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Field key to the bats of Costa Rica and Nicaragua

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With more than 1,400 species of bats described worldwide, the order Chiroptera is second only to rodents in ecological and taxonomic diversity. Bats play critically important roles in natural systems as seed and pollen dispersers, predators of invertebrates and vertebrates, and sanguinivores. The Central American countries of Costa Rica and Nicaragua have at least 123 species of bats (in nine families and 66 genera), or nearly 10% of the world's known species. Because of the importance of proper species identification for ecological and systematic studies and conservation efforts, we present a dichotomous key to the bats of this region. Our goal is the positive, in-hand identification of living bats that may be released unharmed after identification. Identifying Neotropical bats and understanding the taxonomic changes that affect the names used for the various species over time can be a challenge. This key includes the 123 species known to occur in Costa Rica and Nicaragua as well as three that are expected to occur in these countries but which have not yet been recorded. We provide illustrations of key characters useful for differentiating bats to species and updated taxonomic notes to assist the reader in assessing the literature.

Con más de 1,400 especies de murciélagos descritos en todo el mundo, el orden Chiroptera es el segundo más diverso después de los roedores respecto a taxonomía. Los murciélagos juegan papeles de importancia crítica en los sistemas naturales como dispersores de semillas, polinizadores, depredadores de vertebrados e invertebrados, así como hematófagos. Costa Rica y Nicaragua presentan al menos 123 especies de murciélagos (en 9 familias y 66 géneros), casi el 10% de las especies conocidas en el mundo. Debido a la importancia de la identificación precisa de las especies para los estudios ecológicos, sistemáticos y de conservación, presentamos una clave dicotómica para los murciélagos de esta región. Nuestro objetivo es la identificación correcta con los murciélagos in vivo y que se pueden liberar sin daño después de la identificación. La caracterización de los murciélagos neotropicales y el seguimiento del estatus taxonómico de cada especie puede ser un reto en el proceso de identificación. Esta clave incluye las 123 especies conocidas en Costa Rica y Nicaragua, así como 3 no registradas pero con distribución potencial. Proporcionamos ilustraciones de características claves útiles para diferenciar murciélagos al nivel de la especie y notas taxonómicas actualizadas para ayudar al lector a la identificación.

Key words: biodiversity, biogeography, Central America, Chiroptera, dichotomous key, identification, Neotropics

Costa Rica and Nicaragua have extremely diverse bat faunas that include nine families, 66 genera, and 123 species, or about 10% of the world's 1,406 known species; 120 species have been documented in Costa Rica and 115 in Nicaragua (Emmons and Feer 1997; Timm and LaVal 1998; Timm et al. 1999; LaVal and Rodríguez-H. 2002; Simmons 2005; Reid 2009; Medina-Fitoria et al. 2010, 2015; Medina-Fitoria 2014; Rodríguez-Herrera et al. 2014). Costa Rica has eight more-southerly distributed species that are not known from as far north as Nicaragua, and Nicaragua has three species of more-northerly bats, the ranges of which do not extend as far south as Costa Rica.

More than one-half of Costa Rican and Nicaraguan bat species belong to the family Phyllostomidae, one of the most ecologically diverse mammalian families. The phyllostomids include insectivores and carnivores that glean their prey from substrates; phytophagous bats that feed either exclusively or in large part on nectar and fruits as well as on pollen, leaves, and seeds; species that are omnivorous, feeding on both plant and animal material; and the vampires, which are exclusively sanguinivorous (Wilson 1973; Howell and Burch 1974; Gardner 1977a; Bonaccorso 1979; Kalko 1998; Freeman 2000; Wetterer et al. 2000; Nogueira and Peracchi 2003; Giannini and Kalko 2004; Santana et al. 2012). The nonphyllostomid bats forage primarily as aerial insectivores, with piscivory common in the greater bulldog bat (*Noctilio leporinus*) and possible in the lesser bulldog bat (*N. albiventris*—Goodwin 1928; Howell and Burch 1974; Brooke 1994; Schnitzler et al. 1994; Gonçalves et al. 2007).

Given the extent of the taxonomic and ecological diversity exhibited by bats, they play many critical roles in tropical ecosystems (Kunz et al. 2011). Many bat species consume large quantities of insects, many of which are herbivorous; predation by bats results in a drastic decrease in potential damage to forest plants and cultivated crops (Naylor and Ehrlich 1997; Riccucci and Lanza 2014). Nectarivorous bats are important pollinators, including for many plants that are chiropterophilous, or bat-specific in their floral morphology and physiology (von Helversen and Winter 2003; Fleming et al. 2009). Frugivorous bats disperse seeds of late-successional canopy trees as well as of early-successional pioneer species, the establishment of which in disturbed areas is essential for the regrowth of forest where it has been cleared due to natural or anthropogenic processes (Muscarella and Fleming 2007; Lobova et al. 2009).

Bats suffer from habitat loss, as do many other tropical organisms. As natural areas disappear at the hands of humans, the availability of appropriate roosting sites, foraging areas, and prey decreases, with detrimental effects on bat populations (Fenton et al. 1992; Tuttle 2013; Janzen and Hallwachs 2019). Even small-scale habitat destruction can be grievous when the extent of within-site bat diversity in the Neotropics is considered. Despite the benefits they provide, bats tend to be maligned and persecuted in Neotropical areas. Vampire bats, especially the common vampire (*Desmodus rotundus*), can be abundant in rural areas and are considered pests in that they parasitize and occasionally spread disease among domestic animals and humans (Acha and Alba 1988). Due to the frequent confusion of vampire bats with other species and the prevalence of fear and misunderstanding of bats stemming from a paucity of sound information, bats of all kinds often are subjected to indiscriminate extermination. The introduction of organized vampire bat control and bat conservation efforts, the focus of which is public education, can be effective locally, but an aversion to bats remains a widespread threat (Anderson et al. 2012; Tuttle 2013). Bats are essential to so many ecosystem processes, and the loss of bats from an area affects bat symbionts as well (Kunz et al. 2011).

In recent years, concern for the protection of natural areas in Central America has increased tremendously, especially as environmental awareness and the ecotourism industry flourish in the region (Koens et al. 2009; Pennisi et al. 2009). Although habitat loss continues to be problematic, Costa Rica has set aside more than one-quarter of its land in national parks and other refuges (UNEP-WCMC 2019a). It also has a long history of international scientific activity due to political stability (The World Factbook 2019a), the prevalence of biological field stations, and the relative ease with which scientists conduct studies there. Although political and social instability has marked Nicaragua's recent history and is ongoing (The World Factbook 2019b), Nicaragua has more than one-third of its land at least nominally under protection (UNEP-WCMC 2019b) and shows a growing interest in the development of ecotourism. Further, biologists are conducting studies in Nicaragua with increasing frequency and have made important contributions to our understanding of the country's bat fauna (e.g., Medina-Fitoria et al. 2015). Both Costa Rica and Nicaragua are represented in the Latin American Bat Conservation Network (RELCOM 2015; Rodríguez-Herrera and Sánchez 2015), and the establishment of a Central American biological corridor that runs from Mexico to Panama received active interest (Boza 2006). Recent efforts by the Costa Rican and Nicaraguan conservation communities to establish reserves to protect the countries' interesting fauna and associated habitats are to be applauded. For continued and improved conservation of bats and their ecosystems, an active discourse between biologists and the people for whom accurate and current biological knowledge is necessary is essential. We encourage ecologists and systematists alike to contribute to the information available to students, land managers, policy makers, and the public.

Bats in Costa Rica have received considerable study. The species present in the country, their distributions, and, for several species, their ecology are well known. Rodríguez-Herrera et al. (2014) presented a comprehensive and updated synopsis of Costa Rican bats. Regional studies provide additional details on species diversity at specific sites and on distributions, elevational range, and ecology. For example, 82 species of bats are known from the greater Monteverde region (Timm and LaVal 2018), 71 species have been recorded at the La Selva Biological Station in the Caribbean lowland wet forest, 67 species are known from Parque Nacional Palo Verde in the Guanacaste lowland dry forest (Stoner and Timm 2004), and 62 species have been recorded at the mid-elevation Las Cruces Biological Station near the Panama border (Pacheco et al. 2006; Timm and Zahawi 2014; R. M. Timm, pers. obs.). Only 39 species, however, are known from Cabo Blanco at the tip of the heavily ecologically degraded Nicoya Peninsula (Timm and McClearn 2007). Whereas the bat fauna of Nicaragua has not yet received the intensity of study that Costa Rica's has, already 115 species can be attributed to the country and we are confident that more species will be found there as additional studies are undertaken. Recent studies of Nicaraguan bats have yielded a number of new or rarely documented species. Some of these studies

have produced observations that extend previously known species ranges (Medina-Fitoria et al. 2015).

Because of the importance of proper species identification in ecological and systematic studies, we offer this revision of the dichotomous field key to the bats of Costa Rica (Timm and LaVal 1998; Timm et al. 1999); our goal remains the positive identification of living bats in-hand that may be released unharmed after identification. We have expanded this new edition by including Nicaragua. Other modifications to previous editions of this key include updated taxonomy and illustrations, expanded taxonomic and ecological notes, clarifications of the characters used in couplets, and a more user-friendly organization of characters and couplets designed to minimize reliance on hard-to-see features while making each combination of characters unique within a couplet.

This key, as well as those in previous editions, is based on extensive observations and measurements of live bats in the field and of museum specimens, and it draws from material available in earlier keys and accounts. The current key has been a work-in-progress for over a decade, with the authors' amendments and addenda field-tested over several years by many people, ranging from novices to experts, all of whom are the intended users of the information presented here. Because the focus of our key is the identification of the bats of Costa Rica and Nicaragua, our measurements and illustrations come primarily from Costa Rican and Nicaraguan individuals, with additional information from specimens from neighboring areas when necessary. Whereas we hope this key will be useful for the identification of bats throughout Central America, the user should keep in mind that geographic variation in color and size, as well as the presence of species not included in the key, may make identification difficult in some instances when used outside of Costa Rica or Nicaragua. The study of museum specimens is extremely helpful in illustrating the variation to be expected within and among species and geographic areas, and we encourage the examination of museum specimens along with the use of this key for becoming familiar with and distinguishing bat species from this region.

Identifying Neotropical bats and understanding the taxonomic changes that affect the names used for the various species can be a challenge. This key includes the 123 species known to occur in Costa Rica and Nicaragua as well as three that are expected to occur in these countries but which have not yet been recorded. With continued field studies in areas that have not been well sampled, observations of bats not previously recorded will, undoubtedly, be reported from both countries. With this in mind, we herein present a dichotomous key to these 126 species from the region. The taxonomic notes following the key provide a brief outline of the recent systematic literature that explains our choices of scientific names and our inclusion of unrecorded but expected species.

The arrangement of families and phyllostomid subfamilies in this key generally follows Simmons (2005). Many taxon names are well established, whereas others either remain controversial or recently have been changed, often because of the accumulation of molecular data in a field traditionally based on comparative morphology. In cases where we use a name that may be unfamiliar to the user or that has been the subject of recent taxonomic study, we mark the name with an asterisk (*) and provide a discussion in the taxonomic notes that follow the key.

Other keys to Neotropical bats also may prove useful in Central America and elsewhere in the Neotropics, including those of Hall (1981) for North and Central American species; Álvarez et al. (1994), Medellín et al. (1997), and Álvarez-Castañeda et al. (2017) for Mexican species; Pine (1980) for the species of the Caribbean islands; Baker et al. (1984) for the species of the Antilles; and Gardner (2007) for South America. Emmons and Feer (1997) and Reid (2009) provided extremely useful and well-illustrated guides to Neotropical mammals, and Jones and Carter (1976) offered a valuable review of the taxonomy of the phyllostomid bats with an excellent key to the genera, based primarily upon cranial characters, albeit now somewhat dated. Other useful keys include those of Vizzoto and Taddei (1973), Buden (1987), Handley (1987), Linares (1987, 1998), Fernández Badillo et al. (1988), Muñoz (1995), Barquez and Díaz (2009), and Díaz et al. (2011).

Users are strongly encouraged to read and consider the complete combinations of characters in each couplet before making a determination and moving on in the key. General bat anatomy is detailed in Figures 1 and 2.

Key to Families of Bats

1. Tail present or absent; nose with fleshy leaf-like structure (Fig. 1A) or with short, fleshy ridge present above (not behind) nostrils (Fig. 1B) or naked and completely covered with yellowish, fleshy folds and wrinkles (Fig. 1C); facial vibrissae with swollen bases ..... Phyllostomidae
1′. Tail present; nose without leaf-like structure or fleshy ridge above nostrils; facial vibrissae lacking swollen bases, face not completely covered with yellowish, fleshy wrinkles, although a black, fleshy flap may be present on the cheek or chin.....2
2. Adhesive disc on ankle and base of thumb (Fig. 2) ..... Thyropteridae
2′. No adhesive discs on ankle or thumb 3
3. Tail shorter than uropatagium when tail membrane is extended manually, its tip often projecting out above surface of membrane.....4
3′. Tail as long as or longer than uropatagium when tail membrane is extended manually 8
4. Thumb and claw reduced, with thumb almost completely enclosed in propatagium.....5
4′. Distal joint and claw of thumb extend obviously beyond edge of propatagium.....6
5. Color white; forearm 65 mm or longer..... Emballonuridae
5′. Color dark; forearm 37 mm or shorter.....Furipteridae

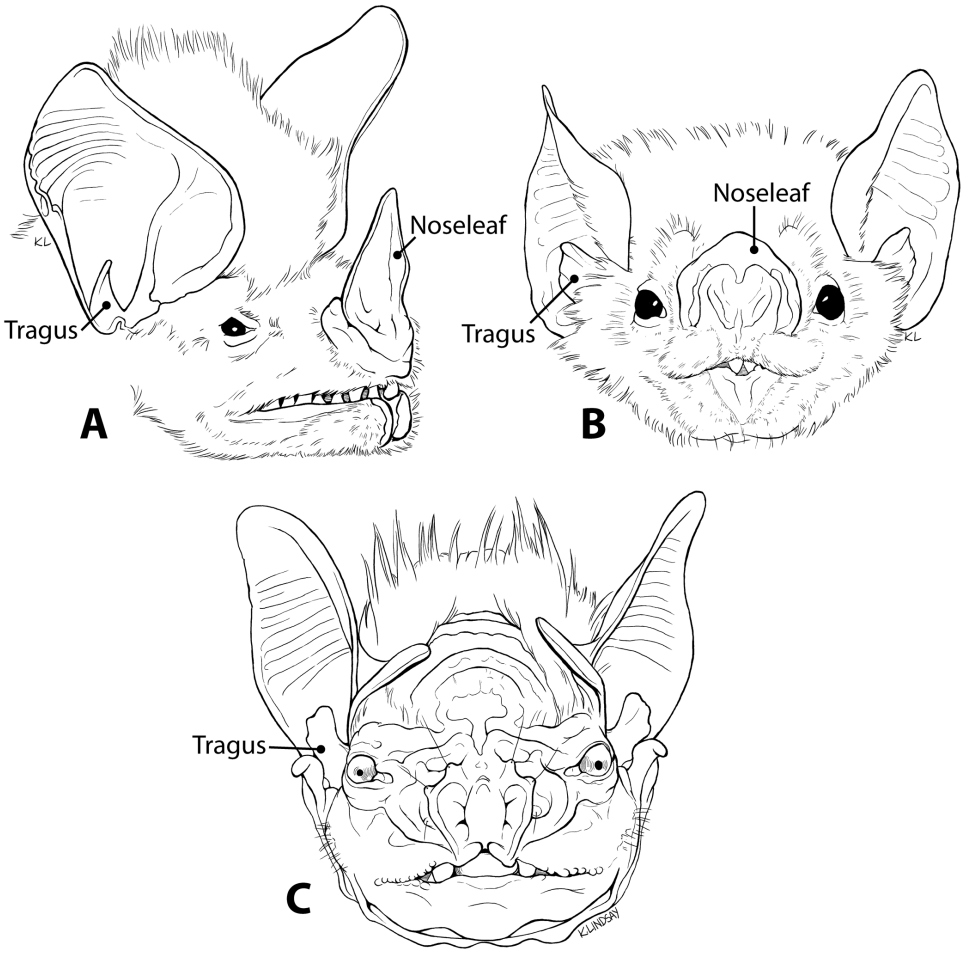

Fig. 1.—Phyllostomid facial characteristics. Many phyllostomids have large ears with an obvious tragus. The noseleaf of *Micronycteris hirsuta* (A) is typical of family Phyllostomidae. The vampire bats, including *Desmodus rotundus* (B), have a reduced noseleaf. *Centurio senex* (C) is the only Central American phyllostomid that lacks a noseleaf, instead possessing extensive wrinkles and folds on the face.

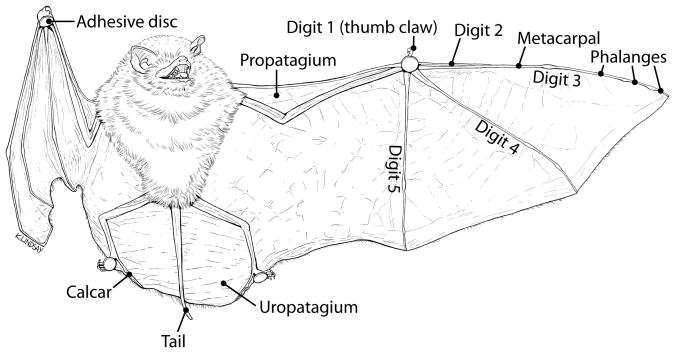

Fig. 2.—External anatomy of *Thyroptera discolor*. The tragus, calcar, and wing bones of *T. discolor* are typical of many bats. The two species of *Thyroptera* are unique among Costa Rican and Nicaraguan bats in having adhesive discs on the wrists and ankles.

6. Second digit of hand with 2 or 3 bones (1 metacarpal and 1 or 2 phalanges); lips and chin with wrinkles, fleshy flaps, or multiple grooves; lateral swellings between eye and nostril present or absent; propatagium without dorsal slit or ventral sac.....7

6′. Second digit of hand with 1 bone (1 metacarpal but without phalanges); lips and chin without wrinkles, flaps, or grooves; no large lateral swellings between eye and nostril; propatagium often with dorsal slit or ventral sac.....Emballonuridae

7. Four lower incisors; second digit in hand with 2 bones (1 metacarpal and 1 phalanx); fur long and silky; wing membranes meet at middorsal line in some species, giving naked-backed appearance; no pale dorsal stripe .....Mormoopidae

7′. Two lower incisors; second digit in hand with 3 bones (1 metacarpal and 2 phalanges); fur very short; wings attach to sides of body; pale dorsal stripe sometimes visible.....Noctilionidae

8. Tail protrudes more than 5 mm beyond uropatagium when membrane is extended manually.....Molossidae

8′. Tail as long as or only slightly longer than uropatagium, not extending more than 5 mm beyond tail membrane when it is extended manually.....9

9. Legs, tail, and uropatagium longer than head plus body; ears and muzzle light-colored; no obvious swelling between eyes and nose; ears wide and not pointed at tips;

third digit in hand with 3 bones (1 metacarpal and 2 phalanges).....Natalidae

9′. Legs, tail, and uropatagium not as long as head plus body; ears and muzzle black or brown; obvious swelling usually present between eyes and nose; ears pointed or rounded and not particularly wide at tips; third digit in hand with 4 bones (1 metacarpal and 3 phalanges).....Vespertilionidae

Key to Species of Emballonuridae

(Sac-winged bats)

1. Fur white; forearm 65 mm or longer; males with dark, keratinized V-shaped structure on dorsal side of uropatagium..... *Diclidurus albus*
1′. Fur black, brown, reddish-brown, or gray; forearm 55 mm or shorter; no V-shaped structure on uropatagium 2
2. Back with 2 pale, wavy stripes (sometimes indistinct and grizzled with dark flecks) 3
2′. Back without pale stripes and fur not grizzled 5
3. Dorsal fur grizzled brown or gray and with 2 indistinct, pale, wavy stripes; forearm with tufts of pale hair; upper lip extends obviously beyond lower lip; no slit or glandular sac in propatagium; calcar longer than tibia; forearm 35–41 mm.....*Rhynchonycteris naso*
3′. Dorsal fur black, dark brown, or brown, not grizzled, and with 2 distinct, wavy light stripes; forearm without bands of light hair; upper lip does not extend beyond lower lip; slit-like opening present on dorsal side of propatagium, sometimes accompanied by large glandular sac on ventral side of propatagium; calcar shorter than tibia; forearm 37–47 mm.....4
4. Fur black or dark brown; dorsal lines whitish; forearm 41–47 mm in males or 43–49 mm in females..... .....*Saccopteryx bilineata*
4′. Fur brown; dorsal lines tan or light brown; forearm 37–40 mm in males or 39–41 mm in females..... .....*Saccopteryx leptura*
5. Conspicuous slit-like opening on dorsal side of propatagium.....6
5′. No slit-like opening on dorsal side of propatagium....9
6. Slit-like opening in propatagium faces body and does not reach anterior edge of propatagium; forearm 38–47 mm; restricted to Pacific lowlands .....*Balantiopteryx plicata*
6′. Slit-like opening in propatagium faces away from body and reaches anterior edge of propatagium; forearm 38–54 mm; widely distributed.....7
7. Slit-like opening extends from anterior edge of propatagium to near forearm; fur tapers in length from top of head toward nose; wing attaches near base of toes; forearm 46–48 mm .....*Cormura brevirostris*
7′. Slit-like opening extends from anterior edge of propatagium to midpoint of membrane and does not reach forearm; fur does not taper in length from top of head toward nose; wing attaches to ankle; forearm 38–54.....8
8. Forearm 45–51 mm in males or 47–54 mm in females; fur usually dark brown.....*Peropteryx kappleri*
8′. Forearm 39–45 mm in males or 43–45 mm in females; fur usually reddish-brown.....*Peropteryx macrotis*
9. Forearm 45–48 mm; ears short and rounded; fur dull black or dark grayish-brown dorsally and ventrally; fur on uropatagium same color as dorsum..... .....*Cyttarops alecto*
9′. Forearm 42–46 mm; ears moderately long and pointed; fur pale reddish-brown, venter paler than dorsum; fur on uropatagium reddish.....*Centronycteris centralis*

Key to Subfamilies of Phyllostomidae

(Leaf-nosed bats)

1. Incisors and canine teeth laterally flattened and triangular in profile, with incisors similar to canines in size and shape (Fig. 3A); molars reduced and without crushing surface; noseleaf reduced to small, fleshy ridge above nostrils (Fig. 1B); thumb long and with 2 pads; legs strong, stocky, often held bent and to sides of body.....Desmodontinae
1′. Incisors and canine teeth pointed, rounded, or conical in profile, with canines usually longer than incisors; premolars and molars well developed and with crushing surface (Fig. 3B); noseleaf obvious and triangular (Fig. 1A), or face naked and covered in yellowish fleshy wrinkles and folds (Fig. 1C); thumb not exceptionally long

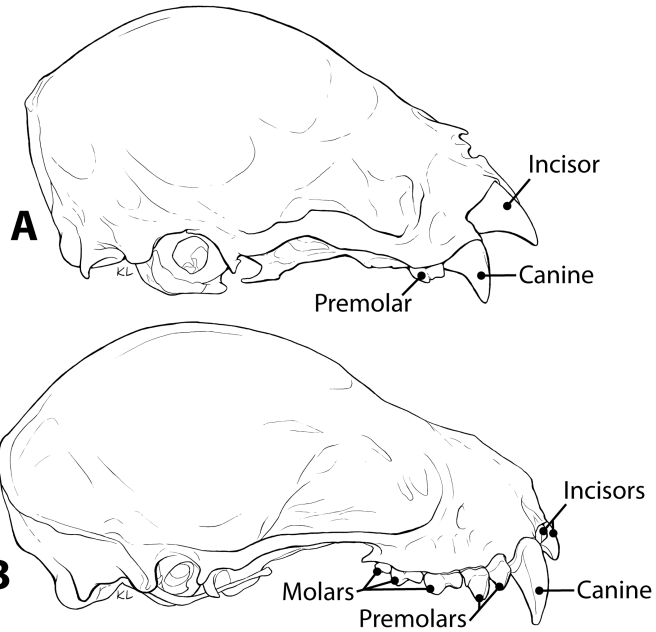

Fig. 3.—Lateral views of the crania of *Desmodus rotundus* (A) and *Sturnira parvidens* (B). The incisors and canines of vampire bats are triangular and blade-like, whereas the premolars are reduced and poorly developed. In contrast, other phyllostomids have small incisors, long and conical canines, and well-developed cheek teeth with elaborate occlusive surfaces.

and with only 1 pad; legs usually thin, not exceptionally strong, and often held posteriorly.....2

2. Tail absent; uropatagium reduced and narrow, following contour of legs, or absent; light stripes often present on the face or back; head rounded; snout short, blunt, and typically rounded; noseleaf usually equilaterally triangular, often with fleshy accessory pad behind it, or face naked and covered with yellowish fleshy wrinkles and folds.....Stenodermatinae

2′. Tail usually present; uropatagium usually well developed and filling space between legs, though sometimes reduced or absent; pale facial or dorsal stripes rare; snout somewhat elongate, typically narrow or squared; noseleaf equilaterally triangular or longer than broad and without accessory pad 3

3. Lower lip with deep groove extending from mouth to chin; snout narrow and elongate; teeth small; ears small, rounded, and widely separated where they attach to the head; noseleaf small and equilaterally triangular (Fig. 4A); tongue long.....Glossophaginae and Lonchophyllinae*

3′. Lower lip with 2 smooth, raised pads in the shape of a "V" (Fig. 1A), round warts (Figs. 4B and 4C), or papillate projections (Fig. 4D), but without a deep groove; snout somewhat squared; teeth large; ears medium to large, often somewhat pointed and set close together where they attach to the head; noseleaf usually longer than broad; tongue not long.....4

4. Chin with larger, distinctive central wart surrounded by smaller bumps; snout slightly squared; tail extends to midpoint of uropatagium, protruding above tail membrane; noseleaf slightly longer than broad; ears of moderate size, always set wide apart where they attach to the head, and not connected by a fleshy interauricular band (Fig. 4C); forearm 34–45 mm.....Carolliinae

4′. Chin with 2 smooth, raised pads in the shape of a "V" (Fig. 1A), small bumps but no larger central wart (Fig. 4B), or long, papillate projections (Fig. 4D); snout obviously squared; tail often extends at least to midpoint of uropatagium; noseleaf often much longer than broad; ears large or moderately sized, sometimes set close together where they attach to the head and sometimes connected by a fleshy interauricular band; forearm 31–116 mm .....Glyphonycterinae, Lonchorhininae, Micronycterinae, and Phyllostominae*

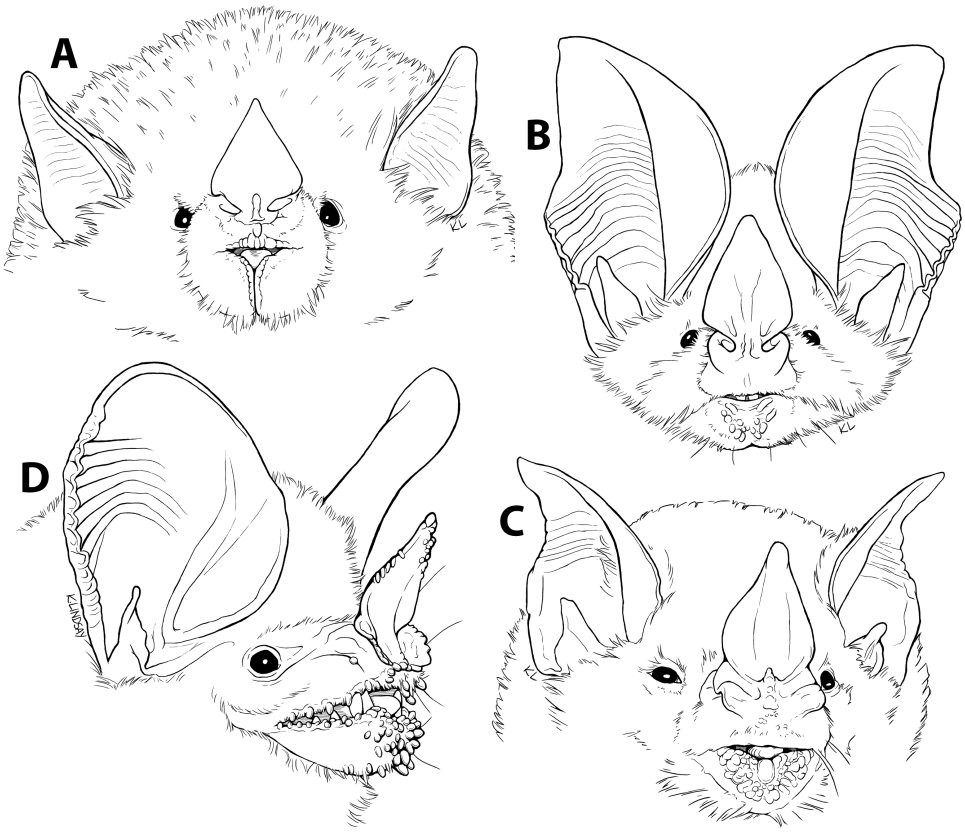

Fig. 4.—Phyllostomid facial characteristics. In many nectar-feeding phyllostomids, such as *Hylonycteris underwoodi* (A), there is a deep groove on the lower lip, the noseleaf is equilaterally triangular, and the ears are small, rounded, and widespread. A variety of adornments are found on the lips and chins of phyllostomid bats, including the round warts found in *Lophostoma brasiliense* (B) and *Carollia perspicillata* (C), the long, papillate projections characteristic of *Trachops cirrhosis* (D), and the raised, V-shaped pads of *Micronycteris hirsuta* (Fig. 1A). Species in the subfamilies Glyphonycteris, Lonchorhininae, Micronycterinae, and Phyllostominae typically have large, closely spaced ears and an elongate noseleaf. Similarly, the carolliine species also have moderately large ears, a somewhat elongate noseleaf, and round warts on the chin but are distinguished by the larger central wart.

Key to Species of Glyphonycterinae, Lonchorhininae, Micronycterinae, and Phyllostominae*

(Gleaning bats)

1. Forearm 75 mm or longer.....2
1′. Forearm 70 mm or shorter.....5
2. Tail absent or shorter than 10 mm; ears large and rounded.....3
2′. Tail longer than 15 mm, obviously extending partway into uropatagium; ears moderately sized and somewhat pointed.....4
3. Forearm 100–116 mm; 4 lower incisors; tail absent; wingtips black.....*Vampyrum spectrum*
3′. Forearm 78–84 mm; 2 lower incisors; tail very short but visible; wingtips white.....*Chrotopterus auritus*
4. Forearm 88 mm or longer; lower incisors of equal width (Fig. 5A); wingtips dark; fur uniformly black or dark brown.....*Phyllostomus hastatus*
4′. Forearm 83 mm or shorter; outer lower incisors much narrower and shorter than inner incisors (Fig. 5B); wingtips white; fur brown with whitish basal band.....*Phylloderma stenops**
5. Tail extends to edge of uropatagium.....6
5′. Tail extends only partway into uropatagium.....7
6. Forearm 45 mm or longer; noseleaf extremely long and narrow, approximating the length of the ears; papillae absent from ventral side of uropatagium.....*Lonchorhina aurita*
6′. Forearm 38 mm or shorter; noseleaf long but somewhat broad and not as long as the ears; papillae present posteriorly on uropatagium..*Macrophyllum macrophyllum*
7. Lips and chin with numerous long, fleshy, papillate projections (Fig. 4D); forearm 56–62 mm .....*Trachops cirrhosus*
7′. Lips and chin without fleshy papillate projections; chin with 2 smooth, raised pads in the shape of a "V" (Fig. 1A) or with low wart-like bumps (Fig. 4B); forearm 31–67 mm 8
8. One pair of lower incisors.....9
8′. Two pairs of lower incisors 13
9. Forearm 45 mm or longer; chin with 2 smooth, raised pads in the shape of a "V" or low bumps; fleshy interauricular band present or absent.....10
9′. Forearm 40 mm or shorter; chin with low bumps; fleshy interauricular band present....*Lophostoma brasiliense**
10. Noseleaf slightly longer than broad; ears rounded; interauricular band present or absent.....11
10′. Noseleaf about twice as long as broad; ears somewhat pointed; interauricular band absent 12
11. Ventral fur much paler than dorsal fur; interauricular band present; rostrum, ears, forearms, and legs with very little fur; no central stripe or patch of pale fur on head; ears longer than 33 mm.....*Lophostoma silvicolum**
11′. Ventral fur dark, sometimes frosted, and similar in color to dorsal fur; interauricular band absent; rostrum, ears, forearms, and upper legs furred; light central stripe or patch usually visible on forehead; ears shorter than 32 mm.....*Tonatia saurophila*
12. Forearm 53 mm or longer; dorsal stripe absent; found primarily in Caribbean lowlands.....*Mimon cozumelae**
12′. Forearm 52 mm or shorter; pale dorsal stripe present; widely distributed .....*Gardnerycteris crenulatum**
13. Forearm 53 mm or longer 14
13′. Forearm 46 mm or shorter.....15
14. Two upper incisors; upper incisors almost equal in length to canines (Fig. 6A); forearm 53–58 mm; tail longer than one-third the length of the uropatagium .....*Glyphonycteris daviesi**
14′. Four upper incisors; upper incisors much shorter than canines (Fig. 6B); forearm 55–67 mm; tail shorter than one-third the length of the uropatagium .....*Phyllostomus discolor*
15. Calcar shorter than foot when laid along foot.....16
15′. Calcar longer than foot 18
16. No fleshy interauricular band between ears; forearm 35–43 mm.....17
16′. Fleshy interauricular band present between ears; forearm 33–36 mm.....*Micronycteris minuta*
17. Dorsal hairs faintly banded; no dorsal stripe; upper incisors equal in length to canines; first lower premolar similar in size to other premolars; fifth metacarpal

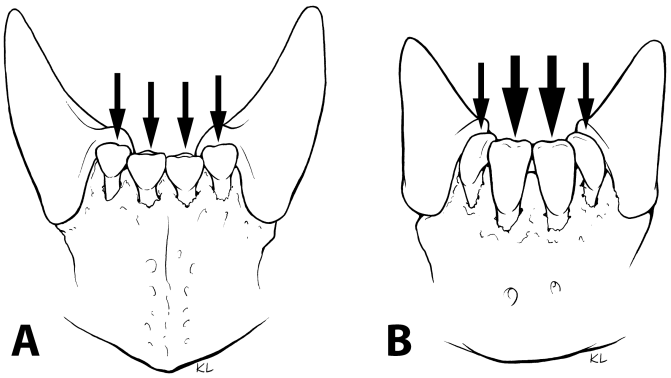

Fig. 5.—Frontal views of the jaws of *Phyllostomus hastatus* (A) and *Phylloderma stenops* (B). The two pairs of incisors are equally sized in *Phyllostomus*, but the outer incisors are narrower than the outer incisors in *Phylloderma*.

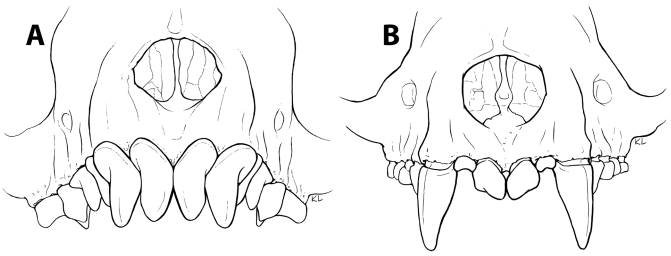

Fig. 6.—Frontal views of the crania of *Glyphonycteris daviesi* (A) and *Phyllostomus discolor* (B). The single pair of upper incisors in *G. daviesi* are exceptionally elongate, approximating the size and shape of the canines. In contrast, the two pairs of upper incisors in *P. discolor* are much smaller than the canines.

longer than other metacarpals; forearm 37–43 mm ..... *Glyphonycteris sylvestris**

17′. Dorsal hairs clearly banded; pale dorsal stripe sometimes visible posteriorly; upper incisors much shorter than canines; first lower premolar larger than other premolars; third metacarpal longer than other metacarpals; forearm 35–39 mm ..... *Trinycteris nicefori**

18. Ventral fur dark gray or brown, with or without pale tips; dorsal fur uniformly dark or with narrow light basal band 19

18′. Ventral fur clearly yellow, gold, orange, or white; dorsal fur with pale basal band 20

19. Forearm 40 mm or longer; ventral fur dark with pale tips; patch of long, erect hair on head anterior to interauricular band (obvious when hair is laid forward manually) ..... *Micronycteris hirsuta*

19′. Forearm 38 mm or shorter; ventral fur uniformly dark; hair on head not particularly long ..... *Micronycteris microtis**

20. Forearm 38 mm or longer; ventral fur yellow, gold, or orange; outer upper incisors clearly visible and bicuspidate ..... *Lampronycteris brachyotis**

20′. Forearm 36 mm or shorter; ventral fur pale or white; outer upper incisors minute ..... *Micronycteris schmidtorum*

Key to Species of Glossophaginae and Lonchophyllinae*

(Nectar-feeding bats)

1. Uropatagium lightly to heavily furred and reduced, following contour of legs and not filling space between legs; tail absent or very short; wide gap separates upper incisors (Fig. 7) 2

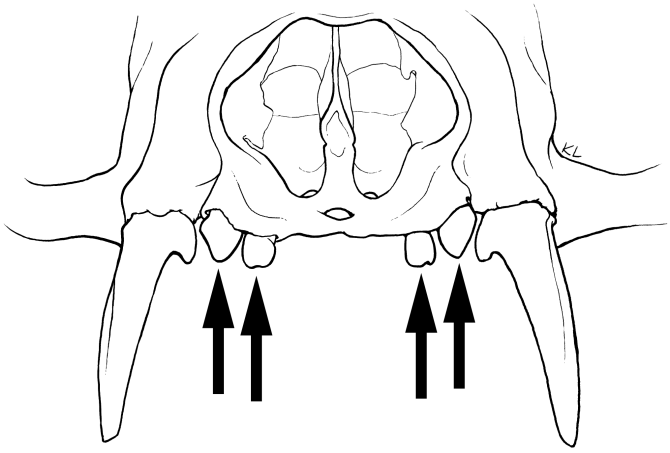

Fig. 7.—Frontal view of the cranium of *Anoura cultrata*. The minute upper incisors are separated by a wide median gap in *Anoura* and *Leptonycteris*.

1′. Uropatagium naked and filling space between legs; tail usually extends at least one-third of the way into the uropatagium; upper incisors vary in spacing 4

2. Forearm 53 mm or longer; 4 upper cheek teeth on each side ..... *Leptonycteris curasoae**

2′. Forearm 47 mm or shorter; 6 upper cheek teeth on each side 3

3. Tail present but very short; calcar obvious and uropatagium conspicuous, especially between knee and ankle; first lower premolar larger than other premolars (Fig. 8A) ..... *Anoura cultrata**

3′. Tail absent; calcar and uropatagium inconspicuous; lower premolars similar in size (Fig. 8B) ..... *Anoura geoffroyi*

4. Calcar as long as foot or longer when laid next to toes, reaching well past base of toes and typically at least to claws; lower incisors absent (best seen with a hand lens) 5

4′. Calcar reaches base of toes but does not reach claws when laid next to toes; lower incisors present 8

5. Wing membrane attaches to feet near base of toes; 4 upper and 5 lower cheek teeth on each side ..... *Lichonycteris obscura*

5′. Wing membrane attaches to feet above base of toes or at ankle; 5 upper and 6 lower cheek teeth on each side 6

6. First and second upper premolars similar in length (Fig. 9A); fur two-banded with pale base; forearm varies in length 7

6′. Long cusp on second upper premolar much longer than that of first premolar (Fig. 9B); fur faintly three-banded with dark base; forearm 34 mm or shorter ..... *Hylonycteris underwoodi**

7. Forearm 43 mm or longer ..... *Choeronycteris mexicana**

7′. Forearm 35 mm or shorter ..... *Choeroniscus godmani*

8. Forearm 40 mm or longer; fur orangish-brown ..... *Lonchophylla robusta*

8′. Forearm 39 mm or shorter; fur brown or gray 9

9. Gaps separate inner from outer upper incisors; outer upper incisors much shorter than outer cusp of inner incisors (Fig. 10A) ..... *Lonchophylla concava**

9′. Upper incisors in close contact; outer upper incisors similar in length to outer cusp of inner incisors (Figs. 10B and 10C) 10

10. Tail visible but very short; gap between inner lower incisors larger than gap separating inner and outer incisors ..... *Glossophaga leachii*

10′. Tail reaches at least one-third of the way into uropatagium; gap between inner lower incisors not particularly wide 11

11. Outer upper incisors shorter than inner incisors; cusps on inner upper incisors unequal, giving incisor region a tapered, V-shaped appearance (Fig. 10B) ..... *Glossophaga soricina*

11′. Outer upper incisor similar in length to inner incisors; cusps on inner upper incisors equal, giving incisor region a squared appearance (Fig. 10C) ..... *Glossophaga commissarisi*

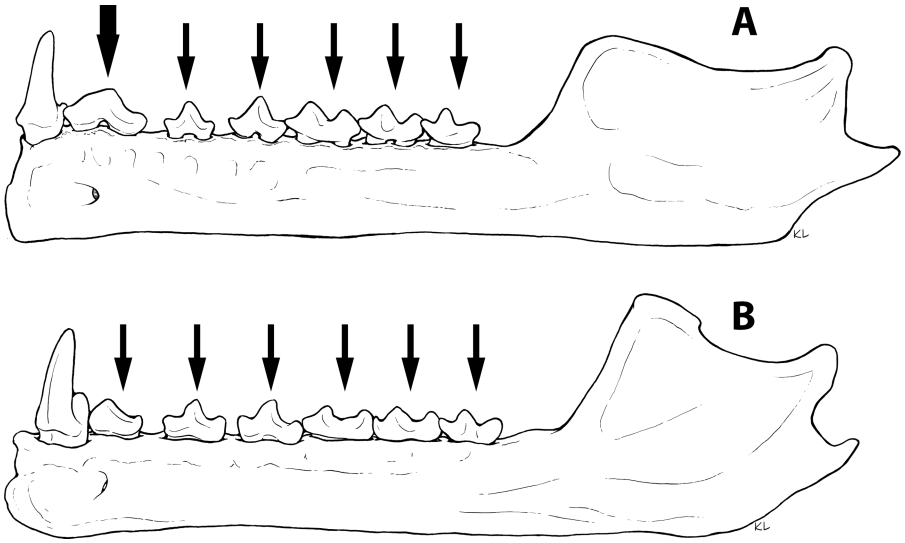

Fig. 8.—Lateral views of the jaws of *Anoura cultrata* (A) and *Anoura geoffroyi* (B). The first lower premolar is larger than other cheek teeth in *A. cultrata*, but premolars and molars are equally sized in *A. geoffroyi*.

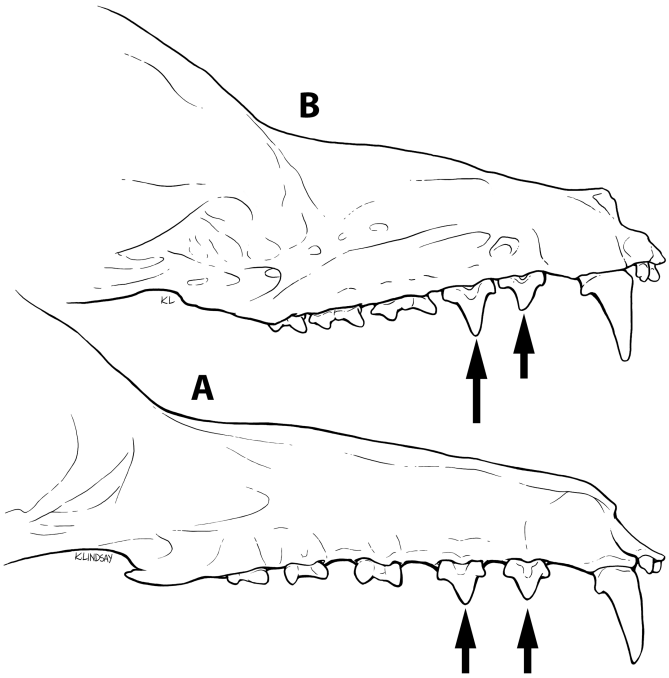

Fig. 9.—Lateral views of the crania of *Choeronycteris mexicana* (A) and *Hylonycteris underwoodi* (B). The first and second premolars are similarly sized in *Choeronycteris*. The first premolar is shorter than the second premolar in *Hylonycteris*.

Key to Species of Carolliinae

(Short-tailed fruit bats)

1. Forearm 37–45 mm; tibia 15–21 mm; hairs brown or gray with distinct dark basal and whitish middle bands.....2
1′. Forearm 35–39 mm; tibia 13–17 mm; fur dark chestnut-brown with indistinct banding.....*Carollia castanea*
2. Forearm 40–45 mm; tibia 19–21 mm; outer lower incisors obviously shorter and narrower than inner incisors (Fig. 11A); upper toothrows straight from canines to molars (Fig. 12A); forearms and feet sparsely furred (feet best viewed in profile, from the side).....*Carollia perspicillata*
2′. Forearm 37–43 mm; tibia 15–19 mm; outer lower incisors similar in size to inner incisors (Fig. 11B); upper toothrows clearly angled between canines and molars (Fig. 12B); forearms and feet variably furred (feet best viewed from the side).....3
3. Forearms and feet well furred; dorsal fur clearly three-banded; usually occurs in low- and mid-elevation wet forest.....*Carollia sowelli**
3′. Forearms and feet sparsely furred; dorsal fur indistinctly banded; usually occurs in Pacific-slope dry forest .....*Carollia subrufa*

Key to Species of Stenodermatinae

(Fruit-eating bats)

1. No obvious noseleaf; face naked and covered with folds and wrinkles (Fig. 1C); conspicuous patch of white fur on shoulder.....*Centurio senex*
1′. Noseleaf present; face without folds or wrinkles; no white patches on shoulders 2
2. Face with 1 or 2 pairs of pale stripes; fur brown or gray 3
2′. No pale stripes on face; fur color varies.....23
3. White dorsal stripe present.....4
3′. No white dorsal stripe.....12
4. Forearm shorter than 52 mm 5
4′. Forearm longer than 52 mm 11
5. Dorsal stripe distinct for its whole length, including on upper back and neck 6
5′. Dorsal stripe present but indistinct, especially on upper back and neck 10

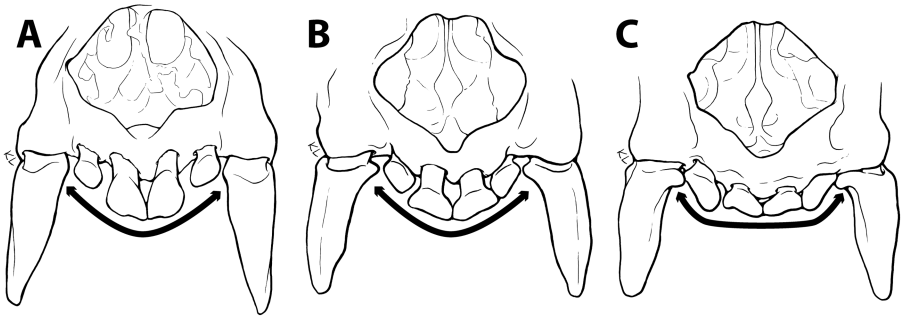

Fig. 10.—Frontal views of the crania of *Lonchophylla concava* (A), *Glossophaga soricina* (B), and *G. commissarisi* (C). In *Lonchophylla*, the outer incisors are separated from the inner incisors by a conspicuous gap, and the outer incisors are shorter than either cusp of the inner incisors. In contrast, in both species of *Glossophaga*, the two pairs of incisors are not conspicuously separated, and the outer incisors approximate the length of at least the outer cusp of the inner incisors. The larger inner cusps on the inner incisors of *G. soricina* give the incisors a V-shaped appearance, whereas the similar lengths of the incisors of *G. commissarisi* give them a squared appearance.

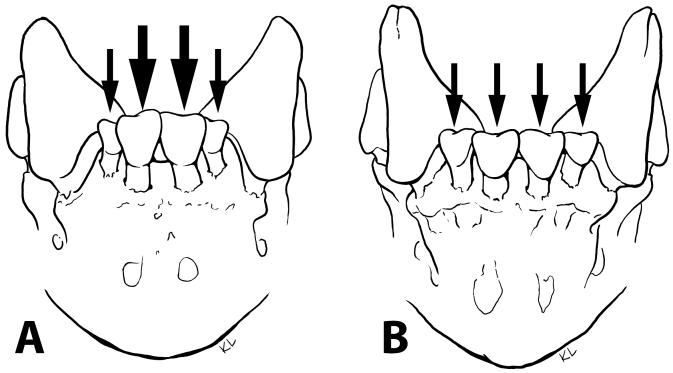

Fig. 11.—Frontal views of the jaws of *Carollia perspicillata* (A) and *C. sowelli* (B). The inner incisors are conspicuously wider and taller than the outer incisors in *C. perspicillata*. The two pairs of incisors are similar in width in *C. sowelli*.

6. Facial stripes distinct; ears rimmed with yellow or white; forearm 37–52 mm.....7
6′. Facial stripes indistinct; ears dark and not rimmed with yellow or white; forearm 36–46 mm..... .....*Uroderma magnirostrum**
7. Edge of uropatagium with thick fringe of hairs; bright white dorsal stripe reaches between ears on top of head; forearm 37–40 mm .....*Platyrrhinus helleri**
7′. Edge of uropatagium bare or sparsely furred; light dorsal stripe reaches upper back but not top of head; forearm 37–52 mm.....8
8. Dorsal fur gray or grayish-brown; inner upper incisors bilobed and only slightly larger than outer incisors (Fig. 13A); 5 upper and 5 lower cheek teeth on each side; forearm 39–46 mm .....*Uroderma convexum**
8′. Dorsal fur dark brown, brown, or yellowish-brown; inner upper incisors not lobed and more than twice the length of outer incisors (Fig. 13B); 4 upper and 4 lower cheek teeth on each side; forearm 37–52 mm.....9
9. Dorsal fur dark brown; forearm 44–52 mm..... .....*Chiroderma salvini*

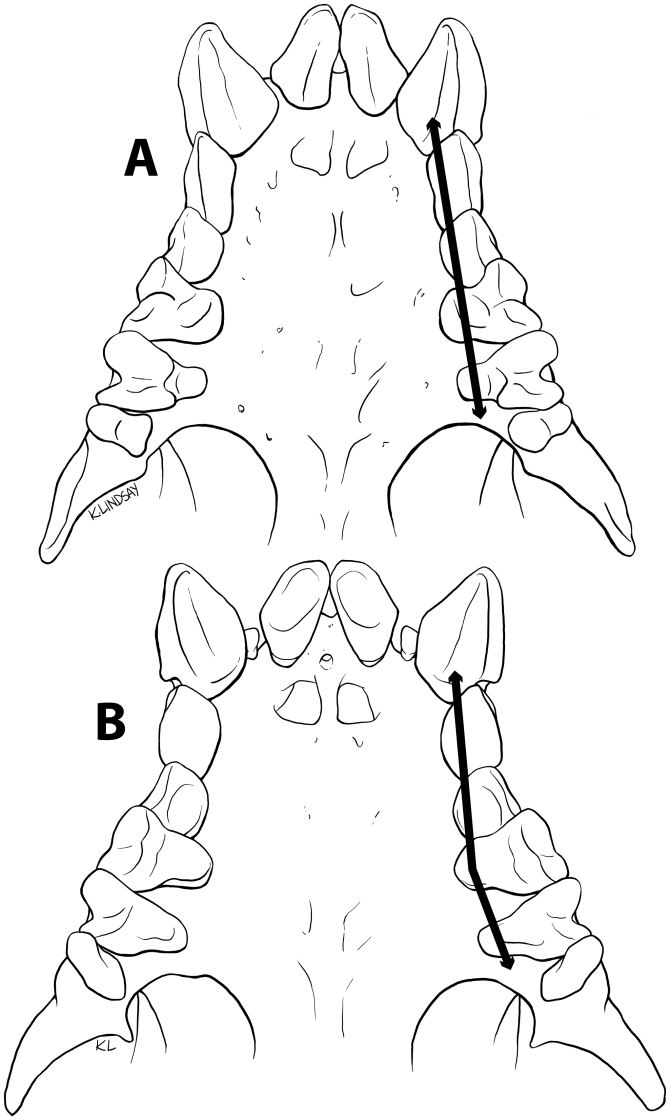

Fig. 12.—Palatal views of the crania of *Carollia perspicillata* (A) and *C. sowelli* (B). The toothrow from canine to last molar is approximately linear in *C. perspicillata*, whereas the toothrow is conspicuously angled in *C. sowelli*.

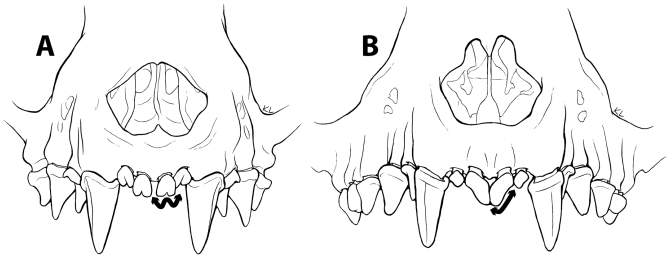

Fig. 13.—Frontal views of the crania of *Uroderma convexum* (A) and *Chiroderma trinitatum* (B). The incisors of *U. convexum* are evenly bilobed, appearing w-shaped. The cusps on the incisors of *C. trinitatum* are unequal in length, giving a relatively pointed appearance.

9′. Dorsal fur brown or yellowish-brown; forearm 37–42 mm.....*Chiroderma trinitatum**
10. Facial stripes indistinct; long guard hairs scattered throughout dorsal fur; inner upper incisors long, narrow, somewhat pointed, and not lobed (Fig. 14A); forearm 43–50 mm.....*Chiroderma villosum*
10′. Facial stripes distinct; dorsal fur of uniform length and without long guard hairs; inner upper incisors blunt, not particularly narrow, and either not lobed or unevenly bilobed (Fig. 14B); forearm 35–40 mm.....*Vampyriscus nymphaea**
11. Forearm 59–64 mm; 5 upper cheek teeth on each side; fur dark brown; facial stripes pale brown, with lower pair of stripes indistinct or absent; usually found in highlands .....*Platyrrhinus vittatus**
11′. Forearm 52–55 mm; 4 upper cheek teeth on each side; fur pale brown; both pairs of facial stripes distinct and white; usually found in lowlands.....*Vampyrodes caraccioli**
12. Inner upper incisors obviously evenly bilobed (Fig. 14C); forearm 48 mm or longer.....13
12′. Inner upper incisors indistinctly bilobed (Figs. 14B and 14D) or distinctly bilobed (Fig. 14C) and forearm shorter than 48 mm, or inner upper incisors without lobes (Fig. 14A) and forearm 50 mm or shorter 16
13. Basal half of uropatagium thickly furred dorsally; ventral fur dark brown and without white tips; facial stripes distinct; forearm 61–76 mm.....14
13′. Basal half of uropatagium bare or sparsely furred dorsally; ventral fur with white-tipped hairs; facial stripes often indistinct; forearm 48–67 mm.....15
14. Forearm 63–76 mm; both pairs of facial stripes distinct .....*Artibeus lituratus*
14′. Forearm 61–68 mm; stripes above eye distinct; stripes below eye indistinct or absent.....*Artibeus intermedius**
15. Forearm 48–53 mm; uropatagium sparsely furred with fringe of hairs along edge .....*Artibeus inopinatus*
15′. Forearm 52–67 mm; uropatagium naked or very sparsely furred and without fringe of hairs.....*Artibeus jamaicensis*
16. Forearm 35–50 mm; fur color varies; facial stripes vary; uropatagium variably hairy 17

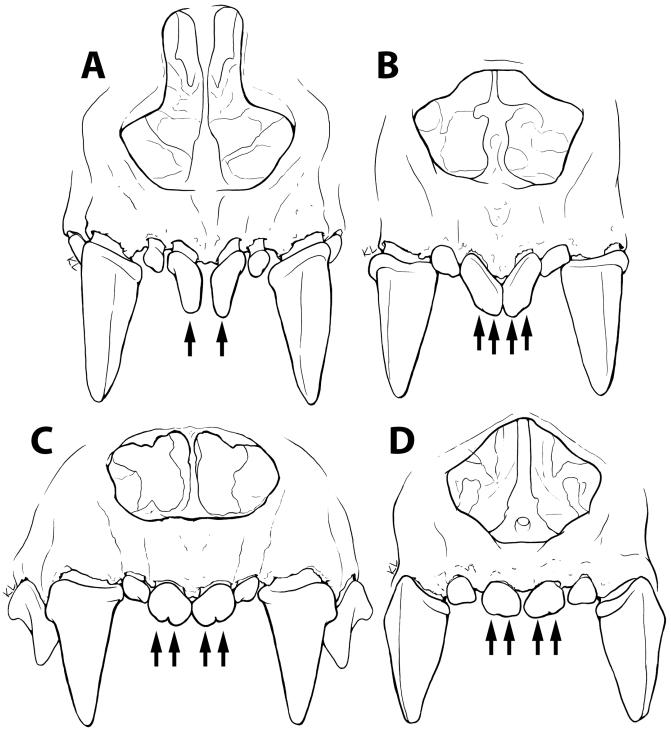

Fig. 14.—Frontal views of the crania of *Chiroderma villosum* (A), *Vampyriscus nymphaea* (B), *Dermanura watsoni* (C), and *Enchisthenes hartii* (D). The inner incisors of *C. villosum* lack distinct cusps and appear long and pointed. The inner incisors of *V. nymphaea* are blunt, with indistinct, uneven cusps that may be hard to detect, appearing unlobed. In *Dermanura* and *Artibeus*, the inner incisors have obvious, even lobes. In contrast, the even lobes on the inner incisors of *E. hartii* are indistinct and may be difficult to detect.

16′. Forearm 30–32 mm; fur pale brown; facial stripes usually indistinct; edge of uropatagium with thick fringe of hairs.....*Vampyressa thyone**
17. Inner upper incisors not lobed or weakly bilobed (Figs. 14A, 14B, and 14D).....18
17′. Inner upper incisors obviously bilobed (Fig. 14C).....20
18. Forearm 43–50 mm; inner upper incisors long and narrow (Fig. 14A); fur pale brown; facial stripes indistinct; long guard hairs scattered throughout dorsal fur; uropatagium without fringe of hairs .....*Chiroderma villosum*
18′. Forearm 35–43; inner upper incisors broad-tipped (Figs. 14B and 14D); fur brown to dark brown; facial stripes distinct; dorsal fur of uniform length and without long guard hairs; uropatagium with fringe of hairs.....19
19. Forearm 37–43 mm; inner upper incisors indistinctly evenly lobed and with broad, squared tips (Fig. 14D); ears rimmed in white; noseleaf dark; fur dark brown .....*Enchisthenes hartii**
19′. Forearm 35–40 mm; inner upper incisors with broad, angled tips and indistinct, uneven lobes (Fig. 14B); ears bright yellow, especially at base; noseleaf pale near nostrils; fur brown.....*Vampyriscus nymphaea**

20. Fur brown or gray; upper facial stripes distinct; uropatagium without conspicuous fringe of hairs.....21
20′. Fur dark brown, gray, or black; upper facial stripes usually indistinct; uropatagium conspicuously haired and with obvious fringe of hairs along edge 22
21. Wide talonid cusp on first upper molar (Fig. 15A); ears trimmed in yellow; 4 lower cheek teeth on each side (Fig. 16A); scattered guard hairs approximately twice the length of the fur; occurs below 1,000 m .....*Dermanura phaeotis**
21′. Narrow talonid cusp on first upper molar (Fig. 15B); ears trimmed in white or grayish-white; 4 or 5 lower cheek teeth on each side, with a tiny third molar sometimes present (Fig. 16B); scattered guard hairs much longer than twice the length of the fur; occurs below 1,500 m.....*Dermanura watsoni**

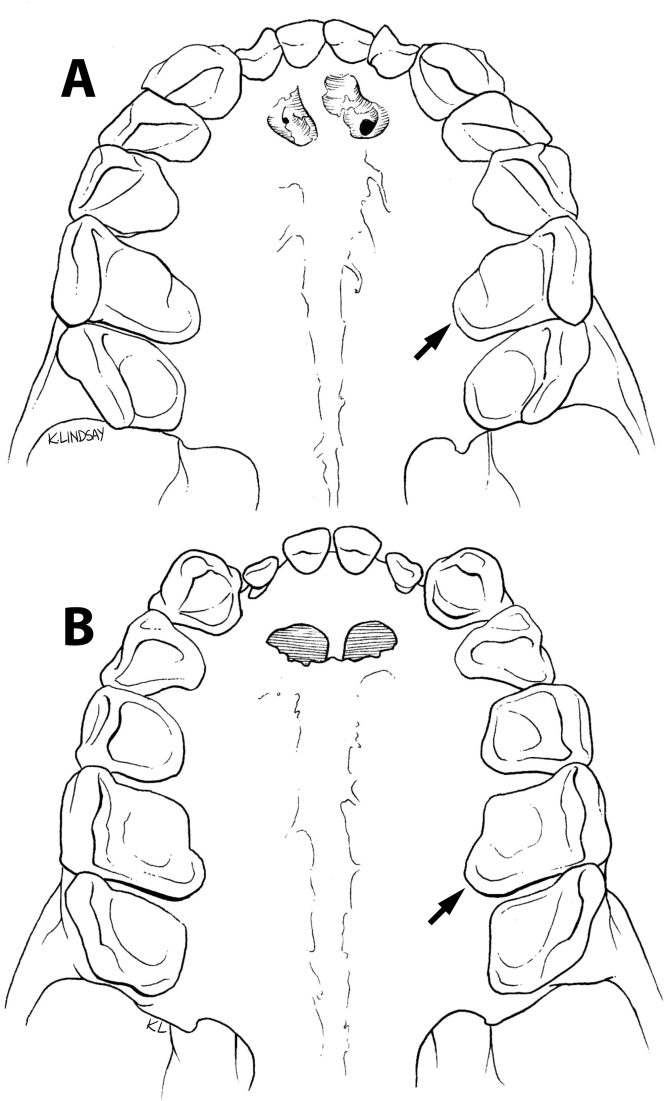

Fig. 15.—Palatal views of the crania of *Dermanura phaeotis* (A) and *D. watsoni* (B). The first upper molar has a wide talonid cusp, giving the tooth a rounded appearance, in *D. phaeotis*. In contrast, the talonid cusp is narrow on the first upper molar in *D. watsoni*, giving the tooth a jagged appearance.

22. Forearm 43–48 mm; usually occurs above 900 m .....*Dermanura azteca**
22′. Forearm 37–40 mm; usually occurs between 300 and 1,500 m.....*Dermanura tolteca**
23. Forearm 52 mm or longer; dorsal fur gray and ventral fur always with white tips .....*Artibeus jamaicensis*
23′. Forearm 50 mm or shorter; fur color varies.....24
24. Forearm 37–49 mm; fur usually brown, orangish-brown, or orange, but not white or very light; noseleaf dark and without yellow trim; uropatagium narrow and with fur extending to edge to form a fringe.....25
24′. Forearm 25–33 mm; fur white or very pale brown; noseleaf with yellow trim; uropatagium present but without fur 29
25. Forearm 42–49 mm; lower incisors bilobed (Fig. 17A); usually occurs at middle and high elevations 26
25′. Forearm 37–45 mm; lower incisors trilobed (though with wear may appear bilobed; Fig. 17B); occurs below 1,000 m.....28
26. Forearm 44–49 mm; inner upper incisors bilobed, flattened, and in contact near tips (Fig. 18A); dorsal fur dark brown and similar in color to venter; legs, feet, and uropatagium sparsely furred; hairs on edge of uropatagium shorter than 6 mm long..... *Sturnira mordax**
26′. Forearm 42–46 mm; inner upper incisors pointed, with diverging tips, and not lobed (Fig. 18B); dorsal fur brown or gray and darker than or similar in color to venter; legs, feet, and uropatagium heavily furred; hairs on edge of uropatagium longer than 7 mm 27
27. Dark-brown patches of fur on shoulders; ventral fur tricolored with pale basal band, dark middle band, and gray tips..... *Sturnira burtonlimi**
27′. Orangish patches of fur on shoulders; ventral fur pale and without dark bands ..... *Sturnira hondurensis**
28. Forearm 41 mm or longer; dorsal fur orangish-brown or dark orange; upper toothrows straight and nearly parallel (Fig. 19A).....*Sturnira luisi**
28′. Forearm 41 mm or shorter; dorsal fur orangish-brown or pale orange; upper toothrows arched outward and not parallel (Fig. 19B)..... *Sturnira parvidens**
29. Forearm 29–33 mm; fur very light brown; wing membranes dark brown; a second tiny noseleaf present behind principal noseleaf.....*Mesophylla macconnelli**
29′. Forearm 25–30 mm; color white or grayish-white, wing membranes black; no accessory noseleaf..... ..... *Ectophylla alba*

Key to Species of Desmodontinae

(Vampire bats)

1. Legs thickly furred; calcar present and distinct; eyes large; noseleaf reduced to a simple ridge over nostrils and without a cleft; inner lower incisors four-lobed and outer lower incisors seven-lobed, forming continuous row between canines; uropatagium extremely reduced at midpoint between legs.....*Diphylla ecaudata*

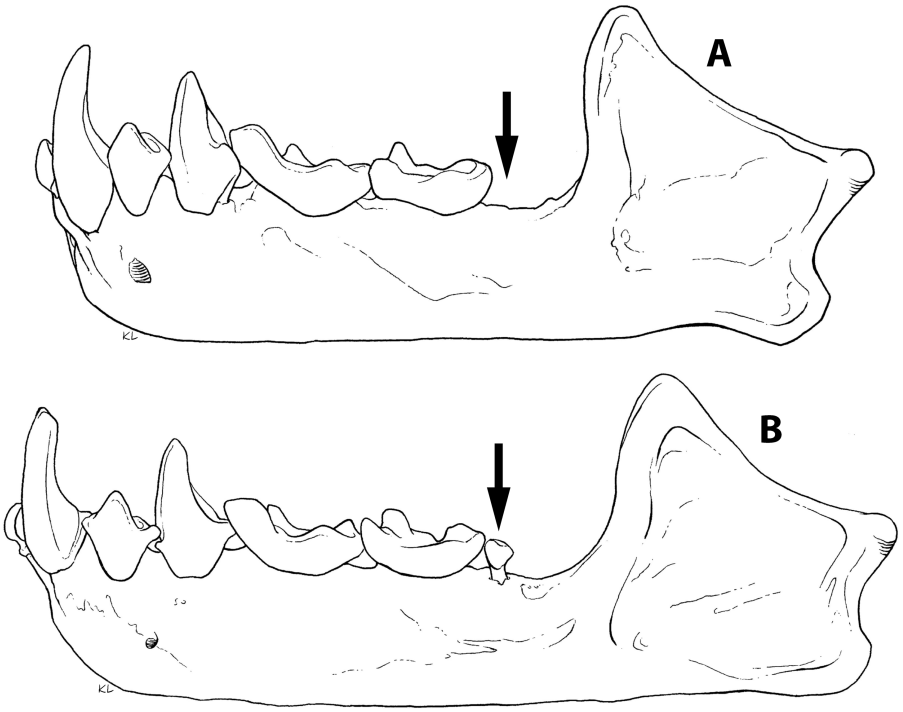

Fig. 16.—Lateral views of the jaws of *Dermanura phaeotis* (A) and *D. watsoni* (B). A minute third molar is often present in *D. watsoni* but is always absent in *D. phaeotis*.

1′. Legs sparsely furred; calcar reduced or absent; eyes small; noseleaf reduced to a ridge over nostrils and with a V-shaped cleft; lower incisors each with 3 or fewer lobes and separated into pairs by a median gap 2
2. Forearm 57 mm or longer; wing tips dark; thumb exceptionally long and with obvious accessory pad at base of each phalanx; calcar absent; small pad present on ankle; lower incisors bilobed..... ..... *Desmodus rotundus*
2′. Forearm 56 mm or shorter; wing tips white; thumb exceptionally long but without accessory pads; calcar small but present; ankle without pad; inner lower incisors trilobed and outer lower incisors bilobed or entire ..... *Diaemus youngi*

Key to Species of Mormoopidae

(Mustached or leaf-chinned bats)

1. Ears rounded and short, not projecting above top of head; face with multiple folds of skin .... *Mormoops megalophylla*
1′. Ears pointed and projecting above top of head; face with a single fold of skin.....2
2. Wings attached to middorsal line, giving back appearance of being naked 3
2′. Wings attached to sides of body and fur on back obvious 4
3. Forearm 50 mm or longer; short hairs scattered sparsely on membrane over back ..... *Pteronotus gymnonotus*
3′. Forearm 49 mm or shorter; membrane over back conspicuously hairy, especially along anterior edge ..... *Pteronotus davyi*
4. Forearm 50 mm or longer..... *Pteronotus mesoamericanus**
4′. Forearm 47 mm or shorter..... *Pteronotus personatus*

Key to Species of Noctilionidae

(Bulldog or fishing bats)

1. Forearm 75 mm or longer; hind feet longer than 25 mm ..... *Noctilio leporinus*
1′. Forearm 70 mm or shorter; hind feet shorter than 20 mm ..... *Noctilio albiventris*

Family Furipteridae

(Smoky bats)

1. Thumb and claw obviously reduced; tail completely enclosed in long uropatagium, not reaching edge of membrane; forearm 35–36 mm; only 1 species is known to occur in Central America ..... *Furipterus horrens**

Key to Species of Thyropteridae

(Disk-winged bats)

1. Forearm 35–38 mm; ventral fur pale and much lighter than brown or grayish-brown dorsal fur; ears dark;

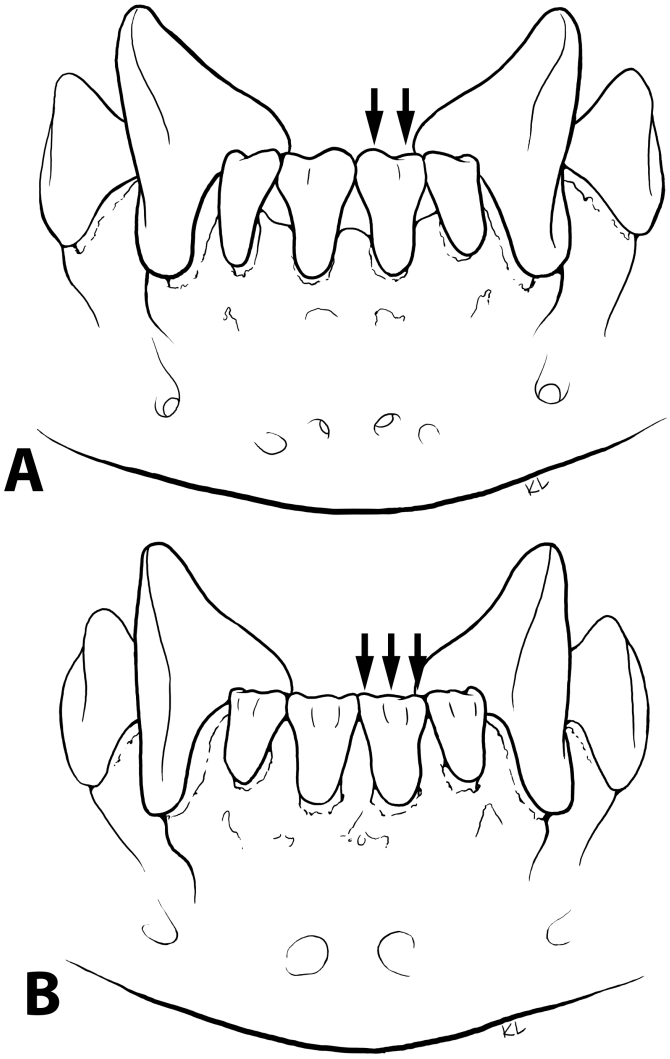

Fig. 17.—Frontal views of the jaws of *Sturnira hondurensis* (A) and *S. parvidens* (B). The incisors are bilobed in *S. hondurensis* and usually trilobed in *S. parvidens*.

uropatagium nearly naked but with sparse fringe of long, reddish-brown hairs; tail extends 5–8 mm beyond uropatagium; usually 2 projections extend from calcar ..... *Thyroptera tricolor*

1′. Forearm 31–35 mm; ventral fur yellowish-brown and only slightly paler than dorsal fur; ears yellowish; uropatagium densely covered with long fur; tail extends 2–3 mm beyond uropatagium; 1 projection extends from calcar ..... *Thyroptera discifera*

Key to Species of Natalidae

(Funnel-eared bats)

1. Tibia 17–23 mm; dorsal hairs uniformly colored or with bases paler than tips; ears with 2–4 ridges near tips; found only in lowland Pacific dry forest..... *Natalus mexicanus**

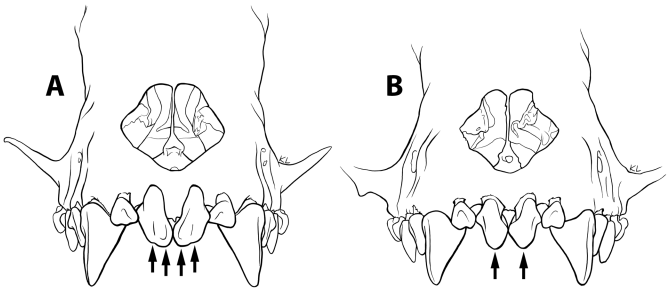

Fig. 18.—Frontal views of the crania of *Sturnira mordax* (A) and *S. hondurensis* (B). The upper incisors of *S. mordax* are weakly bilobed and appear blunt, with tips that are in contact, whereas the upper incisors of *S. hondurensis* are not lobed and appear somewhat pointed with diverging tips.

1′. Tibia 15–19 mm; dorsal hairs with dark bases and pale tips; ears with 0–1 ridges near tips; occurs in Pacific lowlands and slopes ..... *Natalus lanatus**

Key to Species of Molossidae

(Free-tailed bats)

1. Upper lip with deep vertical grooves or wrinkles; ears with row of tubercular projections along anterior edge..... 2
1′. Upper lip smooth and without grooves; ears without row of tubercles 3
2. Forearm 37–46 mm; ears do not extend beyond nose when laid forward, not joined at base; usually 3 pairs of lower incisors with outer pair minute; short, thick, blunt-tipped bristles on face and chin..... ..... *Tadarida brasiliensis*
2′. Forearm 41–45 mm; ears extend beyond nose when laid forward, joined at base; 2 pairs of lower incisors; facial bristles sparse, long, and slender .... *Nyctinomops laticaudatus**
3. Ears large, extending to or beyond tip of nose when laid forward; five upper cheek teeth on each side; first upper premolar tiny and possibly appearing as a gap between canine and large second premolar 4
3′. Ears small and do not reach tip of nose when laid forward; four upper cheek teeth on each side; first upper premolar large with no apparent gap 8
4. Forearm 55 mm or longer 5
4′. Forearm 49 mm or shorter..... 7
5. Forearm 65 mm or longer; dorsal fur with a pale basal band; hairs present on calcar..... *Eumops underwoodi**
5′. Forearm 63 mm or shorter; dorsal fur with or without a pale basal band; no hairs on calcar..... 6
6. Ears reach tip of nose when laid forward; no long bristles present posteriorly on dorsum; dorsal fur usually without a pale basal band; forearm 56–63 mm..... ..... *Eumops auripendulus*

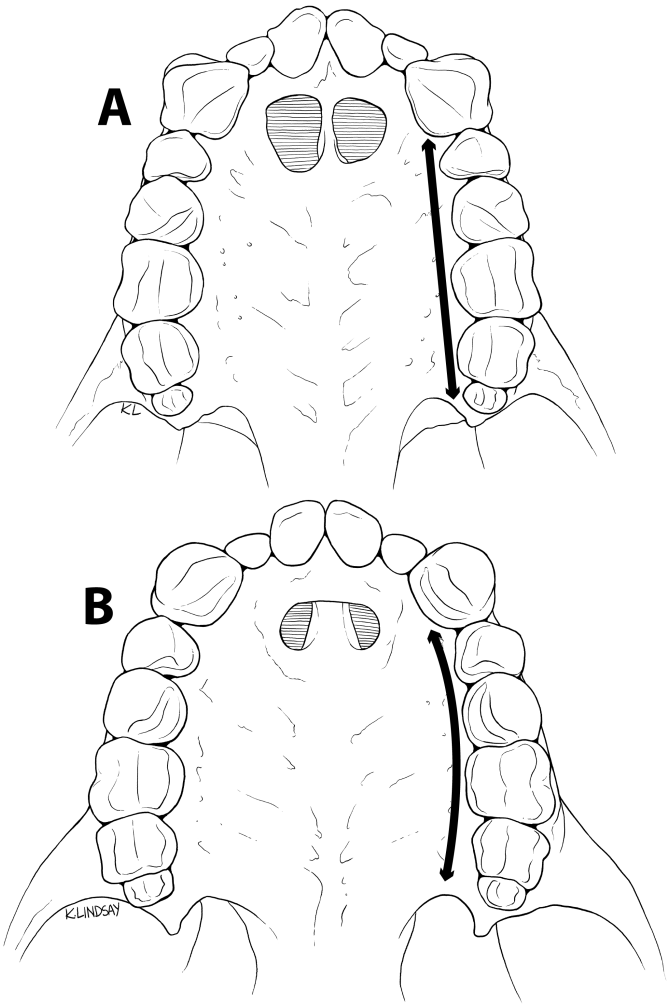

Fig. 19.—Palatal views of the crania of *Sturnira luisi* (A) and *S. parvidens* (B). The toothrow is relatively straight from canine to last molar in *S. luisi*. In contrast, the toothrow is curved in *S. parvidens*.

6′. Ears do not reach tip of nose when laid forward; long bristles present posteriorly on dorsum; dorsal fur with an obvious white basal band; forearm 55–63 mm ..... *Eumops glaucinus*

7. Forearm 39–49 mm; dorsal fur with pale bases and longer than 5 mm; ventral fur paler than dorsum, with pale tips and dark at base; hairs present on calcar..... .....*Eumops nanus**

7′. Forearm 36–42 mm; dorsal fur with dark bases and shorter than 3 mm; ventral fur slightly paler than dorsum, without pale tips and white at base; no hairs on calcar ..... *Eumops hansae**

8. Long bristles (at least 5 mm long) present posteriorly on dorsum; 1 pair of obvious lower incisors (Fig. 20A); ears connected at base; head not especially flattened... 9

8′. No long bristles posteriorly on dorsum; typically 2 pairs of lower incisors, with the outer pair tiny and inconspicuous when present (Fig. 20B); ears may or may not be connected at base; head noticeably flattened 15

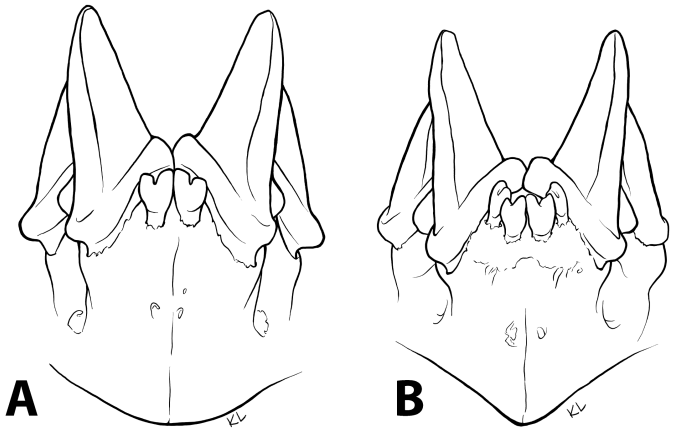

Fig. 20.—Frontal views of the jaws of *Molossus sinaloae* (A) and *Promops centralis* (B). Species of *Molossus* have a single pair of incisors, contrasting with the presence of a minute second pair of incisors in *P. centralis* and *Cynomops mexicana*.

9. Dorsal hair obviously bicolored, with dark tips and white, gray, or pale bases 10

9′. Dorsal fur nearly uniformly colored without pale bases 14

10. Forearm 45–52 mm; dorsal hairs black, dark brown, or reddish, contrasting sharply with white or gray bases .....*Molossus sinaloae*

10′.Forearm 43 mm or shorter; dorsal hairs vary in color 11

11. Dorsal fur brown or pale gray; fur on neck and center of back 3 mm long; forearm 35–40 mm .... *Molossus molossus*

11′. Dorsal fur orange, dark brown, or black; fur on neck and center of back varies in length; forearm 36–43 mm 12

12. Forearm 38–43 mm; dorsal fur orange, dark brown, or black and somewhat paler, but never white, at base; fur short and velvety; dorsal bristles shorter than 6 mm; found in Caribbean lowlands.....*Molossus currentium*

12′. Forearm 33–38 mm; dorsal fur dark chocolate-brown or black with white bases; fur varies in length; dorsal bristles 8 mm or longer; found primarily in Pacific lowlands and slopes 13

13. Forearm 36–38 mm; fur on upper back 4 mm long; known from northern Nicaragua and found at 600–1,800 m.....*Molossus aztecus*

13′. Forearm 33–37 mm; fur on upper back 2–3 mm long; found in Pacific lowlands up to 300 m ....*Molossus coibensis*

14. Forearm 47 mm or longer; dorsal hairs black or rust; inner upper incisors slightly recurved, with a gap between tips (Fig. 21A); occurs in Pacific lowlands and slopes up to 1,500 m .....*Molossus rufus**

14′. Forearm 47 mm or shorter; dorsal hairs reddish brown, dark brown, or black; inner upper incisors meet at tips (Fig. 21B); restricted to Pacific lowlands ....*Molossus pretiosus*

15. Forearm 51 mm or longer; dorsal fur very dark with slightly paler basal band; ears connected across forehead ..... *Promops centralis**

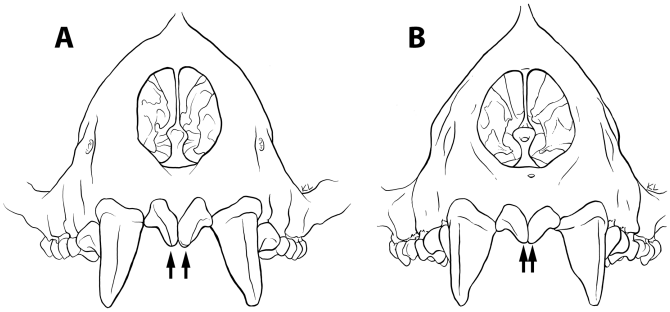

Fig. 21.—Frontal views of the crania of *Molossus rufus* (A) and *M. pretiosus* (B). These species can be distinguished by the shape of the inner incisors, which are recurved with divergent tips in *M. rufus* but which have convergent tips in *M. pretiosus*.

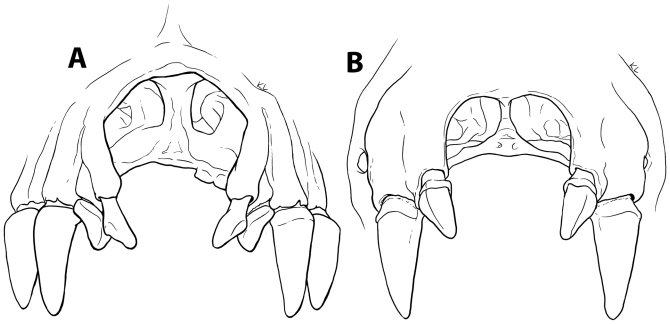

Fig. 22.—Frontal views of the crania of *Myotis nigricans* (A) and *Lasiurus ega* (B), showing the median gap between incisors that is typical of many vespertilionids. Species of *Eptesicus* and *Myotis* have two upper incisors, whereas *Lasiurus* and *Rhogeessa* have a single pair of upper incisors.

15′. Forearm 38 mm or shorter; dorsal fur brown with paler bases; ears not connected across forehead..... ..... *Cynomops mexicanus**

Key to Species of Vespertilionidae

(Evening bats)

1. Ears extend more than 2 mm past end of snout when laid forward; muzzle squared, with nostrils opening forward on horseshoe-shaped ridge; forearm 49 mm or longer .....*Bauerus dubiaquercus**
1′. Ears as long as snout or shorter when laid forward; nose lacking horseshoe-shaped ridge; forearm 52 mm or shorter 2
2. Two pairs of upper incisors separated by a median gap (Fig. 22A) 3
2′. One pair of upper incisors separated by a median gap (Fig. 22B) 13
3. Forearm 37–54 mm; 4 upper cheek teeth on each side, with first upper premolar longer than other cheek teeth and no apparent gap between canine and large first premolar (Fig. 23A); inner upper incisors much larger than outer upper incisors 4
3′. Forearm 31–44 mm; 5 or 6 upper cheek teeth on each side, with 1 or 2 tiny premolars small and set to inside of toothrow, perhaps appearing as a gap between canine and large last premolar (Fig. 23B); inner and outer upper incisors equal in size 7
4. Forearm 48 mm or longer; rostrum black; dorsal fur dark brown and longer than 8 mm; occurs at high elevations .....*Eptesicus fuscus*
4′. Forearm 48 mm or shorter; rostrum pale pinkish-brown; dorsal fur black, brown, or orangish-brown and varies in length; found at various elevations.....5
5. Forearm 39–48 mm; dorsal fur longer than 7 mm; ventral fur orangish-brown or pale brown with black basal band; found at various elevations 6
5′. Forearm 37–43 mm; dorsal fur shorter than 6 mm; ventral fur pale grayish-brown with black basal band; occurs primarily at low elevations..... ..... *Eptesicus furinalis*
6. Forearm 42–47 mm; dorsal fur indistinctly banded, appearing blackish-brown throughout; dorsal hairs 8–10 mm long; ventral fur pale brown with black basal band; sagittal crest may be noticeable when top of skull is palpated..... *Eptesicus chiriquinus**
6′. Forearm 39–48 mm; dorsal fur distinctly banded, with brown or orangish-brown tips and black basal band; dorsal hairs 7–9 mm long; ventral fur orangish-brown or light brown with black basal band; sagittal crest not obvious when palpated.....*Eptesicus brasiliensis*
7. Forearm 31–35 mm; tragus curves forward with a rounded tip.....*Perimyotis subflavus*
7′. Forearm 31–44 mm; tragus straight with a pointed tip 8
8. Fur dark grayish-brown or black, with conspicuous white, silver, or light gray tips 9
8′. Fur orange, yellow, brown, or gray, sometimes with brownish, indistinctly paler tips but without conspicuous white, silver, or gray tips 10
9. Fringe of hairs present on uropatagium; dorsal fur with white or silver tips; ventral fur pale gray or white; wing tips white .....*Myotis albescens*
9′. No fringe of hairs on uropatagium; dorsal fur with pale gray tips; ventral fur dark and similar in color to that of dorsum; wings without white tips ..... *Myotis nigricans*
10. Fur medium to dark brown or gray, with little contrast between basal band and tips.....11
10′. Fur orange, yellow, orangish-brown, brown, or gray, with or without contrast between basal band and tips 12
11. Forearm 38–44 mm; dorsal and ventral fur similar in color; dorsal fur longer than 7 mm; second upper premolar not crowded in toothrow and easily visible from the side (Fig. 23B).....*Myotis oxyotus**
11′. Forearm 32–39 mm; ventral fur lighter than dorsal fur; dorsal fur shorter than 6 mm; second upper premolar crowded to inside of toothrow and not easily visible from the side (Fig. 23C).....*Myotis riparius*

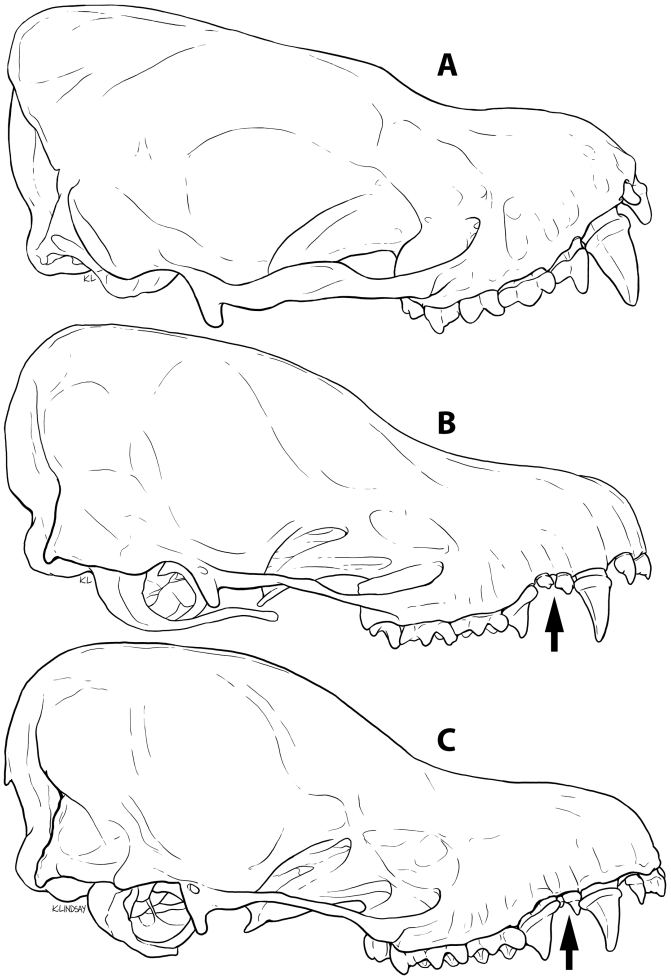

Fig. 23.—Lateral views of the crania of *Eptesicus furinalis* (A), *Myotis oxyotus* (B), and *Myotis riparius* (C). Species of *Eptesicus* lack minute premolars, putting their large premolar into contact with the canine. In contrast, *Perimyotis subflavus* and species of *Myotis* have two minute premolars that separate the canine from the large third premolar. In *M. oxyotus*, the first two premolars are aligned in the toothrow and may be clearly visible from the side. In *M. riparius*, the first two premolars are crowded in the toothrow and may be partially obscured in side view.

12. Uropatagium and legs furred at least to knee; upper surface of wing with fur near legs; tips of dorsal fur slightly paler than basal band; forearm 31–41 mm; occurs above 1,000 m ..... *Myotis pilosatibialis*
12′. Uropatagium and legs not furred below knee; upper surface of wing without fur; tips of dorsal fur obviously paler than basal band; forearm 32–35 mm; occurs at low elevations in Nicaragua and northern Costa Rica ..... *Myotis elegans*
13. Forearm 38 mm or longer; uropatagium with dense fur; ears short and rounded at tips 14
13′. Forearm 32 mm or shorter; uropatagium without fur; ears long and pointed at tips 19
14. Fur four-banded and appears yellowish-gray with broad white outer band; ears dark; uropatagium fully furred; forearm 50–57 mm ..... *Lasiurus cinereus**
14′. Fur two- or three-banded and appears uniformly dark reddish-brown, reddish-orange with short white tips, or yellow with gray tips; ears light or dark; uropatagium with fur at least on basal half; forearm 38–58 15
15. Dorsal fur uniformly dark reddish-brown or reddish-orange with white tips; ears dark or light; uropatagium fully furred 16
15′. Dorsal fur yellow with gray tips; ears light; uropatagium furred only on basal half 18
16. Dorsal fur uniformly dark reddish-brown; ears dark ..... *Lasiurus castaneus**
16′. Dorsal fur red with white tips; ears light 17
17. Forearm 50 mm or longer ..... *Lasiurus egregius**
17′. Forearm 44 mm or shorter ..... *Lasiurus frantzii**
18. Forearm 49 mm or longer ..... *Lasiurus intermedius**
18′. Forearm 48 mm or shorter ..... *Lasiurus ega**
19. Forearm 30–32 mm; dorsal fur dark yellowish-brown; occurs in Caribbean lowlands and slopes ..... *Rhogeessa io**
19′. Forearm 26–30 mm; dorsal fur pale yellow or yellowish-brown; occurs in Pacific lowlands and slopes ..... *Rhogeessa bickhami**

Taxonomic and Ecological Notes

Anoura.—*Anoura cultrata* is widespread at higher elevations in Costa Rica (LaVal and Rodríguez-H. 2002), but it is not known from Nicaragua.

Artibeus.—See the taxonomic note on *Dermanura* for comments on its separation from *Artibeus*. We accord specific status to *A. intermedius*, following Davis (1984) and Wilson (1991), and we find it readily identifiable in the field, although Simmons (2005) does not recognize its distinction from *A. lituratus palmarum*.

Bauerus.—We follow Engstrom and Wilson (1981) in recognizing *Bauerus* at the generic level rather than as a subgenus of *Antrozous*. Although rarely captured, it is now known from several mid-elevation sites in Costa Rica (Dinerstein 1986; LaVal and Timm 2014; Timm and Zahawi 2014), and it recently has been captured in northern Nicaragua (Reid 2009; Medina-Fitoria et al. 2010, 2015).

Carollia.—We consider the Central American *C. sowelli* to be distinct from the South American *C. brevicauda* (as in Baker et al. 2002). Simmons (2005) states that *C. subrufa* is found only as far south as northwestern Nicaragua; however, we have observed it at several localities in Guanacaste Province, and in Puntarenas Province, in northwestern Costa Rica.

Chiroderma.—*Chiroderma trinitatum* is known from Panama, but there are no known specimens from Costa Rica or Nicaragua. An adult male *Chiroderma* with a short forearm (38 mm) was captured and released at Tortuguero in 1997 by LaVal, who is confident it was *C. trinitatum* (Timm and LaVal 1998).

Choeronycteris.—*Choeronycteris mexicana* has not yet been recorded from Nicaragua but is known from Honduras and almost surely will be found in the northwest region of Nicaragua (Reid 2009).

Cynomops.—Rather than regarding *Cynomops* as a subgenus of *Molossops* (as in Williams and Genoways 1980; Koopman 1994), we treat it as a distinct genus based on karyotypic data (Gardner 1977b) and following Peters et al. (2002), who found the two genera to be reciprocally monophyletic based on molecular evidence. We follow Peters et al. (2002) in recognizing *C. mexicanus* as the correct name for the dog-faced bats of the Central American dry forest.

Dermanura.—We consider *Dermanura* to be a separate genus (following Owen 1987; Solari et al. 2009 and citations therein) rather than as a subgenus of *Artibeus* (as in Van Den Bussche et al. 1993, 1998; Koopman 1994; Baker et al. 2000; Wetterer et al. 2000; Simmons 2005), thus assigning *D. azteca*, *D. phaeotis*, *D. tolteca*, and *D. watsoni* to the genus *Dermanura*. We accept *D. watsoni* as a species distinct from *D. cinerea* (following Handley 1987; Simmons 2005) rather than following Koopman (1994) in regarding it as a subspecies of *D. cinerea*. *Dermanura azteca* is known from Costa Rica but not Nicaragua.

Enchisthenes.—We recognize *Enchisthenes* as a distinct, monotypic genus (Van Den Bussche et al. 1993, 1998; Baker et al. 2000; Wetterer et al. 2000; Simmons 2005), rather than treating it as a subgenus of *Artibeus*, as in Lim (1993) and Koopman (1994).

Eptesicus.—We follow Simmons and Voss (1998) in considering *E. brasiliensis* and *E. chiriquinus* to be species distinct from each other and from *E. andinus*.

Eumops.—*Eumops hansae* is known from the Pacific lowlands of Guanacaste in Costa Rica but has not been recorded from Nicaragua (Foster and Aguilar 1993; Timm and LaVal 1998; Pineda et al. 2008). This species is likely to be restricted to the seasonal dry forest in Central America. *Eumops nanus* is recognized as a species separate from *E. bonariensis* (Eger 2008), and its presence in Costa Rica has been confirmed by Villalobos-Chaves et al. (2018).

Furipterus.—*Furipterus horrens* was recently rediscovered in Costa Rica (Alfaro-Lara et al. 2019) after having been known previously only from La Selva (LaVal 1977). It was recorded recently in Nicaragua by Medina-Fitoria et al. (2015).

Gardnerycteris.—Following Hurtado and D'Elía (2018), we recognize the elevation of *Gardnerycteris* as a genus separate from *Mimon*, thus placing *G. crenulatum* and *M. cozumelae* in separate genera.

Glossophaginae.—Based on morphological evidence, Griffiths (1982) accords subfamilial rank to the Lonchophyllinae, which includes the genera *Lionycteris*, *Lonchophylla*, and *Platalina*. Although some molecular studies (e.g., Wetterer et al. 2000; Carstens et al. 2002; Simmons 2005) favor recognition of Lonchophyllini as a tribe within Glossophaginae, other such studies (e.g., Koopman 1993, 1994; Baker et al. 2000, 2003) find the two taxa to be paraphyletic. Therefore, we recognize Glossophaginae and Lonchophyllinae as separate subfamilies but include *Lonchophylla* and glossophagines in a single key due to the similarities of their field characteristics.

Glyphonycterinae.—See Phyllostominae.

Glyphonycteris.—We follow Simmons and Voss (1998) and Wetterer et al. (2000) in recognizing *Glyphonycteris* as a genus separate from *Micronycteris*. *Glyphonycteris daviesi* is known to occur in the Caribbean lowlands of Honduras, Nicaragua, Costa Rica, and Panama (LaVal 1977; Reid 2009).

Hylonycteris.—*Hylonycteris underwoodi* is widespread in Costa Rica (Timm et al. 1999) but is known in Nicaragua only from the southern part of the country.

Lampronycteris.—We follow Simmons and Voss (1998) and Wetterer et al. (2000) in recognizing *Lampronycteris* as a genus separate from *Micronycteris*.

Lasiurus.—We follow Baker et al. (1988a), Roehrs et al. (2010), and Ziegler et al. (2016) in placing all Central American species of the Lasiurini within *Lasiurus*, rather than recognizing the hoary, red, and yellow bats as separate genera as suggested by Baird et al. (2015). *Lasiurus borealis* historically had been considered to range widely across North America and Central America (e.g., Goodwin and Greenhall 1961) but then was split, with western and southern bats considered to be *L. blossevillii* (Baker et al. 1988a; Morales and Bickham 1995). However, Baird et al. (2015) conclude that this red bat in Central America should be considered as a separate species, *L. frantzii*. *Lasiurus cinereus* has not been recorded in Costa Rica or Nicaragua, but there are records of this species from Guatemala and the highlands of western Panama (Reid 2009), so we include it herein, as it is likely also to occur in our study region. *Lasiurus egregius* has not been recorded from Costa Rica or Nicaragua but is known from Panama (Handley 1966) and Honduras (Mora 2012). *Lasiurus intermedius* has been reported from Costa Rica by Rodríguez-H. et al. (2003) and from Nicaragua by Medina-Fitoria et al. (2015).

Leptonycteris.—*Leptonycteris curasoae* has not been recorded from Nicaragua but is known from adjacent areas of Honduras (Lee and Bradley 1992).

Lonchophylla.—We follow Albuja and Gardner (2005) and Woodman and Timm (2006) in recognizing *L. concava* and *L. mordax* as distinct species, with *L. concava* occurring in Costa Rica, Panama, Colombia, and Ecuador and with *L. mordax* known only from northeastern Brazil. *Lonchophylla concava* is not known from Nicaragua.

Lonchophyllinae.—See Glossophaginae.

Lonchorhininae.—See Phyllostominae.

Lophostoma.—We follow the recent molecular systematic revisions of the round-eared bats in considering *Lophostoma* and *Tonatia* to be distinct genera and placing the species *L. brasiliense* and *L. silvicolum* within *Lophostoma* rather than within *Tonatia* (Lee et al. 2002; Porter et al. 2003).

Mesophylla.—We treat *M. macconnelli* as the only member of the genus *Mesophylla*, following Koopman (1994), Baker et al. (2000), and Simmons (2005), rather than recognizing it as a species of *Vampyressa* (following Owen 1987) or *Ectophylla* (as in Lim 1993; Wetterer et al. 2000 and citations therein).

Micronycterinae.—See Phyllostominae.

Micronycteris.—The species referred to as *M. megalotis* in the literature prior to 1996 is a composite of two valid species:

M. microtis, which occurs from Mexico to northern South America, and *M. megalotis*, which occurs throughout much of northern South America (Simmons 1996; Simmons and Voss 1998).

Molossus.—We consider *M. coibensis* to be a species distinct from *M. molossus*, following Dolan (1989), Reid et al. (2000), and Simmons (2005), rather than considering it to be a subspecies of *M. molossus*, as in Koopman (1994). Herein, we refer to *M. currentium*, as it is an earlier name than its synonym, *M. bondae* (Simmons 2005). Likewise, we refer to *M. rufus*, which is the correct name for individuals previously referred to in the literature as *M. ater* (Dolan 1989; Simmons 2005).

Mormoops.—*Mormoops megalophylla* was reported recently at various sites in Nicaragua (Medina-Fitoria et al. 2015), and it was captured recently by Amanda Vicente and Paula Ledezma at Cavernas del Venado in Alajuela Province in northwestern Costa Rica (pers. comm.).

Myotis.—*Myotis oxyotus* is known from high-elevation areas of Costa Rica and western Panama, but it has not been recorded from Nicaragua. We recognize *M. pilosatibialis* as distinct from *M. keaysi*, following Mantilla-Meluk and Muñoz-Garay (2014).

Natalus.—Work by Tejedor (2005, 2006, 2011) indicates that what was long recognized as a single species of *Natalus* throughout Central America and the Caribbean, *N. stramineus*, instead consists of two distinct taxa in Mexico: *N. mexicanus*, which was split from the now strictly Lesser Antillean *N. stramineus* (sensu stricto), and the recently described *N. lanatus*. Although López-Wilchis et al. (2012) call into question the degree of genetic and morphological differentiation between *N. lanatus* and *N. mexicanus*, suggesting that their recognition as two separate species is not warranted, we treat them separately here as they appear to occupy distinct habitats and present distinguishing morphological characteristics. Medina-Fitoria et al. (2015) report *N. lanatus* in Nicaragua from one individual captured in Tisey-Estanzuela in the northwest and two found in Rivas in the southwest. A specimen captured at the middle elevations of the Pacific slope of Costa Rica by Rodríguez-H. and three individuals captured at Monteverde by LaVal are considered to be *N. lanatus*, representing a range extension for this species (Rodríguez-Herrera et al. 2011).

Nyctinomops.—Several individuals of *Nyctinomops laticaudatus* were recorded recently in Madríz in northwestern Nicaragua (Medina-Fitoria et al. 2015) and in Costa Rica by Villalobos-Chaves et al. (2018).

Perimyotis.—A single specimen of *Perimyotis subflavus* was collected in Madríz in northwestern Nicaragua by Medina-Fitoria et al. (2015), extending the known range of this species south into the dry forest of Nicaragua.

Phylloderma.—Baker et al. (1988b) regard *Phylloderma* as congeneric with *Phyllostomus*, thus treating *P. stenops* as a species of *Phyllostomus*. However, following Simmons and Voss (1998) and Wetterer et al. (2000), we continue to recognize *Phylloderma* as a distinct genus. The first records of *P. stenops* from Nicaragua were recently reported by Medina-Fitoria et al. (2015).

Phyllostominae.—We follow Van Den Bussche et al. (1993), Baker et al. (2016), and Cirranello et al. (2016) in acknowledging Glyphonycterinae, Lonchorhininae, Micronycterinae, and Phyllostominae (sensu stricto) as distinct subfamilies of typically predatory phyllostomids. Members of these subfamilies previously had been grouped into Phyllostominae (sensu lato) as it was traditionally recognized and whose monophyly is no longer well-supported. Our inclusion of these subfamilies in a single key to the identification of the species reflects the similarity of their external characteristics rather than their taxonomy.

Platyrrhinus.—We follow Hall (1981) and Gardner and Ferrell (1990) in recognizing *Platyrrhinus* as the senior synonym of *Vampyrops*. *Platyrrhinus vittatus* is widespread at higher elevations in Costa Rica but is unknown from Nicaragua.

Promops.—*Promops centralis* is known from northwestern Nicaragua, and in 2008 Rodríguez-H. captured one individual in northeastern Costa Rica (Rodríguez-Herrera et al. 2014; catalog number UCR-4093).

Pteronotus.—Recent phylogenetic studies indicate that what has been considered the single, widespread species *P. parnellii* is instead a complex of several distinct species (Clare et al. 2013; Pavan and Marroig 2017). Following this, we recognize the Central American populations as *P. mesoamericanus*.

Rhogeessa.—Baird et al. (2012) describe *R. bickhami* as the member of the "*R. tumida* complex" found on the Pacific versant of Nicaragua and Costa Rica, and we follow this conclusion herein. A new species of *Rhogeessa* from Nicaragua was recognized recently based on morphological, karyotypic, and molecular data (Baird et al. 2019).

Sturnira.—The species previously known in Central and South America as *S. ludovici* represents a composite of species. *Sturnira hondurensis* is the name applicable to the Central American populations (Velazco and Patterson 2014). Velazco and Patterson (2014) recently described *S. burtonlimi* based upon one Costa Rican and two Panamanian specimens. This small number of specimens provides us with little information about variation in the species; our couplet separating *S. burtonlimi* from *S. hondurensis* should be regarded as preliminary and possibly imprecise. *Sturnira parvidens* is recognized as a Central American species separate from *S. lilium*, which is now restricted to South America. *Sturnira luisi* has been recorded in Costa Rica and southeastern Nicaragua, whereas *S. mordax* is known from middle and high elevations of Costa Rica but not from Nicaragua.

Thyroptera.—The first published record supposedly of *T. discifera* in Costa Rica (Rodríguez 1993) is based on a single specimen, collected at Parque Nacional Tortuguero, which Timm and LaVal (1998) examined and consider to be a juvenile *T. tricolor*. Tschapka et al. (2000) report *T. discifera* from La Selva, with which Timm and LaVal (1998) concur based upon examination of the specimen. *Thyroptera tricolor* has been reported recently from Nicaragua by Medina-Fitoria (2014).

Trinycteris.—We follow Simmons and Voss (1998) and Wetterer et al. (2000) in recognizing *Trinycteris* as a genus separate from *Micronycteris*.

Uroderma.—The Nicaraguan and Costa Rican populations of the *U. bilobatum* species complex are now recognized as a distinct species, *U. convexum*, on the basis of morphological and karyotypic characteristics (Mantilla-Meluk 2014). *Uroderma magnirostrum* is known from the Pacific lowlands of Nicaragua but has not been recorded in Costa Rica.

Vampyressa.—*Vampyressa thyone*, which occurs in Central America and northwestern South America, is now recognized as a species distinct from the allopatric *V. pusilla*, restricted to southeastern South America, on the basis of molecular and morphological evidence (Lim et al. 2003).

Vampyriscus.—We follow Hoofer and Baker (2006) in recognizing the generic status of *Vampyriscus*, rather than considering it to be a subgenus of *Vampyressa*.

Vampyrodes.—We follow Velazco and Simmons (2011) in recognizing *Vampyrodes major* as distinct from *V. caraccioli*.

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