspecies on the islands, as proposed by Anderson and Nelson (1965).

Macrotus waterhousii compressus Rehn, 1904

Schwartz's material of the Bahaman subspecies of *Macrotus waterhousii* consists of one male from Great Exuma Island, a male and a female from Long Island, and eight males and 21 females from Cat Island. External measurements from seven specimens and cranial measurements from 27 specimens are given in Table 2. Anderson and Nelson (1965) suggested that *M. w. compressus* is larger than *M. w. minor* in most external measurements, except the forearm; the measurements of our much larger series from the Bahamas confirm theirs. The most noticeable external mensural difference between these two subspecies is in ear length, which is 26–30 ($\bar{x}$ = 26.8) in *M. w. minor* and 30–33 ($\bar{x}$ = 31.6) in *M. w. compressus*. The forearms (means 51.0 in *minor*, 51.5 in *compressus*) are comparable. Cranially, *M. w. compressus* averages larger in all measurements except that of postorbital constriction; length of upper toothrow virtually separates skulls of the two subspecies (8.6–9.4 in *minor*, 9.3–10.0 in *compressus*).

The forearm of *Macrotus w. jamaicensis* is longer than *M. w. compressus* (mean 52.8 in the former, 51.5 in the latter), but all external measurements overlap so broadly that differences in size are obscured. In cranial measurements, all means are comparable between these two subspecies, with *M. w. jamaicensis* having a slightly longer upper toothrow. Compared with *M. w. waterhousii*, the Bahaman subspecies has longer ears (26–29 in *waterhousii*, 30–33 in *compressus*) and a distinctly smaller skull.

Comparisons of *Macrotus w. compressus* with bats that we assign to *M. w. waterhousii* from Great Inagua reveal the latter average larger in all cranial measurements, most distinctly so in length of upper toothrow (9.3–10.0 in *compressus*, 9.9–10.6 in Great Inagua *waterhousii*). External measurements are not so diagnostic of these two subspecies, although the forearms of specimens from Inagua have a slightly higher mean (53.5) than those of *compressus* (51.5).

In pelage, *M. w. compressus* is darker (more grayish) than brown-phase specimens of *M. w. jamaicensis, M. w. minor,* and *M. w. waterhousii*. However, these differences may be the result of longer time since preservation of the specimens of the latter three subspecies.

All of the Bahaman *M. w. compressus* were taken in caves. A young, but volant, male was in the twilight zone of a very high cave on Great Exuma. A cave at Bain's Town,

Table 2. External and cranial measurements (in mm) of Antillean populations of *Macrotus waterhousii*. In each column, the mean is followed by the range.

Island and Statistics	Total length	Tail length	Length of hind foot	Length of ear	Length of tragus	Length of forearm	Greatest length of skull	Condylo-basal length	Zygo-matic breadth	Post-orbital constriction	Mastoid breadth	Length of upper toothrow
Jamaica	99.5	32.2	13.3	30.0	11.7	52.8	25.3	22.2	12.2	4.3	11.0	9.6
(*N* = 11 ♂, 5 ♀)	92.0–107.0	30.0–36.0	12.0–14.0	28.0–32.0	10.0–13.0	49.7–55.5	24.3–26.2	21.4–23.4	11.6–12.7	4.0–4.6	10.4–11.4	9.3–10.0
Cuba; I. Juventud	97.4	32.7	14.0	26.6	12.3	51.0	23.5	20.7	11.0	4.2	10.0	9.0
(*N* = 10 ♂, 9 ♀)	91.0–103.0	28.0–39.0	12.0–16.0	26.0–30.0	11.0–14.0	48.3–53.4	22.8–24.3	20.0–21.3	10.7–11.6	4.0–4.4	9.6–10.5	8.6–9.4
Grand Cayman	97.4	35.0	14.1	26.7	12.3	51.0	23.5	20.3	11.2	4.0	10.0	8.9
(*N* = 7 ♀)	91.0–103.0	32.0–39.0	13.0–15.0	25.0–29.0	11.0–14.0	48.3–53.4	22.8–24.5	19.6–20.9	10.7–11.6	3.8–4.2	9.6–10.3	8.8–8.9
Hispaniola	96.1	32.4	14.3	26.7	11.6	53.9	26.1	22.6	12.3	4.5	11.1	9.9
(*N* = 6 ♂, 2 ♀)	93.0–99.0	29.0–37.0	12.0–16.0	25.0–29.0	10.0–13.0	51.5–55.6	25.2–26.6	22.2–22.7	11.9–12.5	4.4–4.7	10.8–11.4	9.4–10.3
Inagua	100.2	36.0	14.5	30.8	11.2	53.5	26.3	23.3	12.7	4.4	11.1	10.1
(*N* = 9 ♂, 20 ♀)	97.0–105.0	32.0–40.0	12.0–16.0	27.0–34.0	10.0–12.0	47.4–56.2	25.1–27.0	22.2–23.7	12.3–12.9	4.3–4.6	10.3–11.5	9.9–10.5
North. Bahamas	96.7	33.3	14.6	31.6	12.9	51.5	25.0	22.0	11.9	4.2	10.7	9.5
(*N* = 10 ♂, 22 ♀)	91.0–102.0	30.0–39.0	14.0–16.0	30.0–33.0	10.0–16.0	49.1–53.0	23.6–26.4	21.6–22.4	11.5–12.4	3.9–4.5	10.3–11.1	9.3–10.0

Cat Island, has two entrances; *Macrotus* were congregated at one end and *Erophylla sezekorni* at the other. An adult male from Clarencetown was taken in a tall chimney in the ceiling of an extensive (but not deep) cave.

Specimens examined (32).—BAHAMAS. *Cat Island*: 4.1 mi N Tea Bay, 1 (KU 150958); E end Cutlass Bay, Bain's Town, 15 (KU 150959–73); 3 mi NE Cutlass Bay, 13 (KU 150974–86); *Great Exuma*: 1 mi SSW Forest, 1 (KU 150987); *Long Island*: 4.9 mi SE Clarence Town, 1 (KU 151017); Pinder's Settlement, 24 mi NW Clarence Town, 1 (KU 151080).

Macrotus waterhousii jamaicensis Rehn, 1904

Sixteen specimens from Jamaica agree well with this subspecies as defined by Anderson and Nelson (1965). *Macrotus waterhousii jamaicensis* is easily distinguishable from *M. w. minor* from Cuba by its larger skull (Table 2). In coloration, five bats are in the red and 11 in the brown phases; of eight bats taken at the same locality on the same date, five are distinctly reddish, and three are brown. Although Anderson and Nelson (1965) wrote that *M. w. jamaicensis* possibly is darker than *M. w. minor*, differences in depth of pigmentation between the various subspecies are so subtle that it is difficult to state definitively which subspecies is paler or darker.

Specimens from Clarendon Parish, Jamaica, were collected in the same open and well-lighted cave as *Glossophaga soricina*. Two specimens from Westmoreland Parish, Jamaica, were netted in semi-xeric forest with abundant limestone outcroppings, boulders, and low cliffs; the entire region was one of alternating pastureland and woods.

Specimens examined (15).—JAMAICA. *Clarendon Parish*: 5.6 mi SE Portland Cottage, 8 (KU 151018–25); *Portland Parish*: Port Antonio, 1 (KU 151026); *St. Elizabeth Parish*: 3 mi SE Whitehouse, 4 (KU 151028–31); *Trelawny Parish*: Kinloss, 1 (KU 151027); *Westmoreland Parish*: Negril, large cave in town, 1 (KU 151032).

Additional specimen (1).—JAMAICA. *Westmoreland Parish*: Negril, 1 (exchanged).

Macrotus waterhousii minor Gundlach, 1865

Anderson and Nelson (1965) gave the distribution of *Macrotus waterhousii minor* as Cuba, Isla de Pinos (now Isla de la Juventud), and the Cayman Islands. Thomas (1966) referred two specimens from Navassa to this subspecies (also see Koopman, 1994). We have examined material from all these islands and agree that all are correctly assigned to the Cuban subspecies.

Macrotus waterhousii minor is the smallest of the Antillean subspecies of *M. waterhousii*. It is readily differentiated from *M. w. jamaicensis*, because skull measurements of *M. w. minor* (greatest length, condylobasal length, zygomatic breadth, mastoid breadth, upper toothrow) show little or no overlap with those of *M. w. jamaicensis*. External mensural differences are not so clear, but the ears of *M. w. minor* are distinctly shorter than are those of *M. w. jamaicensis* (Table 2).

A male and female taken on 26 April 1965 on Navassa are clearly referable to *M. w. minor*; length of upper toothrow measurements of 9.0 and 9.1 fall within the range of *M. w. minor* (8.6–9.4) and below that of *M. w. jamaicensis* (9.3–10.0). However, the forearm lengths of the specimens from Navassa (50.4, 50.5) are within the range of both *M. w. minor* (48.3–53.4) and *M. w. jamaicensis* (49.7–55.5). Other external and cranial measurements of these specimens

confirm the allocation of the population to *M. w. minor*—total length, 91, 90; length of tail, 34, 35; length of hind foot, 16, 15; length of ear, 30, 29; length of tragus, 12, 12; greatest length of skull, –, 23.8; condylobasal length, –, 11.2; postorbital constriction, 4.1, 4.1; mastoid breadth, –, 9.9.

Anderson and Nelson (1965) examined five specimens from Grand Cayman, and we have studied seven additional females from that island. Cranial measurement of these bats agree well with those of Cuban *M. w. minor*, except that in two characters (condylobasal length, postorbital constriction), the bats from Grand Cayman have lower extremes than do specimens from Cuba. Externally, the Cayman specimens are slightly larger than Cuban specimens—total length ($\bar{x}$ = 93.1 on Cuba and 97.4 on Grand Cayman), and have distinctly longer ears ($\bar{x}$ = 26.8 on Cuba and 30.1 on Grand Cayman). Because the Cayman Islands are virtually equidistant between Cuba and Jamaica, it is possible that these slight differences from *M. w. minor* are reflections of occasional dispersal from Jamaica; however, the concordance of skull measurements between specimens from Cayman and those from Cuba seems to negate any influence of *M. w. jamaicensis*, and the mean external differences may well be due merely to the smaller Caymanian sample.

On Cuba, *M. w. minor* was found regularly by Schwartz in well-lighted and often shallow caves. At times, even superficial "caves" are utilized; in such instances the bats retreated to the most remote portion of the depression so as to avoid direct sunlight. Evidence of occupancy of caves by *Macrotus* was often revealed by the presence on the cave floor of the dissociated wings of lepidopterans and odonates, as well as the wings of a variety of other insects. These result from the habit of *Macrotus* of returning during the night to a feeding perch, where prey captured on the wing is devoured while the bat hangs suspended. An adult male from San Vicente was consuming a large moth in a cave when captured. Two bats from Charco Mono in eastern Cuba were taken from within the arches and tunnels of a newly constructed dam. The specimens from Navassa were collected inside the lighthouse on that islet; occasionally, *M. w. minor* utilizes man-made structures rather than natural caves.

Six skins of *M. w. minor* show the reddish phase; these are from Cuba, Isla de la Juventud, and Grand Cayman. The rest of the skins are brown to brownish tan. Brown-phase *M. w. minor* seem to be slightly paler than brown-phase *M. w. jamaicensis*, but possibly this is because the specimens of *M. w. minor* have been preserved for a longer period of time.

Specimens examined (28).—CAYMAN ISLANDS. *Grand Cayman*: 6.6 mi SE Georgetown, 7 (KU 151033–39). CUBA. *Provincia de Camagüey*: Los Paredones, 10 mi NE Banao, 1 (KU 151040); *Provincia de Cienfuegos*: Guajimico, 2 (KU 151051–52); *Provincia de Guantánamo*: U.S. Naval Base, Guantánamo, 1 (KU 151058); *Provincia de La Habana*: Cueva del Rincon de Guanabo, 2 mi E Playa de Guanabo, 10 (KU 151041–48, KU 151055–56); *Isla de la Juventud*: 4.7 mi SW Santa Fe, 1 (KU 151049); 8.8 mi SSW Nueva Gerona, 1 (KU 151050); *Provincia de Pinar del Río*: San Vicente, 1 (KU 151057); *Provincia de Santiago de Cuba*: Charco Mono, 13 mi NW Santiago de Cuba, 2 (KU 151053–54). UNITED STATES. *Navassa Island*: The Lighthouse, 2 (KU 151061–62).

Additional specimen (1).—CUBA. *Provincia de Camagüey*: Los Paredones, 10 mi NE Banao, 1 (ROM 78502 [= AS 4953]).

Macrotus waterhousii waterhousii Gray, 1843

Three *Macrotus waterhousii* from Haiti, 78 from the Dominican Republic, and 29 from Great Inagua in the southeastern Bahamas are assignable to the nominate subspecies. The 29 bats from Great Inagua are larger than the four specimens examined by Anderson and Nelson (1965). The specimens from Great Inagua average larger than our Hispaniolan specimens in all external measurements except tragus and forearm (see Table 2), in which the means are slightly less in the bats from Inagua. Judging only from cranial measurements, the Inagua bats average slightly larger than our series from Hispaniola in most measurements, but the differences are not pronounced. The two large Inagua bats commented upon by Anderson and Nelson (1965) are larger than any from our series from that island.

Three of eight skins from Hispaniola and two from Inagua are in the reddish color phase. The remaining five Hispaniolan skins are brown dorsally. The bats from Great Inagua are pale, dusty, grayish brown and are quite distinct from both phases of *M. waterhousii* from Hispaniola.

On Hispaniola, *M. waterhousii* was found in caves. A cave at Diquini is a simple, open, and well-lighted dome-shaped cavern and is precisely the sort of cave that *Macrotus* customarily inhabits. Specimens from near Azua were taken from a widely open shelf-like cavern on a wooded hillside in semi-arid country. At a large cave at Boca de Chavon, *Macrotus* were collected in an interior chamber that opened by a flue to the outside. The large series from Great Inagua was taken from the interior of an abandoned and well-lighted kiln building; the bats were taken primarily from aggregations along the roofbeam and on the ceiling, but a few were observed in bricked kilns near the floor.

A female taken on 26 July 1975 and nine individuals collected on 1 August 1974 at Los Patos and two females obtained on 6 August 1974 near Cabo Rojo were volant young of the year as evidenced by their open ephyseal phalanges. Two females from 21 km northeast of Cabo Rojo were described by the collector as having "at term fetuses"

when taken on 19 May 1969. A female from Los Patos was lactating when obtained on 1 August 1974.

Specimens examined (110).—BAHAMAS. *Great Inagua*: 7 mi NE Matthew Town, 5 (KU 150988–92); Windsor Lake, 8 mi N Matthew Town, 24 (KU 150993–016). DOMINICAN REPUBLIC. *Provincia de Azua*: 8.9 mi N, 1.8 mi W Azua, 800 ft, 2 (KU 151063, KU 152427); 4 km NW Barreras, 9 (KU 151064–72); Loma El Numero, 1 (KU 151073); *Provincia de Barahona*: Los Patos, 55 (KU 151074–108, KU 151112–31, KU 152428); no specific locality, 3 (KU 151109–11); *Provincia de La Romana*: 1 mi N Boca de Chavon, 3 (KU 151132–34); *Provincia de Pedernales*: l'Eglise, 21 km NE Cabo Rojo, 1300 ft, 2 (KU 151135–36); east of Cabo Rojo, 3 (KU 151137–39). HAITI. *Dépertement de l'Ouest*: Diquini, 3 (KU 151059–60, KU 152426).

Monophyllus
Long-tongued Bats

In a systematic revision of the genus *Monophyllus*, Schwartz and Jones (1967) recognized two species—*M. redmani* and *M. plethodon*. The former is confined to the Greater Antilles, whereas living representatives of the latter are known only from the Lesser Antilles, although it is known as a fossil on Puerto Rico (Schwartz and Jones, 1967). The two living subspecies of *Monophyllus plethodon*—*luciae* and *plethodon*—each are represented in the Schwartz Collection by single individuals. A fossil subspecies, *M. p. frater*, is known from Puerto Rico, where it occurs sympatrically with *M. redmani*.

Monophyllus plethodon luciae Miller, 1902
Insular Long-tongued Bats

One adult female was taken in a mist net set across a stream in dense rainforest on Dominica on 21 February 1962. The subspecies *Monophyllus plethodon luciae* is distinguished from the nominate form by its overall larger size. External and cranial measurements of the female are: total length, 71; length of tail, 8; length of hind foot, 13; length of ear, 15; length of tragus, 5; length of forearm, 42.6; greatest length of skull, 23.4; condylobasal length, 21.8; zygomatic breadth, 9.7; postorbital constriction, 4.5; mastoid breadth, 9.5; length of upper toothrow, 7.9.

Specimen examined (1).—DOMINICA. *St. Paul Parish*: 6 mi NE Roseau, 1100 ft, 1 (KU 151216).

Monophyllus plethodon plethodon Miller, 1900

The single representative of the nominate subspecies is an adult male taken on 16 November 1961. Because Schwartz and Jones (1967) had measurements from only two specimens from Barbados, they were uncertain as to morphological distinctiveness of the population on the island. They continued to recognize the population on Barbados as a separate taxon because of the smaller measurements of the holotype, which fell below the known range of *Monophyllus plethodon luciae*. Schwartz and Jones (1967) did point out, however, that the specimen in the Schwartz Collection had measurements that fell within the range of those for *M. p. luciae*. External and cranial measurements of this male are: total length, 67; length of tail, 9; length of hind foot, 12; length of ear, 14; length of tragus, 5; length of forearm, 40.6; greatest length of skull, 23.0; condylobasal length, 21.5; zygomatic breadth, 10.2; postorbital constriction, 4.9; mastoid breadth, 9.9; length of upper toothrow, 7.5. Based on a comparison of this specimen with other Antillean populations, Schwartz and Jones (1967) concluded that there were no color differences between *M. p. plethodon* and *M. p. luciae*.

The specimen was taken in a mist net set between the supports for the road bridge at Jack-in-the-box Gully. The gully was a steep-sided ravine containing dense riparian woods. The surrounding area was flat and devoted primarily to cultivation of sugarcane. *Artibeus jamaicensis* was the only other species of bat captured in the ravine.

Specimen examined (1).—BARBADOS. *St. Thomas Parish*: Jack-in-the-box Gully, 1 (KU 151217).

Monophyllus redmani
Leach's Long-tongued Bat

Monophyllus redmani has three recognized subspecies, all of which are all represented in the Schwartz Collection.

Monophyllus redmani clinedaphus Miller, 1900

Schwartz and Jones (1967) reviewed the systematics and distribution of *Monophyllus*, and restricted the name *Monophyllus redmani clinedaphus* to populations on Cuba and Hispaniola. Specimens collected by Schwartz prior to 1967 were utilized in that study. Subsequently, two males and six females were netted in July 1968 and 1969 in pine forest at NE of Jarabacoa, Dominican Republic (2000 ft). At two localities near Carrefour Marmelade (3400 ft), 28 adult males were captured by J. W. Norton on 1–3 July 1974. Woods (1986) netted three individuals at 2100 m over a small stream that flows downhill and enters a large cave on the Massif de la Selle, Haiti, and took 23 females at elevations of 975–2300 m in the Massif de la Hotte, Haiti. The ecological situation from which these specimens were taken is unusual because all previous specimens from Hispaniola and Cuba had been collected in lowland caves, such as Cueva de Cotilla, Cuba, and Grotte la Forêt, Haiti (Schwartz and Jones, 1967).

At Les Cayes, Haiti, Schwartz took three females and a male on 3 August 1976. The two specimens from Los Patos, RD, are both juveniles; one is a female taken on 26 July 1975 and the other is a male captured on 1 August

1974. Lactating females were taken 9 July 1976 at Paillant, 19 July 1974 at Constanza, RD, and 23 and 29 July 1969 NE of Jarabacoa, RD.

Specimens examined (57).—CUBA. *Provincia de La Habana*: Cueva de Cotilla, 9 km SW San José de las Lajas, 5 (KU 151218–22). DOMINICAN REPUBLIC. *Provincia de Barahona*: Los Patos, 2 (KU 151241, KU 152401); *Provincia de La Vega*: 12 km NE Jarabacoa, 2000 ft, 8 (KU 151242–48, KU 152403); 19.3 km SE Constanza, 6200 ft, 1 (KU 152402). HAITI. *Dépertement de l'Artibonite*: 2.2 mi E Carrefour Marmelada, 3400 ft, 9 (KU 151223–31); Grotte de Paudin, 2.2 mi E Carrefour Marmelada, 3400 ft, 19 (KU 152378–96); *Dépertement du Sud*: Grotte la Forêt, 9 km WSW Jérémie, 8 (KU 151232–39); Les Cayes, 4 (KU 151240, KU 152398–400); Paillant, 1900 ft, 1 (KU 152397).

Monophyllus redmani portoricensis Miller, 1900

Monophyllus redmani portoricensis, which is characterized by its small size, is known only from Puerto Rico. Of 12 specimens collected by Richard Thomas, four females and two males were collected near Cidra on 4–5 February 1965, three females and a male were taken at Guánica on 6 March 1965, and a female and a male were obtained on 15–16 March 1965 near Utuado. One of the females taken on 5 February at Cidra was pregnant with an embryo measuring 15 in crown-rump length.

Specimens from near Cidra were taken in mist nets set in a wooded ravine. Near Guánica in southwestern Puerto Rico, mist nets were set in a ravine and across an unused road, both in xeric forest and scrub near sea level. Specimens from near Utuado were collected in a net in a cafetal near the edge of the northern escarpment of the Cordillera Central at 335 m. This area supports mesic forest. Because the habitats near Utuado and Guánica represent the extremes on the island, this glossophagine can be expected to occur throughout Puerto Rico.

Specimens examined (12).—PUERTO RICO. *Cidra*: ca. 1 km NE Cidra, 1300 ft, 6 (KU 151249–52, KU 152404–05); *Guánica*: 7.5 km E Guánica, 4 (KU 151253–56); *Utuado*: 17.7 km NE Utuado, 1100 ft, 2 (KU 151257–58).

Monophyllus redmani redmani Leach, 1821

Monophyllus redmani was described by Leach in 1821 based on a single specimen from Jamaica. Schwartz and Jones (1967) differentiated the subspecies *M. r. redmani* by its large body and cranial size, but relatively short forearm. Three males and a female were captured on 4 July 1961 in Windsor Cave, Jamaica, where Schwartz observed the bats clinging to, or flying just below, the high ceiling, well away from the entrance of this moist cave.

Specimens examined (4).—JAMAICA. *Trelawny Parish*: Windsor Cave, 4 (KU 151259–62).

Phyllonycteris poeyi Gundlach, 1861
Cuban Flower Bat

Until 1976, the genus *Phyllonycteris* was thought to be composed of four species, two of which were known from modern preserved specimens (*P. poeyi* on Cuba and *P. aphylla* on Jamaica) and two from sub-Recent fragmentary fossil skeletal remains (*P. obtusa* on Hispaniola and *P. major* on Puerto Rico). Jones and Carter (1976) placed *P. obtusa* as a subspecies of *P. poeyi*. Klingener et al. (1978) reported living individuals of *P. p. obtusa* from Hispaniola and presented additional evidence to support this taxonomic arrangement. Koopman (1993) also considered *P. poeyi* and *P. obtusa* to be conspecific. Schwartz was fortunate in securing living *P. p. obtusa* on Hispaniola, as well as a series of *P. p. poeyi* on Cuba; unfortunately, many of the skulls of the latter have been lost. In addition to Schwartz's specimens, we examined 11 specimens of *P. p. poeyi* from Provincia de Pinar del Río; data from both series are combined herein.

Phyllonycteris poeyi obtusa Miller, 1929

Three female *Phyllonycteris poeyi obtusa* were netted 16–17 October 1963 by Richard Thomas and Schwartz at Sosúa, RD. Details of the locality and other bats taken are given in the account of *Brachyphylla nana*. Specimens were collected at Paraíso, RD, on 4–5 August 1975 and at Río Arbonite, RD, on 18 June 1975 by M. H. Strahm. Measurements of the three adult females from Sosúa are: total length, 80, 83, 84; length of tail, 10, 9, 9; length of hind foot, 15, 16, 17; length of ear 16, 17, 16; length of tragus, 6, 8, 7; forearm 45.4, 47.2, 50.3; greatest length of skull, 24.2, 24.1, 25.0; condylobasal length, 22.5, 22.5, 23.6; zygomatic breadth, 11.1, 11.4, 11.5; postorbital constriction, 5.3, 5.4, 5.5; mastoid breadth, 11.5, 11.4, 11.5; length of upper toothrow, 7.2, 7.4, 7.8. There is nothing striking about the pelage of these three Hispaniolan *Phyllonycteris*. As in Cuban *Phyllonycteris*, the ears are pale tan and in general match the hue of the back, the wing membranes are brownish black, and the ventral fur is grayer than that of the dorsum. In external characters, the three Hispaniolan specimens do not differ from *P. poeyi* from Cuba. Woods (1986) netted a male at 1650 h on the Massif de la Hotte in Haiti.

Phyllonycteris obtusa was described on the basis of three skulls and a single mandible from three caves in Haiti (at St.-Michel de l'Atalaye, Port-de-Paix, and Diquini). As far as we are aware, *P. p. obtusa* had not been reported from living specimens until Klingener et al. (1978) took 37 specimens on the Haitian Tiburon Peninsula in 1973–1974. Miller (1929:10–11) differentiated *P. obtusa* from *P. poeyi* (to which he admitted *P. obtusa* was closely related) by the smaller incisive foramina and "less narrowly curved" anterior border of the premaxillaries in *P. p. obtusa*. In an attempt to

quantify the latter character, Miller stated that the ratio of the distance between the anterior border of the premaxilla and the posterior border of the incisive foramina divided by the width of the palate at the inciso-canine diastema is 56.6–59.5 in *P. p. obtusa*, whereas the average is about 82 in *P. p. poeyi*. Stated another way, "The curve of the anterior premaxillary border of the palate forms part of a circle which, if completed posteriorly, would pass close behind the foramina in *P. poeyi*, but in *P. obtusa* it would be so much larger that the hinder edge of the foramina would scarcely extend beyond its center" (Miller, 1929:11). Miller also noted that the mandible and upper and lower molars of *P. p. obtusa* do not differ appreciably from those of *P. p. poeyi*.

We agree with previous authors that were unable to verify the differences attributed to fresh material by Miller to *P. p. obtusa*. Comparison of a large series of skulls of Cuban *P. p. poeyi* with Hispaniolan specimens, does not reveal cranial differences. There are no differences in the premaxilla-foramen/palatal width ratio between Hispaniolan bats (range 53.6–68.0) and Cuban *P. p. poeyi* (46.7–75.0). All cranial measurements are quite comparable, and in most cases the range of variation in Cuban *P. p. poeyi* encompasses that of the Hispaniolan females. Pelage differences do not exist. We conclude that the recent specimens from Hispaniola are identical with the Cuban specimens and should be referred to *P. poeyi*. Based on these observations, we are following Jones and Carter (1976) and Klingener et al. (1978) in considering living *Phyllonycteris* from Cuba and Hispaniola to be conspecific.

Klingener et al. (1978) caught their Hispaniolan bats in ravines, as well as on dry hillsides. One individual was carrying a fruit. Three females taken 17 December were gravid, each with one embryo (15, 20, 22 mm). One of our specimens from Río Arbonite carried a single embryo 10 in crown-rump length when taken on 18 June 1975.

Specimens examined (27).—DOMINICAN REPUBLIC. *Provincia de Barahona*: 8 km W Paraíso, 500 ft, 22 (KU 151263–82, KU 152406–07); *Provincia de La Estrellita*: Río Arbonite, 15 km SE jct with Río Lupis, 2 (KU 151758–59); *Provincia de Puerto Plata*: Sosúa, 3 (KU 151283–85).

Phyllonycteris poeyi poeyi Gundlach, 1860

Measurements of four males and 11 females from Cueva de los Indios and six females from Guanajay, Cuba as well as one female from Guaso, Guantánamo, Cuba are: total length, 75–87 ($\bar{x}$ = 81.4); length of tail, 8–12 ($\bar{x}$ = 9.8); length of hind foot, (16–20) 17.4; length of tragus, 7–8 ($\bar{x}$ = 7.5); length of forearm, 44.3–49.0 ($\bar{x}$ = 47.0); greatest length of skull, 24.0–25.8 ($\bar{x}$ = 24.7); condylobasal length, 21.8–24.0 ($\bar{x}$ = 22.8); zygomatic breadth, 10.8–11.8 ($\bar{x}$ = 11.3); postorbital constriction, 5.1–5.7 ($\bar{x}$ = 5.4); mastoid breadth, 10.7–11.8 ($\bar{x}$ = 11.1); length of upper toothrow, 7.5–7.9 ($\bar{x}$ = 7.7). Miller's (1904) comments about the uniformity of pelage color in a large series of *P. poeyi* are fully confirmed by our material. This species is an exceptionally attractive one; the hair bases are pale cream and the dorsal hairs are tipped with grayish brown.

Schwartz's experience with *Phyllonycteris poeyi* on Cuba was extremely limited. At Cueva de los Indios, a cave on a forested limestone ridge, the bats were encountered in the high, vaulted, and unventilated chamber at the end of the cave. In the cave, *P. poeyi* was abundant, more so than *Brachyphylla*, which also prefers hot and humid caverns. As described by Palmer (in Miller, 1904), the interior of the cave was extremely hot and humid; once the bats were disturbed, the cave atmosphere quickly became extremely uncomfortable and suffocating.

Specimens examined (14).—CUBA. *Provincia de La Habana*: Tapaste, Cueva de los Indios, San Vicente, 14 (KU 152408–21).

Additional specimens (17).—CUBA. *Provincia de La Habana*: Tapaste, Cueva de los Indios, San Vicente, 6 (ROM 78764 [= AS 4657]; RPM 2002C-5-269–70 [= AS 4659–60]; UIMNH 16403–04 [= AS 4655–56]; AS 4658 marked exchanged to Mumford); *Provincia de Pinar del Río*: Guanajay, 11 (USNM 103537–39, USNM 103544–51).

Phyllops falcatus haitiensis (J. A. Allen, 1908) Cuban Fig-eating Bat

The genus *Phyllops* is one of four endemic Antillean genera (along with *Ardops* in the Lesser Antilles, *Ariteus* on Jamaica, and *Stenoderma* on Puerto Rico and the Virgin Islands) that are poorly known. Of the two currently recognized living species of *Phyllops*—*P. haitiensis* from Hispaniola and *P. falcatus* (Gray) on Cuba—the latter is known from 26 published localities. *Phyllops haitiensis* has been reported previously from only 10 localities, eight in Haiti (cave near St.-Michel de l'Atalaye, Massif de la Hotte, Massif de la Selle, Paillant, Pétionville, Port-au-Prince, and 4 in the vicinity of Lebrun) and two in the Dominican Republic (Caña Honda and 6 mi E Arenosa; Armstrong and Johnson, 1969). Caña Honda lies on the south side of the Bahia de Samana on the north coast of Hato Mayor Province, RD. Hall and Kelson (1959) misplaced the locality symbol for Caña Honda; the name is common in the Dominican Republic, but the correct locality is evident from the collector's (A. H. Verrill) itinerary (Wetmore and Swales, 1931). The locality is a well-known sea cave (locally known as Cueva de Caña Honda), and presumably the other species reported by J. A. Allen (1908) from this locality (*Pteronotus quadridens, Macrotus waterhousii, Artibeus jamaicensis*) were secured in the same cave as the holotype of *P. haitiensis*. However, the latter is not known to use caves as diurnal retreats.

At present, we see no reason to regard *P. falcatus* and *P. haitiensis* as two species and hereby treat *haitiensis* as a

subspecies of *P. falcatus*. Their characters in most cases overlap broadly, and differences in length of forearm and pelage color may be more realistically considered as subspecies characters. Accordingly, we combine the Cuban and Hispaniolan *Phyllops* as *P. f. falcatus* (Cuba) and *P. f. haitiensis* (Hispaniola). This relationship also has been suggested by Klingener et al. (1978).

The only published measurements for *Phyllops f. haitiensis* are those of two females and one skull (Sanborn, 1941) and those of Klingener et al. (1978) and Swanepoel and Genoways (1979) based on specimens from Paillant and the vicinity of Lebrun, Haiti. Thirty specimens are from the Dominican Republic: two females from Sosúa collected by Richard Thomas on 17 and 18 October 1963, six females and one male from 12 km northeast of Jarabacoa taken by John K. Lewis between 18 and 24 July 1968, two females from 8 km west of Paraíso obtained by M. H. Strahm on 5 August 1975, three males and six females from 12 km southwest of Barahona collected by Schwartz on 10 August 1975, a male and a female from Manantial Pepe taken by M. H. Strahm on 5 July 1975, two males and two females from 21 km southwest of La Vega taken by J. W. Norton between 21 and 24 July 1974, a female from 13.5 km southwest of Piedra Blanca taken by Schwartz on 22 August 1973, two females from 1.6 km south of Constanza collected by Schwartz on 9–10 October 1971, and a female from Río Bao taken by Schwartz on 20 June 1975. From Haiti, there are a male from 6.5 km south of Terrier Rouge taken by Elie Cyphale on 8 April 1966, a male and a female netted at Cap Haitien by J. W. Morton on 15 and 30 June 1974, respectively, a male taken at Pétionville by J. W. Norton on 4 May 1974, and a male taken at Les Cayes by Schwartz on 3 August 1976.

External measurements of the seven fresh specimens (2 males first, followed by 5 females) are: total length, 55, 55, 65, 63, 60, 60, 58; length of hind foot, 10, 12, 13, 12, 12, 13, 12; length of ear, 16, 13, 16, 18, 17, 17, 16; length of tragus, 5, 6, 7, 8, 7, 7, 7; length of forearm, 40.7, 39.6, 42.2, 41.6, 42.2, 42.3, 40.4. Cranial measurements of eight individuals (2 males, 6 females) are: greatest length of skull, 19.3, 19.7, 20.3, 20.6, 19.6, 20.8, 19.3, 20.3; condylobasal length, 17.4, 17.5, 18.1, 18.3, 18.4, 18.1, 17.7, 18.4; zygomatic breadth, 13.3, 13.1, 13.0, 13.5, 13.1, 13.7, 13.1, 13.4; postorbital constriction, 5.0, 5.3, 5.2, 5.4, 5.0, 5.7, 5.1, 5.5; mastoid breadth, 11.4, 11.6, 11.7, 11.1, 11.4, 12.4, 11.4, 11.9; length of upper toothrow, 5.9, 5.6, 5.9, 6.2, 5.6, 6.1, 5.5, 6.0.

Dorsally, the general aspect of *Phyllops f. haitiensis* is drab tan (Pl. 14D6, Pl. 13B6), but some specimens are somewhat darker brown (Pl. 15A10). The hairs are gray basally and tipped with brown to tan. The head is paler than the back, due both to the paler gray hair bases and the pale tan or brown hair tips. The ears are the same color as the head fur, and the tragus is moderately bright yellow, in sharp contrast to the pinna. The membranes are dark brown. The ventral fur is clearer than that of the back, because the hairs on the belly lack gray bases. There is a small white patch on the shoulder above the insertion of the forearm.

Our measurements, when combined with those of five other specimens (USNM 218351, USNM 2671139–42), show that *Phyllops f. haitiensis* has the following mensural characters: length of forearm, 39.6–42.3 ($\bar{x}$ = 41.3); greatest length of skull, 18.9–20.8 ($\bar{x}$ = 19.9); condylobasal length, 16.8–18.8 ($\bar{x}$ = 18.0); zygomatic breadth, 12.4–13.7 ($\bar{x}$ = 13.2); postorbital constriction, 5.0–5.7 ($\bar{x}$ = 5.3); mastoid breadth, 11.1–12.4 ($\bar{x}$ = 11.7); length of upper toothrow, 5.5–6.2 ($\bar{x}$ = 5.8). J. A. Allen's (1908) measurement of the length of forearm of the holotype (39.0) is below the range given above. According to Hall (1981), one of the two key differences between *P. f. haitiensis* and *P. f. falcatus* is that the length of forearm length is less than 40 mm in the former, more than 40 mm in the latter. Obviously this difference will not separate all specimens of the two species.

We examined one male, two females, and five unsexed skulls of *Phyllops f. falcatus* from Cuba (USNM 123187, 143844, 300504–5, 300591, 300593–5). Data from this series are: length of forearm, 42.7–45.8 ($\bar{x}$ = 44.2); greatest length of skull, 17.4–19.0 ($\bar{x}$ = 18.3); zygomatic breadth, 13.2–14.2 ($\bar{x}$ = 13.7); postorbital constriction, 5.2–5.6 ($\bar{x}$ = 5.4); mastoid breadth, 11.7–12.4 ($\bar{x}$ = 12.0); length of upper toothrow, 5.9–6.2 ($\bar{x}$ = 6.1). In this small, sample *P. f. falcatus* and *P. f. haitiensis* are separable on the basis of shorter forearm in *P. f. haitiensis* (39.6 to 42.3 as opposed to 42.7 to 45.8 in *P. f. falcatus*).

The other supposed key difference between the two species is the shape and extent of the palatal emargination. In *Phyllops f. haitiensis* (Hall and Kelson, 1959; Hall, 1981), the emargination is V-shaped and extends anteriorly approximately to the level of the anterior edge of M2, whereas in *P. f. falcatus* the emargination is U-shaped and extents forward approximately to the level of the middle of M2. Anthony (1919) noted that, in his series of fragmentary skulls of *P. f. falcatus*, there were minor variations in the breadth, extent, and shape of the postpalatal notch. Both our and Schwartz's examination of six skulls of *P. f. falcatus* and 13 of *P. f. haitiensis* readily confirmed Anthony's comments. For example, one skull (USNM 218351) of *P. f. haitiensis* has the anterior margin of the notch U-shaped rather than V-shaped, and one specimen of *P. f. falcatus* (USNM 300591) has the notch much more V-shaped and attenuate than any *P. f. haitiensis*. The anterior extent of the emargination likewise varies considerably within both samples. It is obvious that this cranial character is not constant or even especially significant.

In addition to the forearm measurements, which separate *P. f. falcatus* from *P. f. haitiensis*, there seems to be a distinct color difference. The dorsal pelage of *P. f. falcatus*

is considerably darker (more brown) than that of *P. f. haitiensis*. Although the three *P. f. falcatus* skins are much older than the seven *P. f. haitiensis*, the former are quite consistent in color. This apparent pelage difference offers another useful character for differentiating these two taxa.

The two specimens were taken at Sosúa in a mist net set in a small patch of mesic deciduous forest near the coast. At Jarabacoa, bats were netted in open pine forest at an elevation of ca. 610 m (2000 ft). The two females from 1.6 km south of Constanza were taken at an elevation of 1220 m (4000 ft). An individual (one of two) observed from Terrier Rouge, a western extension of the xeric Dominican Valle de Cibao, flew from a dense tangle of vines during the day. Woods (1986) netted a female at 2150 m in the Haitian Massif de la Selle and two males at 975 m in the Massif de la Hotte in an area of native gardens and fruit trees.

A female from Sosúa taken 17 October 1963 and one from 8 km west of Paraíso taken on 5 August 1975 had fetuses with crown-rump lengths of 21 and 28, respectively. Three females from Jarabacoa were gravid; the fetuses near term on 20 and 23 July 1968 and 29 July 1969. A female from 21 km southwest of La Vega was gravid on 21 July 1974. Lactating females were taken on 20 June 1975, 23 July 1969, and 10 October 1971.

Klingener et al. (1978) reported that *P. f. haitiensis* was second in abundance to *Artibeus jamaicensis*, but that *P. f. haitiensis* was netted more frequently than *A. jamaicensis* in thickly vegetated ravines. They reported gravid females taken 4–9 January (6; embryos 6.5–14 mm), 14–17 August (14; embryos 10–43 mm); and 27 May (5). Apparently, *P. f. haitiensis* has an extended or bimodal reproductive period.

Specimens examined (35).—DOMINICAN REPUBLIC. *Provincia de Barahona*: 8 km W Paraíso, 500 ft, 2 (KU 151289, KU 151291); 12 km SW Barahona, 1400 ft, 9 (KU 151290, KU 151292–99); *Provincia de La Altagracia*: Manantial Pepe, 3 km SW Punta Caña, 2 (KU 151300–01); *Provincia de La Vega*: 21 km SW La Vega, 2100 ft, 4 (KU 151302–05); 12 km NE Jarabacoa, 2000 ft, 7 (KU 151306–12); 13.5 km SW Piedra Blanca, 1200 ft, 1 (KU 151313); 1 mi S Constanza, 4000 ft, 2 (KU 152424–25); *Provincia de Puerto Plata*: Sosúa, 2 (KU 151314–15); *Provincia de Santiago*: Río Bao, 5 km SE Los Montones Abajo, 1 (KU 151316). HAITI. *Département du Nord*: Cap Haitien, 2 (KU 151286, KU 152422); 4 mi S Terrier Rouge, 1 (KU 151287); *Département de l'Ouest*: Pétionville, 1500 ft, 1 (KU 152423); *Département du Sud*: Les Cayes, 1 (KU 151288).

Additional specimens (5).—HISPANOLA. 5 (USNM 218351, USNM 2671139–42).

Stenoderma rufum darioi Hall and Tamsitt, 1968
Red Fig-eating Bat

Stenoderma rufum was described by É. Geoffroy St.-Hilaire in 1818, and no additional living specimens of the red fig-eating bat were collected until 1943, when Harry A. Beatty secured a specimen on St. Thomas in the U.S. Virgin Islands. Three more specimens were collected by James W. Bee on St. John in the same island group in 1957 (Hall and Bee, 1960); at that time, no additional Recent specimens were available from Puerto Rico, where they assumed that the bat still existed, because fossil material had been found there by Anthony (1918).

On 15 and 19 March 1965, two *Stenoderma rufum* were taken by Richard Thomas at 17.7 km NE Utuado (335 m), Puerto Rico. Other *S. rufum* have been collected on Puerto Rico (Tamsitt and Valdivieso, 1966), and Schwartz's specimens and those taken by Tamsitt served as the hypodigm of *S. r. darioi* described by Hall and Tamsitt (1968). Choate and Birney (1968) described *S. r. anthonyi* from sub-Recent cranial material from Puerto Rico. Jones et al. (1971) reported on morphometric variation in a sample of 30 *Stenoderma* from Puerto Rico and documented that males are significantly smaller than females in nine cranial measurements and length of forearm.

The two *Stenoderma rufum* in the Schwartz Collection were collected in a mist net set between two large shade trees in the *cafetal* of Sr. Miguel Roses near the northern slope of the Cordillera Central in central Puerto Rico. Five nights of netting yielded only two *Stenoderma*, but *Artibeus*, *Brachyphylla*, and *Monophyllus* also were taken in the same net, along with diurnal birds (*Coereba flaveola*, *Turdus plumbeus*, *Geotrygon montana*, *Vireo altiloquus*). The net was set in the mouth of a short and open gully—like a small amphitheater—that had only a herbaceous understory and lacked both trees and shrubs. During the day, as in most Puerto Rican *cafetales*, the forest canopy provided ample shade for the lower coffee trees. The area is generally extremely mesic and humid in the summer, hot during the day but cool (due to the elevation) at night.

A male and a female, respectively, have the following measurements that are within the range reported by Jones et al. (1971): total length, 65, 66; length of hind foot, 10, 12; length of ear, 17, 20; length of tragus, 7, 6; length of forearm, 48.0, 49.7; greatest length of skull, 22.8, 23.0; condylobasal length, 18.9, 19.7; zygomatic breadth, 15.1, 15.6; postorbital constriction, 5.8, 5.6; mastoid breadth, 12.7, 13.2; length of upper toothrow, 6.9, 7.0.

In pelage color, the Puerto Rican specimens differ from the bats from St. John described by Hall and Bee (1960). They noted that specimens from St. John were Buckthorn Brown (Ridgway, 1912), which equals Pl. 17L8 of Maerz and Paul (1950). The two Puerto Rican specimens lack the reddish tones ascribed to the bats from St. John; the Puerto Rican female has a pale brown dorsum (Pl. 7A8), and the male is much darker brown (Pl. 16A10). The wing membranes and uropatagium are blackish brown in the male and brown in the paler female. A white subauricular cres-

cent is present, and there is a white patch where the anterior edge of the patagium joins the body. The ventral pelage is paler than the dorsum in both bats, and the ventral fur of the male is, in consonance with its darker pelage, darker than that of the female.

Specimens examined (4).—PUERTO RICO. *Luquiollo*: 1 mi NW El Yungue Peak, 355 m, 2 (KU 114009–10); *Utuado*: 17.7 km NE Utuado, 1100 ft, 2 (KU 151320–21).

Sturnira lilium
Yellow-shouldered Bat

In addition to the widely distributed *Sturnira lilium*, three species have been named in the genus *Sturnira* from the West Indies—*S. angeli*, *S. paulsoni*, and *S. thomasi*. Jones and Phillips (1976) placed the first two of these species as subspecies of the widespread mainland Neotropical species *S. lilium*. They also described two additional subspecies from the islands (*S. l. luciae* from St. Lucia and *S. l. zygomaticus* from Martinique). Genoways (1998) recently described another new subspecies, *S. l. serotinus*, from Grenada, bringing the total forms of yellow-shouldered bats recognized in the Lesser Antilles to five. Two of these subspecies are represented in the Schwartz Collection. Jones and Phillips (1976) continued to treat *S. thomasi* as a distinct species, which is the course of action followed by most subsequent authors. Genoways (1998) recently described a new subspecies of *S. thomasi*, *S. t. vulcanensis*, from Montserrat, but only the nominate subspecies is represented in the Schwartz Collection.

Sturnira lilium angeli de la Torre, 1966

De la Torre (1966) based his description of this taxon on specimens in the Schwartz Collection, which contained the holotype and five of the eight paratypes. Jones and Phillips (1976) placed *Sturnira angeli* as a subspecies of *S. lilium* and distinguished it from other subspecies by its medium size, relatively narrow zygomatic region, and details of the morphology of the molars. Measurements of specimens in the Schwartz Collection were given by de la Torre (1966).

Describing the site of the type locality where Schwartz captured these specimens, de la Torre (1966) stated that the bats were taken in mist nets set across a 8-m and a 5-m wide stream that was fairly placid and torrential, respectively, at locations of nets. The streams were in rainforest with no cultivated fields in the vicinity. Other bats taken in these nets between 15 and 21 February 1962 were *Artibeus jamaicensis* and *Brachyphylla cavernarium*.

Specimens examined (6).—DOMINICA. *St. Paul Parish*: 6 mi NE Roseau, 6 (KU 151322–26; USNM 361881—holotype [= AS 5354]).

Sturnira lilium paulsoni
de la Torre and Schwartz, 1966

The holotype of this taxon described by de la Torre and Schwartz (1966) was originally in the Schwartz Collection, but now is deposited in the National Museum of Natural History. Measurements of the holotype were given by de la Torre and Schwartz (1966). Jones and Phillips (1976) distinguished the taxon from other populations of *Sturnira lilium* by small to medium overall external and cranial size, pale coloration, and details of the molar teeth.

The adult female was captured in a mist net set across 6-m wide fast-flowing stream in montane rainforest.

Additional specimen (1).—ST. VINCENT. *St. Andrew Parish*: Lowrt, 1000 ft, 1 (USNM 361882—holotype [= AS 5333]).

Sturnira thomasi thomasi
de la Torre and Schwartz, 1966
Sofaïa Bat

Sturnira thomasi was described by de la Torre and Schwartz (1966) from a single specimen in Schwartz's collection, which now is deposited in the National Museum of Natural History. Measurements of the holotype were given by de la Torre and Schwartz (1966). This species is distinguished from other Antillean members of the genus by its large size and long, narrow cranium (Jones and Phillips, 1970; Genoways and Jones, 1975; Pedersen et al., 1996; Genoways, 1998).

The single adult male in the Schwartz Collection (the holotype) was taken in a mist net set in a deep ravine in dense forest.

Additional specimen (1).—GUADELOUPE. *Basse-Terre*: Sofaïa, 1200 ft, 1 (USNM 361883—holotype [= AS 5413]).

FAMILY NATALIDAE

Natalus lepidus (Gervais, 1837)
Gervais' Funnel-eared Bat

Natalus lepidus is the smallest of the West Indian bats, and occurs on Cuba and Isla de la Juventud, and in the Bahama Islands on Long, Cat (G. M. Allen and Sanborn, 1937), Eleuthera, and Little Exuma islands (Koopman et al., 1957). Morgan (2001) suggested that this species was distinct from the other members of the genus *Natalus*, warranting recognition as the sole member of the genus *Nyctiellus*, which is a departure from all other recent taxonomic treatments (e.g., Koopman, 1993). Although we concur that there are a number of characters that distinguish this species, we refrain from taking this step until we've had the opportunity to examine specimens from throughout the range as well as genetic data. No subspecies are recognized. Schwartz's material is from mainland Cuba (16 specimens) and Isla de la Juventud (8 specimens), and Long Island in the Bahamas (8 specimens). External mea-

surements for specimens from Cuba and Isla de la Juventud are: total length, 63–70; length of tail, 24–34; length of hind foot, 5–7; length of ear, 10–12; length of tragus, 4–5; length of forearm, 28.0–30.6. Cranial measurements of specimens from Isla de la Juventud are: greatest length of skull, 13.4 (2 skulls); condylobasal length, 12.8–13.2 ($\bar{x}$ = 13.0); zygomatic breadth, 6.4–6.5 (2 skulls); postorbital constriction, 2.6–2.8 ($\bar{x}$ = 2.7); mastoid breadth, 6.3–6.4 ($\bar{x}$ = 6.4); length of upper toothrow, 5.2–5.4 ($\bar{x}$ = 5.3). The length of forearm measurement of the eight Long Island bats averaged 28.4–29.9 ($\bar{x}$ = 28.9); means for length of forearm of Cuban and Isla de la Juventud samples are 29.2 and 29.8, respectively. Allen and Sanborn (1937) recorded means of 27.6–30.4 ($\bar{x}$ = 29.1) for 20 Cuban specimens and 27.2–30.0 ($\bar{x}$ = 28.8) for 112 specimens from Long Island. Despite our much smaller series, there is close agreement in the mean length of forearm in samples from the Schwartz Collection and those of Allen and Sanborn (1937). Apparently, Bahaman specimens have slightly shorter forearms than do those from Cuba, whereas *N. lepidus* from Isla de la Juventud has slightly longer forearms.

All but one of the Cuban specimens are rich orange-brown dorsally; the bases of the hairs are deep orange and the tips, dark brown. On the other hand, specimens from Isla de la Juventud are much paler and have the hair bases creamy color rather than orange. The single exceptional Cuban individual, an adult male from the Peninsula de Guanahacabibes in extreme western Cuba, is like specimens from Isla de la Juventud. Bahaman specimens are preserved in fluid, but the dorsal coloration seems to have been pale like bats Isla de la Juventud, rather than like the deeply pigmented bats from Cuba.

The series from Isla de la Juventud was collected under unusual circumstances. During the day, George R. Zug and Schwartz discovered an abandoned mine shaft on the eastern slopes of the Sierra de las Casas near Nueva Gerona. The shaft sloped steeply at an angle of 45° for about 30 m, ending in a deep pool of fresh water. At the end of the shaft there was a short side shaft at right angles to the main shaft. Twittering of bats was heard within this side shaft, but during the day the animals were inaccessible. Returning to the mine before dusk with a mist net, they approached the mine opening along a fairly wide path through mesic woods and were greeted by a steady and abundant flow of bats along the path. The sun was still shining, but the path itself was shaded. Rather than putting up the net at the mine mouth, they merely stood, one on either side of the path, holding the net very briefly across the path, and immediately caught many *N. lepidus*. The eight specimens represent only a small portion of the *Natalus* caught in the net in 30 s. One of the females taken on 3 July 1958 was pregnant with an embryo described by the field preparator as "term."

On Cuba, Schwartz encountered *N. lepidus* only at the cave near Guanajay, despite visits to many other caves. The single individual from the Peninsula de Guanahacabibes was shot near the coast in xeric habitat.

Specimens examined (32).—BAHAMAS. *Long Island*: Pinder's Settlement, 24 mi NW Clarence Town, 8 (KU 151173–80). CUBA. *Isla de la Juventud*: E base Sierra de las Casas, west of Nueva Gerona, 8 (KU 150708–11, KU 151181–84); *Provincia de Pinar del Río*: Peninsula de Guanahacabibes, 40 km W El Cayuco, 1 (KU 150712); Cueva de William Palmer, Guanajay, 15 (KU 151185–93, KU 152351–56).

Additional specimens (7).—BAHAMAS. *Long Island*: Pinder's Settlement, 24 mi NW Clarence Town, 5 (UF 12833–12837 [= AS 662, 661, 672, 674, 667]). CUBA. *Provincia de Pinar del Río*: Cueva de William Palmer, Guanajay, 2 (ROM 78779–80 [= AS 4681, 4689]).

Natalus micropus macer (Miller, 1914)
Cuban Funnel-eared Bat

Natalus macer was described by Miller (1914) as a species; subsequently it was treated as a subspecies of *N. micropus* by Viña Bayés and Deas Díaz (1970) and Varona (1974), as well as more recent authors (Silva Taboada, 1979; Hall, 1981). Ottenwalder and Genoways (1982) reviewed the systematic relationships of members of the *N. micropus* complex, and recognized two species, *N. micropus* and *N. tumidifrons*, the former with two subspecies, *N. m. micropus* and *N. m. macer*. *Natalus m. macer*, which is confined to Cuba and Isla de la Juventud, was distinguished from the nominate subspecies by a combination of a longer length of forearm and shorter length of Phalanx 1 (Digit III). Ottenwalder and Genoways (1982) examined 28 specimens of *N. m. macer* (including 4 in the Schwartz Collection) from five Cuban localities and Isla de la Juventud.

The length of forearm (32.8) and cranial measurements of the female holotype agree well with those of one male and three females from San Vicente, Provincia de Pinar del Río, Cuba, which have the following external measurements: total length, 89, 92, 89, 85; length of tail, 44, 52, 45, 48; length of hind foot, 7, 7, 8, 7; length of ear, 15, 16, 14, 13; length of tragus, 4, 3, 4, 4; length of forearm, 32.9, 32.8, 32.3, 30.9. Cranial measurements of two females (second and fourth above) are: greatest length of skull, 14.5, 14.5; condylobasal length, 13.2, 13.7; zygomatic breadth, 6.5, 6.7; postorbital constriction, 3.0, 2.9; mastoid breadth, 6.5, 6.5; length of upper toothrow, 6.1, 6.0.

Two of the individuals were collected within Cueva de los Indios, a large and extensive river cave in the limestone *mogotes* to the south of the village of San Vicente, and the two were secured by chance (in different years) when they flew into the same room in the hotel at San Vicente. *Natalus* is not infrequently encountered in buildings. Despite the large numbers of bats in Cueva de los

Indios, *N. m. macer* seems to be distinctly uncommon there, perhaps the least common of the species that regularly occur in the cave—*Mormoops blainvillii, Pteronotus macleayii, P. parnellii, P. quadridens, Phyllonycteris poeyi,* and *Eptesicus fuscus*.

Of the four specimens of *N. m. macer*, one female is pale orange-tan dorsally and ventrally; this tint is due to the buffy hair bases in combination with the darker (medium brown) tips. Two other females and a male are dark brown dorsally and ventrally; the hair bases are creamy gray.

Specimens examined (4).—CUBA. *Provincia de Pinar del Río*: San Vicente, 2 (KU 152358–59); Cueva de los Indios, San Vicente, 1 (KU 152357, KU 152360).

Natalus stramineus
Funnel-eared Bat

We depart from the usage of Goodwin (1959) regarding *Natalus stramineus* and *N. major* as two species and combine (as did Varona, 1974; and Hall, 1981) several named taxa (*N. jamaicensis, major, mexicanus, natalensis, primus, saturatus,* and *stramineus*) as subspecies of *N. stramineus*.

Natalus stramineus major Miller, 1902

Comparison of skulls of *Natalus* from Dominica (*Natalus stramineus stramineus*), Hispaniola (*N. s. major*), and Isla Cozumel (*N. s. saturatus*) reveal no differences that can be considered specific; in fact, the differences are primarily in size of skull rather than any structural feature. Goodwin (1959) associated three populations (*N. jamaicensis, major, primus*) under *N. major*. The only stated differences between these subspecies and *N. stramineus* involve the relative size and shape of the braincase and the rostrum and the posterior extent of the palate ("long and extending backward more than halfway to posterior border of pterygoid wings" in *N. stramineus*—Goodwin, 1959:4). Koopman and Williams (1951:17–18) noted (of *mexicanus, stramineus, "dominicensis," major,* and *primus*): "These forms constitute a series showing a gradual increase in size, *mexicanus* being the smallest, *primus* the largest." The difference in size between the various populations grouped by Goodwin as subspecies of *N. stramineus* and *N. major* indicate that they are much more logically regarded as subspecies than as two species.

Like most Antillean natalids, *N. s. major* is poorly represented in collections. The subspecies has been reported from Savaneta (the type locality near the northern coast of the Dominican Republic) and from Port-au-Prince, Dépt. de l'Ouest, Haiti (Sanborn, 1941). Goodwin (1959) listed material from two additional localities in the Dominican Republic—Los Patos and Maniel Viejo, both in Barahona Province. However, his data include forearm and cranial measurements of only four specimens. Our material is from two new localities: a male is from Camp Perrin at about 300 m elevation on the southern slopes of the Massif de la Hotte, near the extreme tip of the southwestern Tiburon Peninsula and seven males and two females were collected by Richard Thomas at 5 km SE Pepillo Salcedo, RD, where they were taken from the interior of a large hollow tree in well-forested but semi-arid lowlands (near sea level) adjacent to Laguna de Salodillo on the Dominican-Haitian border. The tree was sufficiently large to allow a person to enter, and the bats were seen during the day clinging to the upper portion (about 3 m above ground) of the smooth dome-like ceiling of the hollow. Despite the height of the interior of the cavity, the entrance hole (through which the collector had to crawl) was at ground level.

External measurements for the entire series (8 males, 2 females) are: total length, 102–110 ($\bar{x}$ = 107.0); length of tail, 52–59 ($\bar{x}$ = 56.0); length of hind foot, 8–11 ($\bar{x}$ = 9.0); length of ear, 13–17 ($\bar{x}$ = 15.0); length of tragus, 3–5 ($\bar{x}$ = 4.6); length of forearm, 43.1–45.8 ($\bar{x}$ = 44.1). Cranial measurements of eight specimens are: greatest length of skull, 17.0–18.6 ($\bar{x}$ = 18.0); condylobasal length, 15.4–17.4 ($\bar{x}$ = 16.7); zygomatic breadth, 9.0–9.7 ($\bar{x}$ = 9.5); postorbital constriction, 3.1–3.7 ($\bar{x}$ = 3.4); mastoid breadth, 7.7–9.0 ($\bar{x}$ = 8.7); length of upper toothrow (7 males, 1 female), 7.6–8.0 ($\bar{x}$ = 7.9). The male from Camp Perrin lies at the lower extreme of the series in every cranial measurement and is also the smallest of the series in total length and length of forearm, although it is approached very closely by two males from Pepillo Salcedo (43.1 versus 43.2 and 43.3). The locality where the bat was taken suggests that it may represent an undescribed subspecies of *N. stramineus* on the Tiburon Peninsula.

No structural differences exist between *N. "major"* and *N. stramineus*, but Goodwin's data indicated a difference in length of forearm between the two taxa. Collating his data for *N. stramineus* from throughout its range gives measurements ranging from 35.4 (*N. s. mexicanus* from Baja California, Mexico) to 40.5 (*N. s. saturatus* from Oaxaca, Mexico), whereas combined forearms for *"N. s. major"* vary between 42.0 (*N. s. major*) and 45.2 (*N. s. jamaicensis*). Although Goodwin's data (1959) indicate non-overlap in some cranial measurements (greatest length of skull, condylobasal length, length of upper toothrow) between *N. s. stramineus* and *N. "major,"* the cranial measurements of our *N. s. major* obliterate the dichotomy in condylobasal length. Thus, we recognize *N. major* as a subspecies of *N. stramineus* occurring on Hispaniola.

Two color phases are evident in the specimens of *N. s. major* (as in *N. s. stramineus*). Two males are grayish tan above and paler tan below. The remaining specimens are tawny orange above and below; the ventral tints vary from tan to dull orange. The difference in dorsal hue apparently is due to the color of the hair bases, which vary in color from creamy or very pale gray to deep buffy or orangish.

Specimens examined (10).—DOMINICAN REPUBLIC. *Provincia de Monte Cristi*: 5 km SE Pepillo Salcedo, 9 (KU 150713–20, KU 152361). HAITI. *Département du Sud*: Camp Perrin, 1 (KU 150721).

Natalus stramineus stramineus Gray, 1838

Goodwin (1959) reviewed the bats of the subgenus *Natalus* and showed that the lesser Antillean bats, previously called *N. dominicensis* Shamel, should be referred to *N. stramineus*. The nominate subspecies is restricted to the Lesser Antilles, whence it is known from Anguilla, Antigua (the restricted type locality; Goodwin, 1959), Dominica, Guadeloupe, Montserrat, and Saba (Koopman, 1968; Varona, 1974; Baker et al., 1978; Genoways et al., 2000). Its distribution likely includes several other (if not all) islands in this northern portion of the chain. Its occurrence on Anguilla and Antigua indicates that it is not restricted to the mountainous and mesic inner-chain islands, but that it occurs also on the lower, drier, and less well-forested outer-chain islands. Work on Anguilla would indicate that the availability of cave, caverns, and other suitable roosting habitats may be the key limiting factor. We have only a single *N. s. stramineus* from Dominica, but have data on three fluid-preserved specimens from Guadeloupe (one of which was donated to the Schwartz Collection); one fluid-preserved specimen from Martinique was examined by Schwartz.

Measurements of the male from Dominica are: total length, 100; length of tail, 50; length of hind foot, 7; length of ear, 15; length of tragus, 5; length of forearm, 40.2; greatest length of skull, 16.4; condylobasal length, 15.3; zygomatic breadth, 8.7; postorbital constriction, 3.1; mastoid breadth, 7.2; length of upper toothrow, 7.4. Lengths of forearms of the five specimens (4 males, 1 female) are: 38.0–40.8 ($\bar{x}$ = 39.8). The Dominica specimen was taken at night from a room within the plantation house at Springfield Estate, much in the same fashion as the two specimens of *N. micropus* were collected at San Vicente in Cuba. Père Pinchon (in litt.) informed Schwartz that the bat from Martinique is the only individual he had seen on that island in his many years' of residence there, whereas the specimens from Guadeloupe were taken from a large colony in a cave near Le Moule.

The skin of the specimen from Dominica is a rich reddish orange above; the tips of the dorsal hairs have only the barest touch of darker brown. The venter is slightly brighter orange than the dorsum. The fluid-preserved specimen from Martinique agrees in color with the specimen from Dominica, but the three fluid-preserved specimens from Guadeloupe are much less orange above. Goodwin (1959) pointed out that *N. s. stramineus* has both a red and gray color phase. Père Pinchon (in litt. to Schwartz, 11 October 1966) stated that, in the large colony of *N. s. stramineus* at Le Moule on Guadeloupe whence the three Guadeloupe specimens were secured, he had never observed any individuals in the reddish phase.

Specimens examined (2).—DOMINICA. *St. Paul Parish*: 6 mi NE Roseau, 1 (KU 150726). GUADELOUPE. *Grand-Terre*: Le Moule, 1 (KU 150727).

Additional specimens (3).—GUADELOUPE. *Grand-Terre*: Le Moule, 2 (SCFF). MARTINIQUE. Usine Petit Bourg, 1 (SCFF).

FAMILY VESPERTILIONIDAE

Eptesicus fuscus (Beauvois, 1796)
Big Brown Bat

Big brown bats are widely distributed in the New World with several subspecies recognized, including five in the Antilles—*Eptesicus fuscus bahamensis* in northern Bahamas; *E. f. dutertreus* on Cuba, the southern Bahamas, and the Cayman Islands; *E. f. hispaniolae* on Hispaniola; *E. f. petersoni* from Isla de la Juventud; *E. f. wetmorei* on Puerto Rico, Dominica, and probably Barbados (Koopman, 1994). Burnett (1983a, 1983b) examined geographic and sexual variation and climatic correlates of morphology in *E. fuscus* from throughout North America and found that the Antillean subspecies were well differentiated from the mainland subspecies, as well as from each other, and that both sexes increased in size eastward across the Greater Antilles, although morphological distance from the mainland decreased. Genoways and Baker (1975) argued that *E. fuscus* colonized the Antilles from the west, either from the Yucatan Peninsula or from mainland Central America.

Eptesicus fuscus bahamensis (Miller, 1897)

For comments on the taxonomic relationships of *Eptesicus fuscus bahamensis* and *E. f. dutertreus*, see the following account. *Eptesicus fuscus bahamensis* was described from New Providence, and its range, as currently understood, is restricted to two non-adjacent islands in the Bahamas—New Providence and San Salvador (Buden, 1986; Andersen, 1990).

Specimens from San Salvador were taken along the rafters of a small, abandoned church in extremely arid country on the southern portion of the island, whereas on New Providence, bats were collected in the open and moist cave at Cave Junction along the northern coast, and in the dungeons of Ft. Charlotte. Andersen (1990) did not find the diurnal roost of big brown bats on San Salvador, but as many as 40 bats were observed in a nocturnal roost in the ceiling of an open unused building constructed of concrete block in January. On San Salvador on 24 June 1966, three females were gravid, each carrying a single fetus, whereas five were actively lactating and carrying newly born young. On New Providence on 13 June 1966, two females were gravid and a third was lactating. The same collector, Rich-

ard Thomas, examined the females from New Providence and San Salvador and recorded the females from the latter island carrying single embryos, whereas those from New Providence were each carrying twins. Juvenile bats also were taken with adults. No other species of bat was taken with *Eptesicus* on San Salvador, but a few *Erophylla* occurred in the cave at Cave Junction on New Providence.

Specimens examined (59).—BAHAMAS. *New Providence*: Cave Junction, 29 (KU 151649–77); Fort Charlotte, Nassau, 12 (KU 151678–89); *San Salvador*: 9 mi S Cockburn Town, 18 (KU 151700–17).

Additional specimens (2).—BAHAMAS. New Providence: Fort Charlotte, Nassau, 2 (UF 12838, UF 12839 [= AS 646, 651]).

Eptesicus fuscus dutertreus (P. Gervais, 1837)

In their treatment of the bats of the Bahama Islands, Koopman et al. (1957) considered that *Eptesicus fuscus* in those islands was represented by two subspecies—*E. f. dutertreus* throughout most of the Bahamas and *E. f. bahamensis* on New Providence and San Salvador (Buden, 1986; Andersen, 1990). *Eptesicus f. dutertreus* is primarily a Cuban subspecies, which also occurs throughout most of the Bahamas. Silva Taboada (1979) found little variation throughout Cuba in this subspecies; however, there were a number of significant differences between the Cuban subspecies and smaller *E. f. petersoni* on nearby Isla de la Juventud.

We examined *E. f. dutertreus* from Little Exuma (1 specimen), Great Exuma (9 specimens), and Cuba (15 specimens). In the Bahamas, *E. f. dutertreus* has been reported from Andros, Great and Little Exuma (Koopman et al., 1957), Crooked and Acklin's islands (Buden, 1986), and Long Island and San Salvador (G. M. Allen and Sanborn, 1937; Andersen, 1990). G. M. Allen and Sanborn (1937) suggested that the San Salvador specimens might be intermediate between *E. f. dutertreus* and *E. f. bahamensis* in length of forearm. In measurements of our series, the differences among samples from New Providence, the Exumas, San Salvador in the Bahamas, and Cuba and the Isla de la Juventud (= *E. f. petersoni* Silva Taboada) are slight (Table 3). The length of forearm of bats from New Providence varies from 42.4 to 47.1 ($\bar{x}$ = 44.6), on the Exumas from 43.4 to 47.6 ($\bar{x}$ = 45.9), on San Salvador from 42.6 to 46.2 ($\bar{x}$ = 44.7), and on Cuba from 41.2 to 48.6 ($\bar{x}$ = 45.6). The greatest length of skull varies in the Schwartz Collection series from New Providence from 16.3 to 17.8 ($\bar{x}$= 16.7), on the Exumas from 17.4 to 17.9 ($\bar{x}$ = 17.7), on San Salvador from 17.0 to 17.8 ($\bar{x}$ = 17.5), and on Cuba from 16.0 to 17.9 ($\bar{x}$ = 17.4). Mastoid breadth averages more on Exumas and San Salvador (8.9, 8.8), than it does on Cuba (8.7—2 specimens), and less (8.5) on New Providence. It is clear that the relationships among West Indian populations of the *Eptesicus fuscus* group, including the recently discovered population on Dominica (Hill and Evans, 1985) and *Eptesicus lynni* of Jamaica (Arnold et al., 1980), need to be reassessed using modern genetic and multivariate morphometric techniques.

Table. 3. Means and extremes (in parentheses) of length of forearm and greatest length of skull in five Antillean samples of *Eptesicus fuscus*. Islands arranged from north to south.

Taxa and islands	*N*	Length of forearm	Greatest length of skull
Eptesicus fuscus dutertreus			
New Providence	22♂, 16♀	44.6 (42.4–47.1)	16.7 (16.3–17.8)
Exuma Cays	3♂, 7♀	45.9 (43.4–47.6)	17.7 (17.4–17.9)
San Salvador	1♂, 12♀	44.7 (42.6–46.2)	17.5 (17.0–17.8)
Cuba	8♂, 10 ♀	45.6 (41.2–48.6)	17.4 (16.9–17.9)
Eptesicus fuscus petersoni			
Isla de la Juventad	2♂, 2♀, 1?	43.4 (41.2–44.8)	17.1 (16.9–17.3)

On Great Exuma, the bats were in a dense clump in a solution hole (avon) in the low ceiling of a cave. On Cuba, *E. f. dutertreus* was encountered with some regularity (but seldom abundantly in any one location) in the well-lighted entrance portions of caves, where the bats were hanging, usually singly, on the walls.

Specimens examined (25).—BAHAMAS. *Great Exuma*: 1 mi SW Forest, 9 (KU 151691–99); *Little Exuma*: Robeson Cave, SE Forbes Hill, 1 (KU 151690). CUBA. *Provincia de La Habana*: 9 km SW San José de las Lajas, Cueva de Cotilla, 1 (KU 151718); *Provincia de Pinar del Río*: Cueva de Santo Tomas, 10 km N Cabezas, 1 (KU 151729); San Vicente, 3 (KU 151730–32); *Provincia de Sancti Spíritus*: Cariblanca, 25 km SW Cabaiguan, 8 (KU 151719–26); Finca de Morales, 8 mi NW Trinidad, 2 (KU 151727–28).

Additional specimens (3).—CUBA. *Provincia de La Habana*: 9 km SW San José de las Lajas, Cueva de Cotilla, 1 (ROM 78214 [= AS 4731]; *Provincia de Pinar del Río*: Río los Palacios, 1 (YPM); *Provincia de Sancti Spíritus*: Finca de Morales, 8 mi NW Trinidad, 1 (ROM 78213 [= AS 4948]).

Eptesicus fuscus hispaniolae Miller, 1918

Twelve specimens of *Eptesicus fuscus* from Dominican Republic and Haiti are referred to *E. f. hispaniolae*. A male and a female from Camp Perrin, Dépt. du Sud, Haiti, and a male from 12 km NE Jarabacoa, La Vega Province, Dominican Republic have the following external and cranial

measurements (first 2 males): total length, 104, 98, 113; length of tail, 42, 33, 40; length of hind foot, 10, 9, 9; length of ear, 15, 15, 18; length of forearm, 46.8, 47.4, 47.9; greatest length of skull, 18.1, 18.6, 18.2; condylobasal length, 17.4, 17.5, 17.3; zygomatic breadth, 12.1, 12.1, 12.7; postorbital constriction, 4.3, 4.1, 4.4; mastoid breadth, 9.4, 9.2, 9.7; length of upper toothrow, 6.8, 6.4, 6.8. These data indicate that *E. f. hispaniolae* is intermediate between *E. f. dutertreus* and *E. f. wetmorei* in measurements, as it is geographically. In dorsal color, *E. f. hispaniolae* seems closer to *E. f. wetmorei* than to *E. f. dutertreus*; our specimens are quite dark (blackish brown) and lack the reddish or golden tints of *E. f. dutertreus*.

The bat from Jarabacoa was shot in the early evening as it rested in a well-lighted and busy anteroom to a hotel kitchen. Most previous records for Haiti have been from north of the Plaine de Cul de Sac (Port-de-Paix; near St. Michl de l'Atalaye) with the exception of one specimen from Port-au-Prince (Sanborn, 1941). Klingener et al. (1978) took four males at Zapoti on the Haitian Massif de la Hotte. Woods (1986) observed *E. f. hispaniolae* in a cave at 2100 m on the Haitian Massif del la Selle and took five males at 1040–1250 m on the Massif de la Hotte.

Three females from Pétonville, Haiti, were lactating when captured on: 5 May 1974; 20 May 1974; 9 June 1974.

Specimens examined (12).—DOMINICAN REPUBLIC. *Provincia de Barahona*: Hotel Guarocuya, Barahona, 1 (KU 144610); 12 km SW Barahona, 1400 ft, 1 (KU 151733); *Provincia de La Estrellita*: Puerto Pyramide 204, 5900 ft, 1 (KU 151734); *Provincia de La Vega*: 12 km NE Jarabacoa, 2000 ft, 1 (KU 151735). HAITI. *Département de l'Ouest*: Pétionville, 1500 ft, 6 (KU 151736–41); *Département du Sud*: Camp Perrin, 2 (KU 151742–43).

Eptesicus fuscus petersoni Silva Taboada, 1974

The subspecies *Eptesicus fuscus petersoni*, which is restricted to Isla de la Juventud, differs from *E. f. dutertreus* primarily in the shorter length of forearm (Table 3) and the shorter occipito-premaxillary length. Buden (1985) stated that the two specimens examined by him were paler and more yellow than most Bahaman specimens, and the measurements of *E. f. petersoni* given by Silva Taboada (1974) averaged smaller than those from the Bahamas and mainland Cuba (*E. f. dutertreus*).

Measurements of two females from 8.8 mi SSW of Nueva Gerona are: total length, 100, 104; length of tail, 38, 42; length of hind foot, 9, 10; length of ear, 13, 12; length of tragus, 8, 8; length of forearm, 43.0, 44.8. Cranial measurements of these and two males and one unsexed individual from Finca la Abra (YPM) (only postorbital constriction and length upper toothrow included all specimens) are: greatest length of skull, 16.9–17.3 ($\bar{x}$ = 17.1); condylobasal length, 16.5–16.8 ($\bar{x}$ = 16.7); zygomatic breadth, 10.9–11.8 ($\bar{x}$ = 11.5); postorbital constriction, 3.8–4.0 ($\bar{x}$ = 3.9); mastoid breadth, 8.8–9.3 ($\bar{x}$ = 9.1); length of upper toothrow, 6.1–6.4 ($\bar{x}$ = 6.3).

Specimens examined (2).—CUBA. *Isla de la Juventud*: 8.8 mi SSW Nueva Gerona, 2 (KU 151744–45).

Additional specimens (3).—CUBA. *Isla de la Juventud*: Finca la Abra, 3 (YPM).

Eptesicus fuscus wetmorei Jackson, 1916

Nine specimens demonstrate the distinctness of the Puerto Rican subspecies *Eptesicus fuscus wetmorei*. Measurements of the series (2 males, 7 females) are: total length, 105–120 ($\bar{x}$ = 113.3); length of tail, 42–47 ($\bar{x}$ = 44.5); length of hind foot, 10–13 ($\bar{x}$ = 10.3); length of ear, 18–21 ($\bar{x}$ = 19.4); length of tragus, 8–10 ($\bar{x}$ = 9.1); length of forearm, 45.6–50.0 ($\bar{x}$ = 48.5); greatest length of skull, 18.5–19.5 ($\bar{x}$ = 19.0); condylobasal length, 17.5–18.5 ($\bar{x}$ = 18.1); zygomatic breadth, 12.8–13.6 ($\bar{x}$ = 13.1); postorbital constriction, 4.3–4.6 ($\bar{x}$ = 4.4); mastoid breadth, 9.8–10.3 ($\bar{x}$ = 10.0); length of upper toothrow, 6.9–7.5 ($\bar{x}$ = 7.2). In general, *E. f. wetmorei* is a distinctly larger bat than *E. f. dutertreus* and has a longer ear and tragus. The forearm is slightly longer, but there is overlap in this measurement (41.2–48.6 in *E. f. dutertreus*). Cranial measurements of the nine specimens reveals complete separation between *E. f. dutertreus* and *E. f. wetmorei* in greatest length, zygomatic breadth, mastoid breadth, and length of upper toothrow, and virtually complete separation in postorbital constriction (3.7–4.3 in *E. f. dutertreus*, 4.3–4.6 in *E. f. wetmorei*). *Eptesicus f. wetmorei* is distinctly darker (more brownish) than *E. f. dutertreus*; the latter subspecies is more reddish or golden brown, although some specimens are nearly as dark as *E. f. wetmorei*.

Anthony (1918) noted that the bats were collected only in caves. Likewise, bats from near Mayagüez were taken from shallow caves on the face of the cliffs near Rosario on the western slopes of the Cordillera Central; they were associated with *Artibeus jamaicensis*. At the moist, open, and well-lighted Cueva de Aguas Buenas, *Eptesicus* was uncommon; only one individual was taken along with many *A. jamaicensis*.

Specimens examined (9).—PUERTO RICO. *Aguas Buenas*: Cueva de Aguas Buenas, 3.5 mi SW Aguas Buenas, 1 (KU 151746); *Mayagüez*: 5 mi SE Mayagüez, 8 (KU 151747–54).

Lasiurus borealis minor Miller, 1931
Eastern Red Bat

A single skin of a volant subadult male was taken by J. W. Norton at Pétionville, Haiti on 10 June 1974. Measurements are: total length, 88; length of tail, 40; length of hind foot, 7; length of ear, 10; length of tragus, 6; length of forearm, 38.3.

Specimen examined (1).—HAITI. *Département de l'Ouest*: Pétionville, 1500 ft, 1 (KU 152257).

Myotis martiniquensis LaVal, 1973
Schwartz's Myotis

Myotis martiniquensis is restricted (LaVal, 1973) to the southern Lesser Antilles and consists of two nominal subspecies—*Myotis martiniquensis martiniquensis* on Martinique and *Myotis martiniquensis nyctor* on Barbados.

Myotis martiniquensis martiniquensis LaVal, 1973

Three fluid-preserved females from Fond Ceremeau, Tartane, Martinique, in the collection of the Seminaire Collège de Fort-de-France are assigned to this subspecies. Length of forearm of these individuals is 37.9–38.3 ($\bar{x}$ = 38.1).

Additional specimens (3).—MARTINIQUE. Fond Ceremeau, Tartane, 3 (SCFF).

Myotis martiniquensis nyctor LaVal and Schwartz, 1974

One male and females from Cole's Cave, St. Thomas Parish, Barbados, form the hypodigm of this subspecies described by LaVal and Schwartz (1974). Measurements of these individuals are: total length, 78–85 ($\bar{x}$ = 81.1); length of tail, 34–38 ($\bar{x}$ = 35.4); length of hind foot, 7 (7); length of ear, 13–14 ($\bar{x}$ = 13.9); length of tragus, 6–8 ($\bar{x}$ = 7.1); length of forearm, 34.9–36.6 ($\bar{x}$ = 35.7). Cranial measurements of one male and four females are: greatest length of skull, 13.9–14.8 ($\bar{x}$ = 14.3); condylobasal length, 13.4–13.9 ($\bar{x}$ = 13.6); zygomatic breadth, 8.4–8.8 ($\bar{x}$ = 8.6); postorbital constriction, 3.3–3.4 ($\bar{x}$ = 3.4); mastoid breadth, 7.1–7.4 ($\bar{x}$ = 7.3); length of upper toothrow, 5.5–5.7 ($\bar{x}$ = 5.6).

The specimens were netted at night across the small entrance to Cole's Cave; the bats were not especially common, at least at this entrance, although the eight specimens are the result of about one hour's netting. No *Myotis* were observed within the cave during a diurnal visit; only *Brachyphylla* was then seen. None of the latter genus was taken by netting at the cave mouth at night. The entrance to Cole's Cave lies near the bottom of a small and sparsely wooded ravine, which coursed through cane fields.

Specimens examined (8).—BARBADOS. *St. Thomas Parish*: Cole's Cave, 7 (KU 109473—holotype; 151761–66; USNM 395028 [AS = 5145]).

FAMILY MOLOSSIDAE

Eumops auripendulus (Shaw, 1800)
Shaw's Mastaff Bat

Eger (1977), in her review the species of *Eumops*, recognized two subspecies of *Eumops auripendulus* with the nominate subspecies, *E. a. auripendulus*, occurring on Jamacia, as well as throughout Mexico, Central America, and northern South America. Ronald Klinikowski and Schwartz collected two adult female *E. auripendulus* on Jamaica on 2 August 1961, which represent the first specimens to be obtained on the island. External and cranial measurements of a mature adult female (KU 150206) are: total length, 127; length of tail, 44; length of hind foot, 15; length of ear, 20; length of forearm, 57.2; greatest length of skull, 23.9; condylobasal length, 21.1; zygomatic breadth, 13.7; postorbital constriction, 4.6; mastoid breadth, 12.0; length of upper toothrow, 8.9. The fresh Jamaican skin is a rich velvety reddish brown above, and darker brown below.

The two *E. auripendulus* were collected from the densely packed dead and adherent leaves forming the skirt of a palm in a xeric area on the southern coast of Jamaica. The palm skirt also was inhabited by a nesting colony of Antillean Palm Swifts (*Tachornis phoenicobia*). Schwartz and Klinikowski obtained the *Eumops* by shooting directly upward into the dried palm fronds. These two specimens from Alligator Pond are the first *E. auripendulus* to have been collected on Jamaica, but their significance was overlooked previously as they were identified as *E. glaucinus* by the field collectors. Genoways et al. (in press) report that *E. auripendulus* remains known from only three localities on the island, all of which are below 400 m. These three localities are the only populations known on any of the Antillean islands.

Specimens examined (2).—JAMAICA. *Manchester Parish*: 6.5 mi SE Alligator Pond, 2 (KU 150206–07).

Eumops glaucinus floridanus (G. M. Allen, 1932)
Florida Mastiff Bat

The large mastiff bat *Eumops glaucinus* is known from central Mexico southward through Central America to approximately the northern two-thirds of South America. In the Greater Antilles, it is known from Jamaica and Cuba. There is an additional population in extreme southern Florida. The Schwartz Collection contains an extremely critical series of the subspecies endemic to Florida, *Eumops g. floridanus*. Our study of these mastiff bats documents that considerable geographic variation is present in the species currently known as *E. glaucinus*, and it will likely represent a species group consisting of more than one morphologically recognizable species (Timm and Genoways, in prep.).

The Florida population of mastiff bats has been the subject of considerable controversy, in part because it was first described from Pleistocene fossil remains, a living individual was first discovered in 1936, few colonies have ever been found, few specimens are available for study, and it has the most restricted range of any bat north of Mexico. Schwartz (1952:45) first documented that the species was breeding in Florida with the discovery of a young individual from Coral Gables, and considered that "these bats may have been brought originally to Florida from Cuba during one of the hurricanes." However, the Florida population of mastiff bats is quite distinct from the mastiff bats of Cuba and Jamaica and has been since at least the

Pleistocene (Timm and Genoways, in prep.). Koopman (1971), using specimens in the Schwartz Collection, considered the considerably larger, darker population of mastiff bats in Florida as representing an endemic subspecies distinct from all other populations and applied the name *E. g. floridanus* to the Florida bats.

Eumops glaucinus floridanus has one of the most restricted distributions of any bat in the New World. Recent specimens are known only from extreme southern and southwestern Florida, including Charlotte and Collier counties on the Gulf Coast and Dade County on the Atlantic Coast. Most of the records are several decades old and from the cities of Coral Gables and Miami in extreme southeastern Florida. *Eumops g. floridanus* is classified as an Endangered Species by the Florida Game and Fresh Water Fish Commission.

Specimens examined (11).—UNITED STATES. *Florida*: Dade Co.: Coral Gables, 9 (KU 150202, KU 150204–5, KU 152227, KU 153912–16); Miami, 2 (KU 150203, KU 152155).

Molossus molossus (Pallas, 1766)
Pallas' Mastiff Bat

No other West Indian chiropteran taxonomy is more confusing than that of *Molossus molossus*. In part this is due to the multiplicity of supposedly distinct forms, in part to the peculiar and abbreviated diagnoses and descriptions of Miller (1913), and in part to lack of certainty of the relationships (or differences) of the Lesser Antillean bats with their South American relatives. Some of the past nomenclatorial confusion at the species level, was clarified by Husson (1962) and Dolan (1989). Genoways et al. (1981) analyzed inter- and intra-island variation on Jamaica, Trinidad, and Guadeloupe.

The subspecies of *M. molossus* presently recognized in the West Indies and the islands from which they have been reported (Koopman [1968, 1975], Varona [1974], Hall [1981], Dolan [1989], Jones [1989], and Genoways et al. [2000]) are: *M. m. molossus* (Pallas, 1766)—Guadeloupe, Dominica, Martinique, St. Lucia, St. Vincent, The Grenadines, Grenada, and Barbados; *M. m. tropidorhynchus* Gray, 1839—Cuba and Isla de la Juventud; *M. m. verrillii* J. A. Allen, 1908—Hispaniola and Ile de la Gonâve; *M. m. fortis* Miller, 1913—Puerto Rico, Culebra, St. John, St. Thomas, Tortola, and Virgin Gorda; *M. m. debilis* Miller, 1913—St. Croix, Anguilla, Barbuda, St. Kitts, Nevis, St. Eustatius, Antigua, St. Martin, and Montserrat; *M. m. milleri* Johnson, 1952—Jamaica. Koopman (1968:9) stated: "This common house bat probably occurs on virtually every Lesser Antillean island"; Jones (1989:648) indicated the occurrence of *M. molossus* on all Lesser Antillean islands except St. Barthélemy and Saba, but stated "that it no doubt will be found there." We have followed this current arrangement not because we agree with it, but the morphometric and genetic studies that will be necessary to resolve the relationship among the Antillean populations of this species are far beyond the scope of this present paper. Furthermore, Dolan (1989) has warned that the situation could be even more complicated than presented here, because she found an allele that was otherwise species-specific to *Molossus sinaloae* in the population on Jamaica.

The Schwartz Collection contains specimens from Hispaniola, St. Eustatius, Dominica, St. Vincent, and Grand Cayman, and Schwartz examined specimens from St. Barthélemy, Guadeloupe, Desirade, Marie-Galante, and Martinique in collections of Seminaire Collège de Fort-de-France. Thus, our discussion below pertains to four of the six named Antillean subspecies.

Molossus molossus debilis Miller, 1913

Miller (1913:90) stated that *Molossus molossus debilis* was "like *Molossus major* but crown area of molars decidedly reduced"; this was the only character employed to distinguish *M. debilis* from other *Molossus*. Judging from published measurements of the holotype, specimens from St. Kitts (type locality), and our single specimen from St. Eustatius, *M. m. debilis* differs from *M. m. fortis* to the north (Puerto Rico, Virgin Islands) in shorter length of forearm (37.5–38.6), smaller total length (93–99), and generally smaller skull (most especially narrower postorbital constriction, 2.9–3.4) and shorter upper toothrow (5.4–5.8; 5.9–7.1 in *M. m. fortis*). *Molossus m. debilis* differs from bats from Dominica and Guadeloupe in having a shorter toothrow (5.7–6.2 on Dominica-Guadeloupe), but in all other external and cranial measurements these two samples have close parameters. In color, the specimen from St. Eustatius differs from skins from Dominica and St. Vincent, by being it is pale reddish brown without the rich tones of the two southern populations.

The single male from St. Eustatius has the following measurements: total length, 99; length of tail, 35; length of hind foot, 10; length of ear, 11; length of tragus, 3; length of forearm, 38.4; greatest length of skull, 16.4; condylobasal length, 15.2; zygomatic breadth, 10.3; postorbital constriction, 3.4; mastoid breadth, 9.8; length of upper toothrow, 5.8. This bat was collected by a resident of the island and we have no specific details on its site of capture.

The specimens from St. Barthélemy in the collection of Seminaire Collège de Fort-de-France are the first members of the species to be recorded from the island. This leaves only Saba among the larger Lesser Antillean islands from which *M. molossus* has not been reported.

Specimen examined (1).—ST. EUSTATIUS. English Quarter, 1 (KU 152114).

Additional specimens (2).—ST. BARTHÉLEMY. Lorient, 2 (SCFF).

Molossus molossus molossus (Pallas, 1766)

Although material is extremely limited, specimens from the type locality (Martinique) are distinctly the largest assigned to the species in the Lesser Antilles (with the exception of bats from Barbados) and are likewise larger than a large sample from Dominica to the north and a small sample from St. Vincent and St. Lucia to the south. No cranial measurements or skins are available for the specimens from Martinique. Specimens from St. Vincent and St. Lucia differ from those from Martinique in having a shorter forearm (36.7–39.7). The populations from Guadeloupe, Marie-Galante, Desirade, and Dominica are similar to those from St. Vincent to Trinidad, although the forearms are slightly shorter (36.2–38.7 versus 36.7–39.7). Specimens from St. Vincent and Trinidad are rich dark brown with no reddish tinge, whereas bats from Dominica are much more richly and deeply colored with a distinct reddish brown tone. Measurements of two specimens from St. Vincent (male first, female second) are: total length, 99, 95; length of tail, 37, 32; length of hind foot, 10, 8; length of ear, 11, 11; length of tragus, 3, 3; length of forearm 37.7, 36.9; greatest length of skull, 16.3, 15.6; condylobasal length, 14.7, 14.3; zygomatic breadth, 14.7, 14.3; zygomatic breadth, 10.2, 10.1; postorbital constriction, 3.5, 3.6; mastoid breadth, 10.0, 9.5; length of upper toothrow, 5.8, 5.7. External measurements of a series of six males and two females from Dominica are: total length, 95–105 ($\bar{x}$ = 99.9); length of tail, 27–37 ($\bar{x}$ = 33.9); length of hind foot, 8–11 ($\bar{x}$ = 9.9); length of ear, 10–12 ($\bar{x}$ = 10.9); length of tragus, 3–4 ($\bar{x}$ = 3.6). Cranial measurements of five males and two females from Dominica are: greatest length of skull, 15.8–17.0 ($\bar{x}$ = 16.3); condylobasal length, 14.3–15.6 ($\bar{x}$ = 14.9); zygomatic breadth, 10.2–10.9 ($\bar{x}$ = 10.5); postorbital constriction, 3.2–3.6 ($\bar{x}$ = 3.4); mastoid breadth, 9.6–10.8 ($\bar{x}$ = 10.1); length of upper toothrow, 5.7–6.2 ($\bar{x}$ = 5.9). Length of forearm of two males and four females from Guadeloupe and its islets averaged 36.2–38.7 ($\bar{x}$ = 37.5).

Schwartz's two specimens from St. Vincent were taken in a mist net placed across a swimming pool in a cultivated area in southern St. Vincent. Also taken in the net (and in greater abundance) were *Artibeus jamaicensis* and *Glossophaga longirostris*. Most of the specimens from Dominica were collected in a sea cave near Layou on the leeward coast; a single specimen was secured in a deserted cabin at an elevation of 305 m (1000 ft). In the sea cave, *Molossus* was associated with *Tadarida*; the *Molossus* resting individually in small crevices on the sides and lower roof of the cave during the day. No *Tadarida* were taken in this cave during the day, but they at least frequented it at night and were taken in mist nets at that time. Baker et al. (1978) took 127 *M. molossus* on Guadeloupe, where the bats were extremely common in towns and cities. Of 42 adult females taken on 23–28 July, 18 were gravid with fetuses from microscopic to 30 mm. This is the first report of *M. molossus* from the satellite islands of Guadeloupe.

Specimens examined (11).—DOMINICA. *St. Joseph Parish*: California Estate, 1 (KU 152113); *St. Paul Parish*: 2.5 mi S Layou, 7 (KU 152106–12). ST. VINCENT. *St. George Parish*: Ratho Mill, 2 (KU 152115–16). TRINIDAD. Centero, 1 (KU 152117).

Additional specimens (11).—GUADELOUPE. *Basse-Terre*: Sofaïa, 1 (SCFF); *Grand-Terre*: Le Moule, 1 (SCFF); Gardel, 1 (SCFF); *La Desirade*: Le Bourge, 1 (SCFF). MARIE-GALANTE. St.-Louis, 2 (SCFF). MARTINIQUE. Le Diamant, 4 (SCFF); Pointe Ferret, 1 (SCFF).

Molossus molossus tropidorhynchus Gray, 1839

Nine *Molossus molossus tropidorhynchus* from Grand Cayman establish the occurrence of the genus on the Cayman Islands. Varona (1974) listed the species from Grand Cayman without reference to specimens and subspecies, probably because of his knowledge of the material in the Schwartz Collection. Measurements of two males and seven females are: total length, 87–96 ($\bar{x}$ = 90.1); length of tail, 31.0 (29–36); length of hind foot, 8–10 ($\bar{x}$ = 9.2); length of ear, 11–13 ($\bar{x}$ = 11.6); length of tragus, 3–4 ($\bar{x}$ = 3.7); length of forearm, 35.0–36.2 ($\bar{x}$ = 35.6); greatest length of skull, 15.0–16.3 ($\bar{x}$ = 15.5); condylobasal length, 13.6–15.0 ($\bar{x}$ = 14.2); zygomatic breadth, 9.6–10.4 ($\bar{x}$ = 9.8); postorbital constriction, 3.3–3.8 ($\bar{x}$ = 3.6); mastoid breadth, 9.2–10.1 ($\bar{x}$ = 9.5); length of upper toothrow, 5.4–6.0 ($\bar{x}$ = 5.7). Comparable measurements of five males and 10 females from Cuba are: total length, 83–90 ($\bar{x}$ = 86.5); length of tail, 27–33 ($\bar{x}$ = 29.3); length of hind foot, 9.6 (8–10); length of ear, 7–9 ($\bar{x}$ = 8.1); length of forearm, 32.8–36.4 ($\bar{x}$ = 34.6); greatest length of skull, 14.7–16.2 ($\bar{x}$ = 15.5); condylobasal length, 13.3–14.9 ($\bar{x}$ = 14.1); zygomatic breadth, 9.4–10.2 ($\bar{x}$ = 9.7); postorbital constriction, 3.3–3.7 ($\bar{x}$ = 3.5); mastoid breadth, 9.0–9.9 ($\bar{x}$ = 9.5); length of upper toothrow, 5.2–6.0 ($\bar{x}$ = 5.6). The two samples have close or identical means and ranges, except length of ear; this discrepancy most likely is because of differences in measuring techniques between our fresh material from Grand Cayman and older material from Cuba, that was collected and measured by others. We consider the Grand Cayman bats to be identical to those from Cuba. *Molossus molossus tropidorhynchus* is the most easily definable subspecies of *M. molossus*. Its small size is distinctive; upper extreme of forearm length (36.4) overlaps only the lower extreme of the population from Guadeloupe-Dominica (36.2). Cranial measurements are less distinctive, but invariably *M. m. tropidorhynchus* has lower mean measurements than other populations in the Antilles.

Specimens examined (24).—CAYMAN ISLANDS. *Grand Cayman*: Boddentown, 6 (KU 152128–32); Georgetown, 3 (KU 152125–27). CUBA. *Provincia de Guantánamo*: no spe-

cific locality, 1 (USNM 300575); *Provincia de La Habana*: Santiago de las Vegas, 2 (USNM 260682–83); *Provincia de Matanzas*: Matanzas, 11 (USNM 101373–75, USNM 103748–50, USNM 103753–55, USNM 103757–58); *Provincia de Pinar del Río*: no specific locality, 1 (USNM 103746).

Molossus molossus verrillii J. A. Allen, 1908

The Hispaniolan subspecies resembles *Molossus molossus fortis* in length of forearm (37.9–40.2 versus 37.5–40.6), but differs in smaller size (total length 92–100 versus 100–118), shorter upper toothrow (5.7–6.2 versus 5.9–7.1), and broader postorbital constriction (3.7–4.2 versus 3.4–3.7). Measurements of three males and 12 females (from Barahona, Copey, and Pétionville) are: total length, 92–100 ($\bar{x}$ = 96.7); length of tail, 30–40 ($\bar{x}$ = 33.9); length of hind foot, 9–11 ($\bar{x}$ = 10.3); length of ear, 11–12 ($\bar{x}$ = 11.7); length of tragus, 3–4 ($\bar{x}$ = 3.9); length of forearm, 37.9–40.2 ($\bar{x}$ = 38.8); greatest length of skull, 15.6–17.4 ($\bar{x}$ = 16.4); condylobasal length, 14.2–16.1 ($\bar{x}$ = 14.9); zygomatic breadth, 10.2–11.5 ($\bar{x}$ = 10.8); postorbital constriction, 3.7–4.2 ($\bar{x}$ = 4.0); mastoid breadth, 10.1–11.3 ($\bar{x}$ = 10.4); length of upper toothrow, 5.7–6.2 ($\bar{x}$ = 5.9).

The specimens of *M. m. verrillii* from Pétionville, Haiti, were collected by netting over a swimming pool. The specimen from Copey was taken from a tree in which a colony of *Noctilio leporinus* also was living; two of the bats from Barahona were taken in a hotel corridor. Klingener et al. (1978) took 14 specimens near Lebrun, Beaumont, and Charlier in southwestern Haiti. Nine females from Pétionville were pregnant with a single embryo when taken on 5 May 1974. A female from Barahona also carried a single embryo measuring 10 in crown-rump length when obtained on 12 July 1975.

Specimens examined (54).—DOMINICAN REPUBLIC. *Provincia de Barahona*: Barahona, 23 (KU 152055–77); Hotel Guarocuya, Barahona, 2 (KU 144607, KU 152080); 8 km W Paraíso, 500 ft, 1 (KU 152078); *Provincia de La Vega*: 1 km E Bonao, 2 (KU 152198–99); *Provincia de Monte Cristi*: 1 km W Copey, 1 (KU 152079). HAITI. *Département de l'Ouest*: Pétionville, 1500 ft, 25 (KU 152081–105).

Nyctinomops macrotis (Gray, 1839)
Big Free-tailed Bat

We follow Freeman (1981) in use of the generic name *Nyctinomops* for this species, which previously was included in the genus *Tadarida*. *Nyctinomops macrotis* is a strong flying and widely distributed species ranging from the southern United States to northwestern Argentina and Uruguay. In the Antilles, it is known from Cuba, Jamaica, and Hispaniola. No subspecies are recognized. In nomenclature, we follow the action of Husson (1962) and others in using the specific epithet *N. macrotis* (Gray, 1839) for this large New World species.

In the Dominican Republic, seven female *N. macrotis* were collected by Richard Thomas at La Cruz, four males and four females were taken by J. W. Norton at 21 km SW La Vega, and one male and two females were taken by John K. Lewis at 12 km NE Jarabacoa. Shamel (1931a) reported this species from eastern Hispaniola [no specific locality]; therefore, Schwartz's specimens are the first reported from Hispaniola with precise locality data. *Nyctinomops macrotis* is known from Cuba (type locality); Hall and Kelson (1959, map 154) indicated its occurrence on Isla de la Juventud, but we are unaware of any published reports of *N. macrotis* from that island, and Silva Taboada (1979) did not report the species from Isla de la Juventud. Apparently these bats are uncommon in the West Indies; fossils are known from Provincia de Camagüey, Cuba (Koopman and Ruibal, 1955).

Measurements of one male and nine females from La Cruz and Jarabacoa, RD are: total length, 117–131 ($\bar{x}$ = 125.1); length of tail, 42–50 ($\bar{x}$ = 46.5); length of hind foot, 10–12 ($\bar{x}$ = 11.4); length of ear, 24–28 ($\bar{x}$ = 25.8); length of tragus, 4–6 ($\bar{x}$ = 5.0); length of forearm, 56.0–59.4 ($\bar{x}$ = 57.7); greatest length of skull, 21.0–23.1 ($\bar{x}$ = 22.4); condylobasal length, 20.1–21.7 ($\bar{x}$ = 21.3); zygomatic breadth, 11.4–12.4 ($\bar{x}$ = 12.0); postorbital constriction, 4.0–4.3 ($\bar{x}$ = 4.2); mastoid breadth, 11.0–11.5 ($\bar{x}$ = 11.3); length of upper toothrow, 8.2–8.8 ($\bar{x}$ = 8.6). Two individuals are distinctly reddish brown above and below, whereas the others are plain medium brown with no reddish cast.

The forearms of our sample are shorter (56.0–59.4) than those reported by Shamel (1931a) for specimens from the Dominican Republic and Jamaica (58.2–61.8), but are more comparable to lengths (56.6–63.8) given by Husson (1962) for specimens of unstated provenance. Cranial measurements likewise are slightly smaller than those given for the species by Shamel (1931a).

The series from La Cruz was taken in the large, extremely hot and humid attic of an occupied modern building. The occupants of the building told Schwartz and Thomas that the attic was inhabited by bats; upon entering the attic through a trapdoor in the floor, the unmistakable odor of molossids was at once apparent. Assuming that the species involved was the commoner *Tadarida brasiliensis*, they were pleasantly astonished to discover that it was the much rarer *N. macrotis*. The colony was somewhat larger than the series suggests; the residents of the dwelling had made several attic forays to deplete the colony, but there still were many bats present. The fact that all specimens are females suggests that this may have been a parturient female aggregation, but none of the specimens showed obvious reproductive activity when collected on 7 October.

The series from Jarabacoa, RD was netted in open pine forest; although there was an immediately adjacent hotel,

there was no evidence that the bats were using it as a diurnal retreat. Two females from Jarabacoa were actively lactating on 19 and 20 July as were three females from La Vega when collected on 23 July 1974.

Specimens examined (18).—DOMINICAN REPUBLIC. *Provincia de La Vega*: 12 km NE Jarabacoa, 2000 ft, 3 (KU 151989–91); 21 km SW La Vega, 2100 ft, 8 (KU 151992–99); *Provincia de Monte Cristi*: La Cruz, 7 (KU 152000–06).

Tadarida brasiliensis (I. Geoffroy, 1824)
Brazilian Free-tailed Bat

All five of the subspecies of *Tadarida brasiliensis* that are currently recognized in the Caribbean region are represented in the Schwartz Collection. As far is known, these populations do not undertake long-range migrations as are known in the mainland *Tadarida brasiliensis mexicana*.

Tadarida brasiliensis antillularum (Miller, 1902)

This is the most widespread of the Antillean subspecies of *Tadarida brasiliensis*. It has been recorded (Shamel, 1931a) from Puerto Rico, St. Kitts, Barbuda, Antigua, Montserrat, Guadeloupe, Dominica, St. Lucia, and St. Martin (Husson, 1960), St. Barthélemy (G. M. Allen, 1908), St. John (Hall and Bee, 1960), St. Eustatius and Martinique (Koopman, 1968), and St. Vincent (Vaughan and Hill, 1996), as well as from Tobago (Goodwin and Greenhall, 1961). We have specimens from Puerto Rico (12), Guadeloupe (14), Desirade (1), Dominica (19), and Martinique (6). Of these, Desirade represents a new record for the species in the Lesser Antilles, although the bat presumably occurs throughout the entire Lesser Antillean chain from St. Vincent northward. The type locality of *T. b. antillularum* is Roseau, Dominica, midway in the chain of islands between Puerto Rico and South America.

Even though we have not examined material from all the islands within the known range of the subspecies, skins and skulls (rather than fluid-preserved specimens) from Puerto Rico, Guadeloupe, and Dominica show some marked differences. In general, length of forearm measurements for the subspecies in Puerto Rico, Guadeloupe, and Martinique bats are similar, ranging from 36.8 to 41.0, with the largest forearms in Puerto Rico. Puerto Rican and Guadeloupean bats likewise are comparable in overall size (means 89.7 and 87.1, respectively, in total length) as well as other external measurements, with the specimens from Guadeloupe generally averaging slightly smaller. Exceptions are that the measurements of length of tragus are greater (mean 4.6) on Guadeloupe than on Puerto Rico (4.0), and the length of ear is longer on Guadeloupe (mean 14.9) than it is on Puerto Rico (14.2). No external or cranial measurements are available from the Martinique specimens, which are all fluid preserved.

Topotypes of *T. b. antillularum* from Dominica differ so strikingly from more northern *T. b. antillularum* that in some measurements complete separation (on the basis of our series) is possible; this separation is only slightly weakened by Shamel's (1931) measurements for bats from Dominica, Guadeloupe, and Puerto Rico, so that our material is not unusual. Bats from Dominica are distinctly smaller than more northern *T. b. antillularum*; total lengths are 79–87 (83–94 to the north), shorter tails (23–30 verses 25–35), shorter hind foot (6–9 verses 6–10), and shorter forearm (34.7–39.4 verses 37.7–41.0).

Dominica specimens agree with Puerto Rican specimens quite closely in both means and extremes of all cranial measurements; the greatest differences (0.2 mm in each case) are between the means of greatest length, condylobasal length, and length of upper toothrow. On the other hand, bats from Dominica are completely separable from Guadeloupean specimens by the greatest length of skull (15.0–15.7 Dominica, 15.8–16.4 Guadeloupe), condylobasal length (14.2–14.9 Dominica, 15.1–15.7 Guadeloupe), and virtually so in mastoid breadth (8.6–8.9 Dominica, 8.9–9.3 Guadeloupe). Specimens of *T. b. antillularum* from Puerto Rico differ cranially in the same ways from Guadeloupean bats as do Dominican specimens. Bats from Puerto Rico are completely separable from Guadeloupean *T. b. antillularum* in greatest length of skull (15.0–15.8 Puerto Rico), condylobasal length (14.1–14.9 Puerto Rico), and virtually so in length of upper toothrow (5.4–5.7 Puerto Rico).

Dominican bats are distinctly reddish brown in contrast to dark blackish brown bats from Puerto Rico. Guadeloupean specimens, on the other hand, are about intermediate in dorsal pelage color between these two extremes, although geographically they are closer to Dominica than to Puerto Rico.

A case could be made, in light of the above, for the description of a subspecies of *Tadarida brasiliensis* from Puerto Rico (and presumably the Virgin Islands and the Leeward Islands, but not Montserrat, judging from Shamel's data) as distinct from a smaller form (*antillularum*) from Dominica southward. In fact, Shamel's data for bats from Montserrat, Guadeloupe, Dominica, and St. Lucia (so far as length of forearm is concerned) and Anthony's (1918) data for Puerto Rican specimens tend in general to support this division. The short length of forearm reported by Goodwin and Greenhall (1961) for their one Tobagan specimen suggests that it, too, properly belongs with a smaller southern subspecies (*antillularum, sensu stricto*). We are deterred from this course of action by two facts: (1) the strange combination of characters involved in the three major populations whence we have specimens, and (2) the six bats from Martinique. These latter specimens have not been discussed in detail because they are fluid-preserved;

lengths of forearms (3 males, 3 females) vary from 36.8 to 39.2. Martinique lies next in the Lesser Antillean chain south of Dominica. Thus, it would be logical to expect that *T. brasiliensis* from Martinique would be like their Dominican relatives to the north. Although the length of forearm of the three Martinique males are included within the range of those from Dominica, they lie at the upper extreme of the latter. Martinique females, by contrast, have longer length of forearms (36.8–39.2 verses 35.7–38.2 on Dominica), and thus are precisely comparable to Guadeloupe and Puerto Rican females. At the present, we believe it is inadvisable to separate the populations, which currently are designated as *T. b. antillularum*, into two subspecies, although we suspect that such a division can and will be made with additional material.

Compared with the western subspecies, *T. b. antillularum* differs in smaller size (especially on Dominica). At present *T. b. antillularum* and *T. b. constanzae* females are completely separable on this basis, although males of these two subspecies are not so distinguishable. Male Puerto Rican *T. b. antillularum* are intermediate between more southern specimens of this subspecies and *T. b. constanzae* in length of forearm. It is not useful to pursue these differences taxonomically. It has yet to be confirmed that: (1) the four western subspecies *bahamensis, constanzae, murina,* and *muscula* are nameworthy, and (2) the name *antillularum* is being applied to but a single entity. Until these two premises can be confirmed or denied, detailed comparisons between the eastern and western subspecies is unwarranted.

Tadarida brasiliensis antillularum inhabits caves and human dwellings. On Puerto Rico, *T. brasiliensis* and *Erophylla bombifrons* were taken from a cave on the northern face of the Cordillera Central on 30 August 1962; in 1965 only *T. brasiliensis* was present in the cave. On Dominica, bats were in an open cave adjacent to the coast south of Layou and in a residence at La Haut Estate, where the bats inhabited the space beneath the metal roofing and the ceiling and behind pictures hanging on walls in the main living quarters; others were taken in a mist net set across a mountain stream in mesic forest. On Guadeloupe, *T. b. antillularum* was netted over the Riviere Salee at Sofaïa and removed from an abandoned forester's cabin. All records are from mesic forest; at Sofaïa the mist net and cabin were in dense rainforest. Schwartz's impression was that *T. b. antillularum* was abundant in its Lesser Antillean range, in contrast to *T. b. muscula* on Cuba. However, Baker et al. (1978:13) considered it "much less common" than *Molossus* on Guadeloupe. It is worth noting that mist nets set in xeric woods in southwestern Puerto Rico yielded no *T. b. antillularum*.

Specimens examined (40).—DOMINICA. *St. George Parish*: La Haut Estate, 0.5 mi E Loubiere, 11 (KU 152140–50); *St. Paul Parish*: 2.5 mi S Layou, 6 (KU 152134–39); 6 mi NE Roseau, 2 (KU 152151–52). GUADELOUPE. *Basse-Terre*: Sofaïa, 1200 ft, 9 (KU 152157–65). PUERTO RICO. *Utuado*: 5.5 mi NE Utuado, 12 (KU 152166–77).

Additional specimens (12).—GUADELOUPE. *Basse-Terre*: Sofaïa, 5 (SCFF); *La Desirade*: Lebourg, 1 (SCFF). MARTINIQUE. Anses d'Arlet, 2 (SCFF); Ilet a Ramiers, 4 (SCFF).

Tadarida brasiliensis bahamensis (Rehn, 1902)

This subspecies is represented in the Schwartz Collection by eight females and two males obtained on 7 October 1966 by Richard Thomas and Schwartz on Little Exuma. Cranial measurement of two females followed by two males are: greatest length of skull, 16.2, 15.6, 16.4, 16.5; condylobasal length, 15.4, 15.0, 15.5, 15.6; zygomatic breadth, –, 9.1, 9.5, 9.6; postorbital constriction, 3.7, 3.7, 3.9, 4.0; mastoid breadth, 8.3, 8.8, 9.1, 9.1; length of upper toothrow, 6.0, 5.7, 5.9, 5.9.

Specimens examined (10).—BAHAMAS. *Little Exuma*: Christian Farm Cave, 1 mi S Ferry, 10 (KU 152178–87).

Tadarida brasiliensis constanzae Shamel, 1931

The Hispaniolan subspecies is represented by four specimens from the Dominican Republic. A female from Restauracón was found as a mummy. A male was taken at Puerto Pyramide on 24 July 1975 and preserved in fluid by M. H. Strahm. The lengths of forearm of these two specimens are 41.1 and 40.7, respectively. Schwartz examined a fluid-preserved specimen from Furcy (considered to be a separate species, *T. constanzae*, prior to Schwartz [1955]) in the collection of the Seminaire Collège de Fort-de-France. The elevation at Furcy is 1769 m (5800 ft) and, so far as we are aware, this elevational record for *Tadarida* is exceeded in the West Indies only by a record at 1872 m in the Sierra Maestra, Cuba (Silva Taboada, 1979) in the Antilles. The type locality of *T. b. constanzae* (Constanza, La Vega Province, RD) is at 1220 m. Ottenwalder (1979) took two males at 2 km SW Las Baitoas under the dry loose bark of *Prosopis* (Leguminosae) near the shore of Lago Enriquillo at or below sea level, and two others at La Playa, 2.4 km S Los Ríos, also at the edge of the lake. Thus, *T. b. constanzae* is not restricted to uplands. Woods (1986) netted three Brazilian free-tailed bats on the Haitian Massif de la Selle and one gravid female (27 May) at 1250 m near Pic Macaya on the Massif de la Hotte, Haiti.

The length of forearm of the specimen from Furcy is 39.6. The forearm is slightly shorter than measurements given by Shamel (1931a) for eight males and four females (41.0–43.0). Greatest length of skulls in *Tadarida brasiliensis constanzae* as reported by Shamel (4 males, 5 females, 1 unsexed) are 16.0–16.6. We are unimpressed with the postulated differences between *constanzae* on one hand and *muscula* and *murina* on the other. As far as measurements

are concerned, *constanzae* seems to have a slightly longer forearm and a slightly longer upper toothrow (both mean differences of small magnitude). The three western Antillean subspecies are morphometrically similar, and additional specimens of each will be needed to clarify the respective status of these three forms.

Specimens examined (4).—DOMINICAN REPUBLIC. *Provincia de Barahona*: Hotel Guarocuya, Barahona, 2 (KU 144608–09); *Provincia de Dajabón*: Restauración, 1 (KU 152153); *Provincia de La Estrelleta*: Puerto Pyramide 204, 5900 ft, 1 (KU 152154).

Additional specimen (1).—HAITI. *Département de l'Ouest*: Furcy, 5800 ft, 1 (SCFF).

Tadarida brasiliensis murina (Gray, 1827)

The Jamaican subspecies of *Tadarida brasiliensis* is represented by two males with no habitat data from Port Antonio, Portland Parish. Measurements of the two specimens are: total length, 88, 93; length of tail, 32, 32; length of hind foot, 10, 8; length of ear, 15, 15; length of tragus, 4, 5; length of forearm, 39.2, 40.9; greatest length of skull, 15.8, 16.4; condylobasal length, 15.0, 15.3; zygomatic breadth, 9.4, –; postorbital constriction, 4.0, 3.9; mastoid breadth, 8.8, 9.2; length of upper toothrow, 5.8, 5.9. These measurements are close to those given by Shamel (1931a). A combination of the existing data reveals that the length of forearm of males is 39.2–42.6, of females 40.2–41.8, and greatest length of skull (both sexes combined) 15.8–16.6.

Specimens examined (2).—JAMAICA. *Portland Parish*: Port Antonio, 2 (KU 152188–89).

Tadarida brasiliensis muscula (Gundlach, 1861)

Fourteen specimens from various Cuban localities are available to us. At the time of the last revision of the *Tadarida brasiliensis* group (Schwartz, 1955), no attempt was made to evaluate the status of the various Antillean subspecies (*T. b. antillularum, bahamensis, constanzae, muscula, murina*). Our material is still too limited in several respects to undertake critical a review as may be ultimately necessary as far as West Indian subspecies are concerned, but it is sufficient to point out several peculiarities within and among the named subspecies. Because our material is limited in some cases, we have combined measurements, both external and cranial, for males and females. In general, however, as stated by Schwartz (1955), males are usually slightly larger than females at least in the mainland subspecies, although in our material the secondary sexual differences are not striking.

External measurements of three *T. b. muscula* are: total length, 83–87 ($\bar{x}$ = 85.3); length of tail, 25–32 ($\bar{x}$ = 28.0); length of hind foot, 8–9 ($\bar{x}$ = 8.7); length of ear, 15–17 ($\bar{x}$ = 16.0); length of tragus, 6 in all specimens; length of forearm (12 specimens), 37.3–41.3 ($\bar{x}$ = 40.0). Cranial measurements from a single male are: greatest length of skull, 15.8; condylobasal length, 14.9; zygomatic breadth, 9.6; postorbital constriction, 3.8; mastoid breadth, 9.0; length of upper toothrow, 5.8. The cranial measurements do not agree especially well with those of Shamel (1931a); our single male is slightly smaller than Shamel's series of two males and four females, and the zygomatic breadth is greater in our specimen (8.5 to 9.2 *fide* Shamel). Combining our data and those of Shamel, length of forearm in *T. b. muscula* varies between 37.3 and 41.3 (data from 8 males, 17 females, and 1 unsexed), and greatest length of skull ranges from 15.8 to 16.4.

Mensurally, the subspecies *murina* and *muscula* seem notably poorly defined or incapable of definition. According to Shamel (1931a), *murina* differs from *muscula* in having a smaller ear. Our length of ear measurements do not demonstrate such a difference, and if it exists it must be a mean difference. Skulls of the two sexes of *muscula* are approximately identical in measurements. Length of forearm of both sexes of *muscula* have longer ranges than do forearms of *murina*, and the ranges in each sex (39.2–42.6 male *murina*, 37.3–41.3 male *muscula*; 40.2–41.8 female *murina*, 39.4–41.3 female *muscula*) show considerable overlap, and this feature would be only of questionable significance in differentiating the two subspecies. One of our skins of *murina* is distinctly darker (more blackish brown) than the short series of four *muscula* skins, but the remaining *murina* are slightly paler than specimens of *muscula*. If Jamaican bats are consistently darker in series than Cuban specimens, this may well be the best character for distinguishing the two subspecies, along with slight average differences in length of forearm.

The bats were in caves. This bat seems especially uncommon on Cuba; Palmer (as reported by Miller, 1904) secured only 10 specimens; however, Silva Taboada (1979) showed an island-wide distribution.

Specimens examined (14).—CUBA. *Provincia de Cienfuegos*: Guajimico, 1 (KU 152121); *Provincia de Guantánamo*: leeward fort at Playa Conde, U.S. Naval Base, 2 (KU 152122–23); *Provincia de La Habana*: Cueva de Cotilla, 9 km SW San José de las Lajas, 2 (KU 152118–19); *Provincia de Holguín*: Cueva de los Americanos, 0.5 mi SW Gibara, 8 (KU 152190–97); *Provincia de Sancti Spíritus*: Finca Morales, 8 mi NW Trinidad, 1 (KU 152120).

Additional specimen (1).—CUBA. *Provincia de La Habana*: Cueva de Cotilla, 9 km SW San José de las Lajas, 1 (UMNH 16503 [= AS 4732]).

FAMILY CAPROMYIDAE

In a revision of the chewing lice (Phthiraptera: Gyropidae) parasitic on capromyid rodents, based in large part on specimens in the Schwartz Collection, Price and Timm (1997) recognized nine species from hutias, all in the genus *Gliricola* (subgenus *Hutiaphilus*). They found

these species to be a well-established clade, and to be extremely host specific. This chewing louse-host association is parallel to others that they documented for caviomorph rodents in that there are two (and in one case, three) species of lice on each host species and typically two even on single host individuals. The *Hutiaphilus* they described as a derived clade is well supported by several synapomorphic features, and they proposed that its position within the genus *Gliricola* suggested that the rodent family Capromyidae may be nested within what is now recognized as the Neotropical family Echimyidae.

Capromys pilorides pilorides (Say, 1822)
Desmarest's Hutia

Desmarest's hutia is known from Cuba, Isla de la Juventud, and some of the small associated islands. On Cuba, it was noted to be common (Woods, 1993). Woods' (1993; Woods et al., 2001) arrangement of capromyids, listed this species is the sole representative of the genus *Capromys*. Ten of the 14 specimens in the Schwartz Collection are represented only by skins, including the nine specimens from Sibanicú (3 males and 6 females), all obtained on 12 June 1958, and the female from Arriero taken on 11 June 1953. The remaining five specimens include an adult male from west of Camagüey taken on 27 June 1958 and two adult females (1 at UMMZ) and two juvenile females collected at Samalloa Farm on 15 June 1952.

Measurements of the adult male and two females, respectively, are: total length, 700, 685, 664; length of tail, 142, 202, 210; length of hind foot, 100, 82, 87; length of ear, 35, 36, 35; greatest length of skull, 89.8, 89.4, 89.5; condylobasal length, 84.0, 82.7, 81.9; zygomatic breadth, 43.0, 42.4, 40.4; postorbital constriction, 26.1, 26.2, 24.0; mastoid breadth, 30.5, 31.3, 28.8; length of maxillary toothrow, 18.5, 19.3, 19.2.

The two juvenile females seem to be littermates because their state of development matches very closely. The P4/p4, M1/m1 are erupted in both specimens and show some wear. It is impossible to determine visually whether the premolar is deciduous or permanent. The alveolus of M2/m2 has eroded away and the unerupted tooth can be seen. M3/m3 are not visible in either specimen. Measurements of these two juveniles are: total length, 307, 330; length of tail, 115, 112; length of hind foot, 50, 50; length of ear, 22, 26; greatest length of skull, 48.7, 51.1; condylobasal length, 43.8, 46.0; zygomatic breadth, 26.4, 27.2; postorbital constriction, 20.0, 20.9; mastoid breadth, 21.8, 22.8.

Specimens of Desmarest's hutia in the Schwartz Collection were found to harbor two species of chewing lice of the genus *Gliricola* (*Hutiaphilus*)—*G.* (*H.*) *capromydis* and *G.* (*H.*) *cubanus* (Price and Timm, 1997).

Specimens examined (15).—CUBA. *Provincia de Camagüey*: 20 km W Camagüey, 1 (KU 147700); Sibanicú; 12 km S central highway, 9 (KU 147691–99); *Provincia Las Tunas*: Samalloa Farm, 29 km W Victoria de las Tunas, 3 (KU 147702–04; UMMZ 99445 [= AS 2326]); *Provincia Santi Spíritus*: Arriero, 15 km S Cabaiguán, 1 (KU 147701).

Mysateles melanurus melanurus (Poey, 1865)
Bushy-tailed Hutia

The bushy-tailed hutia occurs in the eastern provinces of Cuba, where it is considered to be rare except in the area of Güisa where it is locally abundant (Woods, 1993). Two of the specimens in Schwartz Collection previously had been in the Coleccion "Evangelina," which was the collection of M. Díaz-Piferrer of Santiago de Cuba. Both specimens are represented only by skins and were obtained on 11 July 1949 on the Río Güira and on 24 August 1951 at Santa María. Both appear to be adult males. A note by the collector of the specimen from the Río Güira indicates it was taken in "high tree over river."

The other two specimens are adult males. An individual from near Banao was taken on 18 August 1957 and the one from Ventura was obtained on 26 December 1954. Measurements of these two specimens, respectively, are: total length, 560, 688; length of tail, 245, 220; length of hind foot, 81, 68; length of ear, 27, 25; greatest length of skull, 71.4, 70.7; condylobasal length, –, 66.0; zygomatic breadth, 36.6, 36.7; postorbital constriction, 23.7, 20.5; mastoid breadth, –, 24.6; length of maxillary toothrow, 16.4, 16.2.

Price and Timm (1997) described three new species of chewing lice that inhabited specimens of bushy-tailed hutia in the Schwartz Collection, including *Gliricola* (*Hutiaphilus*) *schwartzi* (KU 147707–09), *Gliricola* (*H.*) *pinei* (KU 147709), and *Gliricola* (*H.*) *wernecki* (KU 147707).

Specimens examined (5).—CUBA. *Provincia de Camagüey*: 2 km SE Banao, 1 (KU 147706), *Provincia de Holguín*: Güira River, Cueto, 1 (KU 147708); Santa María, Gibara, 1 (KU 147709); *Provincia Santiago de Cuba/Granma*: Ventura, 22 km S Bueycito, 2 (KU 147706–07).

Mysateles prehensilis gundlachi (Chapman, 1901)
Gundlach's Hutia

Mysateles prehensilis gundlachi is confined to the northern part of Isla de la Juventud, where it is described as being common in forested areas of the island north of the central savanna; it appears to be confined to forests including the palms *Roystonea regia, Colpothrinax wrightii*, and *Copernicia hospita* (= *curtisii*) (Varona, 1986). South of the savanna, where the forest composition is quite different, it is replaced by the closely related *Mysateles meridionalis*. We follow Woods (1993) in use of the name *Mysateles* at the generic level, rather than at the subgeneric level as used by earlier authors. Gundlach's hutia historically has been recognized as an insular species; however, Woods et al. (2001) recently concluded, based on sequence diverange

of the cytochrome *b* gene, that it should be treated as a subspecies of the widely distributed *Mysateles prehensilis*.

A resident of the island obtained the single specimen on 25 December 1957. The adult female has following measurements: total length, 612; length of tail, 261; length of hind foot, 71; length of ear, 26; greatest length of skull, 76.5; condylobasal length, 74.0; zygomatic breadth, 40.6; postorbital constriction, 21.7; mastoid breadth, 27.3; length of maxillary toothrow, 16.8.

Specimen examined (1).—CUBA. *Isla de la Juventud*: Paso de Piedras, 1 (KU 147705).

Mysateles prehensilis prehensilis (Poeppig, 1824)
Prehensile-tailed Hutia

The type specimens of *Mysateles prehensilis* were obtained from the wooded south coast of Cuba. Currently the species occurs primarily in western Cuba, where it has been reported as common (Woods, 1993). The specimens in the Schwartz Collection were collected by Cuban residents for him at: Arriero, 14 June 1953 (2 adult males, 1 adult female, and 1 subadult female); San Vicente, 24 December 1956 (adult and subadult males) and 26 December 1956 (adult female); Cueva del Río, 21 June 1957 (adult and subadult males) and 16 August 1958 (subadult male).

Measurements of four adult males and two adult females, respectively, are: total length, 700, 656, 588, 625, 645, 680; length of tail, 330, 295, 173, 192, 291, 180; length of hind foot, 78, 77, 87, 90, 75, 95; length of ear, 26, 26, 33, 36, 25, 37; greatest length of skull, 83.4, 79.5, 85.8, 86.7, 76.7, 94.7; condylobasal length, 77.0, 73.7, 79.8, 82.1, 72.2, 88.5; zygomatic breadth, 41.4, 38.6, 41.8, 44.0, 37.2, 43.9; postorbital constriction, 21.4, 21.1, 23.0, 25.2, 22.0, 24.6; mastoid breadth, 26.5, 26.4, 29.2, 30.4, 25.0, 30.5; length of maxillary toothrow, 16.8, 15.6, 20.1, 20.7, 15.8, 20.8. External and cranial measurements of three subadult males and one subadult female, respectively, are: total length, 425, 470, 517, 596; length of tail, 115, 150, 164, 293; length of hind foot, 70, 75, 76, 70; length of ear, 28, 32, 32, 25; greatest length of skull, 68.4, 74.6, 72.4, 69.3; condylobasal length, 64.5, 68.4, –, 64.4; zygomatic breadth, 33.2, 35.2, 38.8, 33.8; postorbital constriction, 23.4, 19.9, 23.2, 21.8; mastoid breadth, 25.5, 23.8, 26.1, 23.9; length of maxillary toothrow, 15.5, 14.6, 17.0, 14.0.

Specimens examined (10).—CUBA. *Provincia Santi Spíritus*: Arriero, 15 km S Cabaiguán, 4 (KU 147716–19); *Provincia Pinar del Río*; San Vicente, 3 (KU 147713–15); Cueva del Río, San Vicente, 3 (KU 147710–12).

FAMILY DASYPROCTIDAE

Dasyprocta leporina noblei G. M. Allen, 1914
Brazilian Agouti

Three species of *Dasyprocta* originally were described from the Lesser Antilles; however, it is now believed that all of the West Indian agoutis are descendents of animals that were introduced on the islands by humans. Woods (1993:781) summarized these introductions and the current taxonomy as: "The pattern appears to be *D. leporina aguti* (from Brazil) to the Virgin Islands; *D. l. albida* on St. Vincent and Grenada; *D. l. fulvus* on Martinique and St. Lucia; and *D. l. noblei* on Guadeloupe, St. Kitts, Dominica, and Montserrat."

Schwartz collected only a single *D. l. noblei*, a young adult male, on Dominica. Measurements of this individual are: total length, 414; length of tail, 10; length of hind foot, 103; length of ear, 36; greatest length of skull, 88.1; condylobasal length, 80.1; zygomatic breadth, 44.2; postorbital constriction, 25.2; mastoid breadth, 32.5; length of maxillary toothrow, 14.0. The specimen agrees well with G. M. Allen's (1914) description of measurements and coloration. The dorsum is dark blackish brown, with the deep ochraceous tips to the hairs most prominent on the rump and across the middle of the back. The neck is dark, and the crown of the head black with scattered ochraceous hair tips. Both fore- and hind feet are dark blackish-brown, the hairs without ochraceous tips. In 1966, J. Knox Jones, Jr., was given the skull of an old adult male (KU 105053) that had been shot on 8 March 1966 near Wotten Waven, St. George Parish, Dominica. Selected cranial measurements of this animal are: greatest length of skull, 97.2; condylobasal length, 88.2; zygomatic breadth, 47.7; postorbital constriction, 30.7; mastoid breadth, 35.4; length of maxillary toothrow, 14.1.

Schwartz had visited all the islands where *Dasyprocta* has been reported in the Lesser Antilles (St. Kitts, Montserrat, Guadeloupe, Dominica—*noblei*; Martinique, St. Lucia—*fulvus* [= *antillensis*]; St. Vincent, Grenada—*albida*), but never encountered agoutis on any of them. The Dominican specimen was brought to him by a local hunter; on several occasions Schwartz encountered Dominicans in the forests of that island, armed with guns and accompanied by dogs, in search of agoutis for food. Richard Thomas saw an agouti on Montserrat at Cassava Ghaut on 1 August 1965, but was unable to capture it; the habitat was dense ferns in hardwood forest. Agoutis still seem to occur on St. Vincent, but apparently they are rare. We have no recent reports of them on the other islands, but they may persist on any of the islands that still offer sanctuary for these forest animals. The absence of the mongoose on Dominica probably has been a salvation for these rodents. On Dominica, they form at least part of the prey base of the boa, *Boa constrictor nebulosus* Lazell; an agouti was removed from the digestive tract of one of these large snakes that Schwartz secured there.

Specimen examined (2).—DOMINICA. *St. George Parish*: Wotten Waven, 1 (KU 105053); *St. Paul Parish*: 7 mi NE Roseau, 1 (KU 148945).

Dasyprocta punctata richmondi Goldman, 1917
Agouti

The presence of agoutis on Grand Cayman was pointed out by Swabey and Lewis (1946). De Vos et al. (1956) questionably assigned agouti from Grand Cayman to *Dasyprocta punctata*. We can confirm their dubious identification based on a female agouti taken 6.5 km W of East End, Grand Cayman. Measurements of this individual are: total length, 452; length of tail, 17; length of hind foot, 105; length of ear, 32; greatest length of skull, 94.8; condylobasal length, 86.9; zygomatic breadth, 44.5; postorbital constriction, 28.2; mastoid breadth, 32.9; length of maxillary toothrow, 17.8.

Caymanians agree that the "rabbit" was introduced (Woods, 1993) for hunting purposes from British Honduras (Belize); de Vos et al. (1956) gave the 1890s as the date of such introduction. Although local residents claimed that agoutis are abundant on Grand Cayman, Schwartz saw only one during a stay of 22 days. The rodent was shot as it foraged among sparse and open growth on sandy soil near the coast.

Comparison of the specimen with specimens at KU and the USNM collections confirms the identity of the Grand Cayman specimen as *Dasyprocta punctata richmondi* from the Caribbean coast of Central America, including Belize. However, the specimen in the Schwartz Collection is smaller in all measurements, than the data given for two females of this subspecies from Costa Rica (Goodwin, 1946).

Specimen examined (1).—CAYMAN ISLANDS. *Grand Cayman*: 4 mi W East End, 1 (KU 148946).

FAMILY HERPESTIDAE

Herpestes javanicus (É. Geoffroy Saint-Hilaire, 1818)
Common Mongoose

The common mongoose, *Herpestes javanicus*, originally was restricted to Southeast Asia but has been introduced on many tropical islands including most West Indian islands. Much of the literature on this species is under the name *H. auropunctatus* (Hodgson, 1836), and many authorities continue to recognize the two as separate species (e.g., Corbet and Hill, 1991; Hoagland et al., 1993; Nellis, 1989; Nowak, 1999). We follow Wozencraft (1993) in use of *H. javanicus*.

Introduced mongooses occur on Cuba, Jamaica, Hispaniola, Puerto Rico, Vieques, St. Thomas, Water Island, St. John, Jost van Dyke, St. Croix, Buck Island, Tortola, St. Martin, St. Kitts, Nevis, Antigua, Guadeloupe, La Desirade, Marie-Galante, Martinique, St. Lucia, St. Vincent, Grenada, Barbados, and Trinidad (Nellis and Everard, 1981; Hoagland et al., 1989; Horst et al., 2001). Mongooses are absent from the Bahama Islands, Isla de la Juventud, Navassa, Mona, Culebra, Virgin Gorda, Anegada (and from most of the smaller Virgin Islands), Anguilla, St. Barthélemy, Saba, St. Eustatius, Redonda, Barbuda, Les Saintes, Dominica, and the Grenadines. Mongooses have not reached (or been introduced to) most (if not all) of the smaller islets of both the Greater and Lesser Antilles; thus these islands are potential havens for the birds or reptiles, which have become rare or extinct on the larger islands because of predation by the mongoose. Schwartz observed this carnivore widely on the islands, as have we.

The abundance of the mongoose on each island appears to vary greatly. In all of Schwartz's field work in Cuba (1954–60) and the Dominican Republic (1964–77), only a few mongoose were observed. However, Richard Thomas observed *Herpestes* fairly commonly in Haiti in 1966. On Puerto Rico and Antigua, however, Schwartz encountered several to many mongooses regularly on daily field trips. Schwartz collected an adult female on 29 April 1961 that was lactating from Puerto Rico.

The boldness of mongooses in the Antilles hardly can be overstated. Schwartz had them, on several occasions (Grenada, Puerto Rico), respond fearlessly to his squeaking for birds. On Antigua, mongooses were observed regularly foraging in the garbage and trash in the immediate vicinity of a hotel at Dutchman Bay. On St. Thomas, a mongoose was seen repeatedly to enter a large concrete roadside bin, which was used for temporary storage of garbage, despite heavy motor and pedestrian traffic. Occasionally, foraging mongooses were observed busily searching for food, completely oblivious to people. There seemed to be no methods in use for wholesale and systematic extermination of these introduced pests. However, on some islands (Antigua) they were live-trapped in home-devised traps, wetted with gasoline, set afire, and released to run through the stubble fields whence the sugar cane had been removed. Local people claimed that by this method they are able to destroy (by fire) larger numbers of mongoose that have sought refuge or may be foraging in the bagasse (the crushed, juiceless remains of sugarcane as it comes from the mill). Although extremely cruel, this technique was at least partially successful.

Herpestes has been accused, with at least some truth, as a major factor in the rarity or destruction of some of the native avifauna and herpetofauna of the islands on which it has been introduced (Nellis, 1989; Nellis and Everard, 1983). It has been blamed for the extermination, decline, or extinction of four species of ground-nesting goatsuckers (Caprimulgidae): Jamaican Poorwill (*Siphonorhis americanus*) on Jamaica, and presumably for the rarity of White-tailed Nightjars (*Caprimulgus cayennensis*) on Martinique, Rufous Nightjars (*Caprimulgus rufus*) on St. Lucia, and Whip-poor-wills (*Caprimulgus vociferus*) on Puerto Rico. The absence of the Burrowing Owl (*Athene*

cunicularia) from its former Lesser Antillean range (St. Kitts, Nevis, Antigua, Marie-Galante) presumably is due to mongoose predation. The terrestrial habits of Burrowing Owls make them a prime and accessible target for mongoose. Based on Schwartz's notes and our observations, these are the only cases where the mongoose has likely been the major reason for the depletion or extinction of resident land birds in the West Indies. Other possibilities, less clearly definable, are the extinction of House Wrens (*Troglodytes aedon*) on Martinique and Guadeloupe, and the rarity of White-breasted Thrashers (*Rhamphocinclus brachyurus*) on Martinique and St. Lucia, Grenada Dove (*Leptotila wellsi*) on Grenada, House Wrens on St. Lucia and St. Vincent, and Forest Thrush (*Cichlherminia lherminieri*) and Semper's Warbler (*Leucopeza semperi*) on St. Lucia. House Wrens are abundant on Dominica (no mongoose), relatively common on Grenada (mongoose present, but not in high numbers), uncommon on St. Vincent (mongoose present), extremely rare on St. Lucia (mongoose present), and extinct on Martinique and Guadeloupe (mongoose present). Obviously, blame for avian extinctions cannot unqualifiedly be placed exclusively upon *Herpestes*.

The correlation of mongoose presence and the extinction, or at least extreme rarity, of some reptiles has been documented by Henderson and Crother (1989). Schwartz observed that diurnal snakes and diurnal terrestrial lizards are the prime herpetological targets of *Herpestes*. The extinction or rarity of snakes of various genera (*Alsophis, Chironius, Liophis, Mastigodryas, Pseudoboa*) have been attributed to mongoose predation, but with few exceptions the affected snakes have been found to persist, even in some numbers (*Alsophis* and *Arrhyton* on Puerto Rico) despite large numbers of *Herpestes*. The two lizard genera whose fate is determined by the mongoose are *Ameiva* and *Mabuya*; both fell easy and early prey to the mongoose, and *Mabuya* apparently does not easily recover from this initial onslaught, because members of this genus have become rare (persisting possibly in large urban areas) throughout most of their Lesser Antillean range, and in Puerto Rico as well. *Mabuya* is abundant on Dominica and Virgin Gorda, where the mongoose does not occur. Lizards of the genus *Ameiva* likewise suffer greatly from predation by the mongoose. Near extinction within this genus includes only *Ameiva polops* on St. Croix (but even there a very small residual population persists), but the following species are either rare or exist in particularly favorable (protected) localities, often within or adjacent to human habitations: *Ameiva ameiva* (Grenada; presumably extinct on St. Vincent where no recent specimens have been taken), *A. dorsalis* (Jamaica), *A. erythrocephala* (St. Kitts, Nevis), *A. exsul* (Puerto Rico, St. Thomas, St. John), *A. griswoldi* (Antigua), and *A. pleei* (St. Martin). The ground-dwelling diurnal lizard *Gymnophthalmus pleei* may owe its rarity on Martinique to the presence of *Herpestes*; on St. Lucia it is moderately common in non-urban situations. As with birds, one must be careful in attributing the rarity or extinction of reptiles solely to mongoose predation. So many other factors may affect the survival of a species on a particular island, especially small islands that the mongoose may be being blamed without cause. Baskin and Williams (1966) have detailed data on the relationships of mongoose and the Antillean ground-dwelling lizards of the genus *Ameiva*.

Specimens examined (3).—CUBA. *Provincia de Pinar del Río*: 4.5 km NE Guane, 1 (KU 151837). GRENADA. *St. Andrew Parish*: Grand Étang, 1 (KU 151838). PUERTO RICO. *Guánica*: 3 mi S Ensenada, 1 (KU 151839).

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