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FLYING FOXES

Often, any large species in the Pteropodidae is referred to as a flying fox, but this name is more correctly reserved for a group of bats that include the genera *Pteropus*, *Acerodon*, *Styloctenium*, and *Neopteryx*. All other species in the Pteropodidae are more accurately called fruit bats. Flying foxes get their name from their fox-like facial features, including a long pointed snout, large expressive

eyes, and relatively small ears. Flying foxes often have wingspans of 3.3 ft (1 m) or larger, and are found in Asia or Oceania, with most species distributed across the oceanic islands of the Pacific and Indian Oceans.

Flying foxes feed on fruit and nectar and may supplement their diets with occasional leaves and bark. They use their large eyes and acute sense

OPPOSITE | Gray-Headed Flying Foxes (*Pteropus poliocephalus*) provide important pollination and seed dispersal services to Australian ecosystems.



RIGHT | Flying foxes include the largest bats known to exist on earth. Flying foxes, like the Seychelles Flying Fox (*Pteropus seychellensis*), are taxonomically diverse, with many species found on small islands, and are threatened by hunting and land-use change.



DISTRIBUTION

Africa (oceanic islands), Asia (South Asia, Southeast Asia), Oceania

GENERA

Pteropus, *Acerodon*, *Styloctenium*, *Neopteryx*

ROOSTING HABITATS

Trees

FORAGING HABITATS

Forested areas

SIZE

Large. Forearm length: 3.5–8.5 in (90–220 mm)

DIET

Frugivorous with some nectar, leaves, and bark



of smell to navigate the world and find food. They tend to have shorter foraging ranges, often returning to the same areas night after night. Flying foxes typically roost in trees in medium to large aggregations, particularly large emergent trees that are difficult for predators to access.

Their diets primarily consist of fruit and nectar, making them both important seed dispersers and key pollinators for a number of important tree species.

Many flying fox species are endangered due to habitat destruction, hunting, and climate change. Urbanization and deforestation have reduced their natural habitats, pushing some species into conflict with humans (for example, damaging crops). Additional zoonotic disease concerns have also led to persecution, such as the role of flying foxes as reservoirs for zoonotic diseases like the Nipah and Hendra viruses.

PTEROPODIDAE: *PTEROPUS ALECTO*

BLACK FLYING FOX

Black Flying Foxes (*Pteropus alecto*) have a black body with some lighter hairs, and a black head. They may have a brown eye ring, and often a reddish collar on the back of the neck. They are a large flying fox, with a forearm length of 6–7.5 in (153–191 mm) and average weight of 24 oz (680 g), and with little sexual dimorphism. Black Flying Foxes are found in tropical/subtropical coastal Australia as far as 155 mi (250 km) inland, as well as Indonesia and Papua New Guinea.

Preferred habitats include rainforests, eucalypt open forests, and savanna woodlands. The large aggregations that these bats roost in are commonly called camps. Camps can contain up to 100,000 individuals, but more commonly hold several thousand bats. Black Flying Foxes feed on the pollen and nectar of eucalypts and have historically had a nomadic lifestyle that followed the flowering of eucalypts. However, with extensive land use change, more bats are becoming concentrated in coastal areas with remnant forests that have pulses of mass flowering, particularly in the winter when food is limited.



ABOVE | Black Flying Foxes (*Pteropus alecto*) typically roost with their wings wrapped tightly around their body. Their roosting aggregations, or camps, can have hundreds to thousands of individuals that seasonally move to follow blooming eucalypts.



DISTRIBUTION

Asia (Southeast Asia), Oceania

SPECIES

Pteropus alecto

ROOSTING HABITATS

Trees

FORAGING HABITATS

Forested areas

SIZE

Large. Forearm length:
6–7.5 in (153–191 mm)

DIET

Frugivorous with some nectar, leaves,
and bark

PTEROPODIDAE: *PTEROPUS LYLEI*

LYLE'S FLYING FOX

Lyle's Flying Foxes (*Pteropus lylei*) have somewhat variable fur color. They tend to have russet to golden fur with dark wings, but their fur may be dark brown on the back with a lighter color on the head and ventral region. The head may also be darkly colored. Lyle's Flying Fox is restricted to mainland Asia within a limited range, and is found around the Gulf of Thailand in Cambodia, Thailand, and Vietnam. Most aggregations hold 1,000–4,000 individuals, with the largest known colony in Cambodia with up to 8,000 bats. *P. lylei* is listed as Vulnerable by IUCN.

Lyle's Flying Foxes are frugivores that fly 6–9 mi (10–14 km) to foraging patches that are used repeatedly within a season, and will make small-scale movements within these patches throughout the night before returning to their day roost. They feed on a wide range of plant species including cultivated fruits like mango and banana, with remnant mangrove forests being particularly important habitats. They also seasonally feed on the bark and leaves of particular tree species.



ABOVE | Lyle's Flying Foxes (*Pteropus lylei*) are one of the few flying foxes restricted to mainland habitats. Despite their variable fur color, they can often be recognized by the light-colored collar around their neck.



DISTRIBUTION

Asia (Southeast Asia), Oceania

SPECIES

Pteropus lylei

ROOSTING HABITATS

Trees

FORAGING HABITATS

Forested areas

SIZE

Large. Forearm length:
6.3 in (160 mm)

DIET

Frugivorous

PTEROPODIDAE: *PTEROPUS MEDIUS*

INDIAN FLYING FOX

The Indian Flying Fox (*Pteropus medius*) is variable in color, with a black back that is streaked with gray, a pale golden mantle, a brown head, and dark underparts. It is found in the Indian subcontinent, including surrounding continental regions and Sri Lanka. These bats can be found in large aggregations of hundreds to thousands on open branches of emergent trees, and prefer to roost in open areas near water, human settlements, and agricultural land. Indian Flying Foxes are sexually dimorphic, with males approximately 10–15 percent larger than females.

Indian Flying Foxes feed primarily on fruit and nectar, but will seasonally supplement their diet with flowers, leaves, and bark. Their diet is highly diverse and often includes agriculturally important fruit species such as mango. Like many other flying foxes, *P. medius* will fly 6–12 mi (10–20 km) to foraging patches that they will use repeatedly for many nights. Their extensive use of agricultural plant species has led to increased human conflict and persecution in many areas.



LEFT | Indian Flying Foxes (*Pteropus medius*) provide extensive ecosystem services, even helping to process cashew nuts in some farms by removing fruit from the seed and aggregating nuts in concentrated areas.

OPPOSITE | The aptly named Golden-Crowned Fruit Bat or Flying Fox (*Acerodon jubatus*) is a forest specialist and is threatened by land use change and shrinking forests across its range.



DISTRIBUTION
Asia (Indian subcontinent)

SPECIES
Pteropus medius

ROOSTING HABITATS
Trees

FORAGING HABITATS
Forested areas, agricultural areas

SIZE
Large. Forearm length:
6.1–6.7 in (155–170 mm)

DIET
Frugivorous with some nectar, leaves,
and bark

PTEROPODIDAE: ACERODON JUBATUS

GOLDEN-CROWNED FLYING FOX

The Golden-Crowned Flying Fox (*Acerodon jubatus*) is among the largest of bats, and in fact is one of the most sizeable to have existed in evolutionary history. It has a golden-yellow mantle of fur around its head and neck, contrasting with a dark-brown to black body and dark wings. Males are slightly larger than females. The Golden-Crowned Flying Fox is restricted to islands of the Philippines and prefers roosting in tall, undisturbed forest canopies.

A. jubatus feed primarily on figs and a relatively small number of other fruit species, suggesting that they occur only in lowland, mature forests. They typically travel less than 12 mi (20 km) to a feeding site, but occasionally will move up to 30 mi (50 km) from their roosts, and will use two to five foraging sites per night. Their preference for mature, undisturbed forests puts them at high risk from ongoing land use changes across their range. They are listed as Endangered by IUCN.



DISTRIBUTION

Asia (Philippines)

SPECIES

Acerodon jubatus

ROOSTING HABITATS

Trees

FORAGING HABITATS

Forested areas

SIZE

Large. Forearm length:
6.5–7.7 in (165–196 mm)

DIET

Frugivorous

HAMMER-HEADED FRUIT BAT

The Hammer-Headed Fruit Bat (*Hypsignathus monstrosus*) is the only species of its genus and is known for the squared head, enlarged nasal cavity and tulip-shaped lips in males. Females lack the latter two characters but keep a squared head with a more fox-shaped face.



Males are substantially larger than females, with a male average body mass of 13.2 oz (377 g) and female average body mass of 9.7 oz (275 g). It is the largest bat in Africa, with wingspans of up to 3 ft (1 m). Both sexes are slate-brown to gray in color, and have a white collar of fur that stretches from shoulder to shoulder.

Hammer-Headed Fruit Bats are frugivores found in Sub-Saharan Africa at elevations below 5,600 ft (1,800 m) and that prefer tropical rainforest, particularly riverine forests. These bats mostly feed on large fleshy fruits such as figs, and females tend to stay within a small, defined range to forage, while males will range much further to find higher-quality fruit sources. Males seasonally form leks, where they give loud honking calls amplified by their enlarged nasal cavities to attract females.

LEFT | Hammer-Headed Fruit Bats (*Hypsignathus monstrosus*) get their name from the male's enlarged head, which amplifies their mating calls. Males also have unusual tulip-shaped lips that further distinguish them from females.

OPPOSITE | The unusual yellow to lime-green spots on the skin of Queensland Tube-Nosed Fruit Bats (*Nyctimene robinsoni*) provide excellent camouflage for these bats as they roost alone in the forest understory.



DISTRIBUTION
Africa (Sub-Saharan Africa)

SPECIES
Hypsignathus monstrosus

ROOSTING HABITATS
Trees

FORAGING HABITATS
Forested areas

SIZE
Large. Forearm length:
4.6–5.5 in (118–140 mm)

DIET
Frugivorous

QUEENSLAND TUBE-NOSED FRUIT BAT



The Queensland Tube-Nosed Fruit Bat (*Nyctimene robinsoni*) is typically gray to brown with a dark stripe extending down its back, with striking yellow to lime-green colored spots distributed on its wings, face, and ears. It gets its name from tubular nostrils that protrude 0.19–0.23 in (5–6 mm) from the end of the rostrum.

N. robinsoni use small home ranges where they regularly switch day roosts. They tend to roost alone in the subcanopy among foliage and epiphytes with their wings tightly wrapped around their body, relying on their coloration for camouflage. Small roosting groups of five or fewer bats have been reported, but their reliance on camouflage as an anti-predator strategy would suggest that these bats have mostly solitary lifestyles. They strongly prefer primary and secondary intact forests, particularly at low elevations. Queensland Tube-Nosed Fruit Bats forage within several hundred yards of their day roosts, with females using larger foraging ranges than males. They mostly feed on figs, with a limited range of other fruits in their diet.



DISTRIBUTION

Oceania (Australia, with some reports in Papua New Guinea)

SPECIES

Nyctimene robinsoni

ROOSTING HABITATS

Trees

FORAGING HABITATS

Forested areas

SIZE

Medium. Forearm length: 2.4–2.8 in (60–70 mm)

DIET

Frugivorous

ROUSETTE BATS

The rousette bats (*Rousettus*) include seven species: *R. aegyptiacus*, *R. amplexicaudatus*, *R. leschenaultii*, *R. linduensis*, *R. madagascariensis*, *R. obliviosus*, and *R. spinalatus*. These medium-sized fruit bats vary in color from grayish brown to reddish or golden brown, often lighter on the underparts with dark wings. *Rousettus* is distributed across Africa and Asia, including the Middle East and Southeast Asia. Both the common name and

genus name are derived from French and refer to their brown to reddish brown fur color.

Rousette bats all prefer to roost in caves when possible, but have expanded this to include human infrastructures, including mines, tunnels, and buildings. They roost in large aggregations of up to several thousand individuals and are highly social. Rousette bats are frugivorous, feeding primarily on a variety of fruits, nectar, and



LEFT | Rousette bats have large eyes that they supplement with tongue-click echolocation to navigate dark caves and to find fruit.

OPPOSITE | Egyptian Fruit Bats (*Rousettus aegyptiacus*), like all rousettes, are highly social and roost in large aggregations. These bats will also exploit human infrastructure and can often be found in dense human areas across their range.



DISTRIBUTION

Africa (Sub-Saharan Africa, North Africa), Asia (East Asia, South Asia, Southeast Asia, west Asia, central Asia), Oceania, Europe

SPECIES

Rousettus aegyptiacus,
R. amplexicaudatus, *R. leschenaultii*,
R. linduensis, *R. madagascariensis*,
R. obliviosus, *R. spinalatus*

ROOSTING HABITATS

Caves

FORAGING HABITATS

Forested areas, agricultural areas

SIZE

Large. Forearm length:
2.8–4.3 in (70–110 mm)

DIET

Frugivorous



occasionally flowers. Their strong jaws and teeth are well adapted to crushing fruit pulp. They play an essential ecological role as pollinators and seed dispersers in tropical and subtropical regions. They can sometimes supplement their diet with insects or leaves.

The best known of these bats is the Egyptian Fruit Bat (*R. aegyptiacus*). These bats use vocal echolocation, clicking their tongues, and listening

to echoes, instead of the laryngeal echolocation of non-pteropodids. These bats also have complex spatial maps of their ranges and foraging areas that they develop as infants when flying with their mothers, and can use a variety of landmarks to directly navigate their ranges over distances up to 30 mi (50 km).

FAMILY: CRASEONYCTERIDAE

HOG-NOSED BAT

The Craseonycteridae is a family comprising a single species: Kitti's Hog-Nosed Bat or the Bumblebee Bat (*Craseonycteris thonglongyai*). This bat has a distinctive pig-like snout, relatively large ears, and eyes that are mostly hidden by its fur. It is remarkable for being the smallest bat and one of the smallest mammals alive, with a body length of 1.2 in (30 mm) and weighing 0.07 oz (2 g).

These bats are found in two small, disconnected regions of Thailand and Myanmar, and roost in limestone caves and forests near rivers. They have been found in a wide range of forested habitats, but little is known of their specific habitat requirements. They live in small colonies of up to 100 individuals. Kitti's Hog-Nosed Bat uses multi-harmonic, constant frequency (CF) echolocation calls to hunt for small insects, primarily hovering insects like flies, beetles, and moths. Its short, broad wings suggest that it may also catch insects and spiders by gleaning them from surfaces.

Due to its small size and limited distribution, not much is known about this bat species, particularly relative to its social organization. High genetic diversity within *C. thonglongyai* indicates a robust population size and limited gene flow between the Thailand and Myanmar populations, but this is yet to be confirmed, particularly relative to threats to the limestone caves that they prefer. *C. thonglongyai* is listed as Near Threatened by IUCN, with a decreasing population trend.



ABOVE | A Kitti's Hog-Nosed Bat (*Craseonycteris thonglongyai*) roosting in a cave in Kanchanaburi in Thailand.

OPPOSITE | Kitti's Hog-Nosed Bat (*C. thonglongyai*) is also known as the Bumblebee Bat. The world's smallest bat, it weighs only 0.07 oz (2 g) and is the only species in the Family Craseonycteridae.



DISTRIBUTION

Asia (South and Southeast Asia)

SPECIES

Craseonycteris thonglongyai

ROOSTING HABITATS

Caves and subterranean habitats

FORAGING HABITATS

Forests

SIZE

Body mass 0.07 oz (2 g); forearm length 0.9–1 in (22–26 mm)

DIET

Insectivorous



FAMILY: HIPPOSIDERIDAE

ROUNDLEAF BATS



Bats in the family Hipposideridae are insectivores known as the roundleaf bats because of the curved shape of their nose-leaves. The family is one of the more diverse of the Old World bat families with 92 described species distributed across the continents of Asia, Africa, and Australia in tropical and subtropical regions. There are 7 genera in the Hipposideridae, but most of the species diversity is in the widespread and diverse *Hipposideros* genus with 74 described species. Taxonomic revisions are ongoing as scientists use molecular tools to better describe taxonomic statuses within this family. New species are likely to be described within this family in the future, especially in Africa.

Hipposiderid bats are all echolocating and the distinctive roundleaf nose structures are used in producing constant frequency (CF) echolocation calls. Generally, hipposiderid bats occur and forage in tropical forests and savanna habitats. Insects, including beetles, moths, and other flying insects, are typical prey. Larger hipposiderid bats may occasionally take small vertebrates, such as frogs. Most species in this family roost in caves or cave-like structures, such as basal hollows in large trees, tunnels,



DISTRIBUTION

Asia (East Asia, South and Southeast Asia, west and central Asia), Africa (North Africa, Sub-Saharan Africa), Oceania

GENERA

Anthops, *Asellia*, *Aselliscus*, *Coelops*, *Doryrhina*, *Hipposideros*, *Macronycteris*

ROOSTING HABITATS

Caves and subterranean habitats, forests. Most species roost gregariously, some forming large aggregations in caves. Other species are known to use large tree hollows and some use human-made structures like abandoned mines

FORAGING HABITATS

Forests, savannas



ABOVE | This Grand Roundleaf Bat (*Hipposideros grandis*) in flight shows off broad wings typical of most *Hipposideros*. Such wings are adapted for maneuverable flight for foraging in dense vegetation.

OPPOSITE | The Diadem Roundleaf Bat (*H. diadema*) ranges from Southeast Asia to northern Australia. It perch hunts from branches to catch passing insect prey.

SIZE

The largest bat in this family is the Great Roundleaf Bat (*Hipposideros armiger*): body mass 2.5 oz (70 g); forearm length 3.4–3.8 in (86.6–96.6 mm). A smaller bat in this family is the Northern Roundleaf Bat (*H. stenotis*) in Australia: body mass 0.1–0.2 oz (4–6 g); forearm length 1.6–1.8 in (42–46 mm)

DIET

Insectivorous, carnivorous

or abandoned human structures. Many species roost in large colonies, sometimes numbering in the thousands within a large cave. Roosting in large numbers likely helps with thermoregulation and predator avoidance but may make threatened species vulnerable if cave roosts with thousands of bats are repeatedly disturbed or destroyed.

Deforestation and mining activities are primary threats. Of the 88 species classified by IUCN, 2 species are Critically Endangered, 7 Endangered, 15 Vulnerable, 10 Near Threatened, 42 Least Concern, and 12 Data Deficient.

TRIDENT ROUNDLEAF BATS



The *Asellia* genus has four recognized species of hipposiderid bats that are distributed in Africa and Southwest Asia. These bats are called trident roundleaf bats because of the distinctive “trident” shape of their nose-leaf structure. The nose-leaf morphology is similar among all four species, but species within the *Asellia* genus can be distinguished by differences in their body size and size and shape of their skull and baculum.

Asellia bats are insectivorous and shift their diet seasonally to predate on the most available insects, including beetles and wasps. Diets also include arachnids. *Asellia* are highly adapted for arid environments and occur in some of the hottest and most arid deserts on Earth in Saharan Africa. They often forage in palm oases and are highly maneuverable, with a slow-hawking foraging style that includes ground gleaning. Roosting habits include colonial roosting in caves and subterranean features or buildings. Relatively little is known about their mating and reproductive habits. Two species are Data Deficient and the others listed as Least Concern by IUCN.

LEFT | *Asellia tridens* is widely distributed across northern Africa and the Arabian Peninsula to Pakistan in arid desert habitats. The trident shaped nose-leaf helps direct its echolocation calls.



DISTRIBUTION
Africa and Asia

SPECIES
Asellia arabica, *A. italosomalica*,
A. patrizii, *A. tridens*

ROOSTING HABITATS
Caves, culverts, buildings

FORAGING HABITATS
Deserts, palm oases

SIZE
Medium. Forearm length:
0.1–2 in (3–52 mm)

DIET
Insectivorous

HIPPOSIDERIDAE: *ASELLISCUS*

TRIDENT BATS



The *Aselliscus* genus has three recognized species of hipposiderid bats, known as the trident bats. *A. stoliczkanus* is the most widely distributed species, occurring across much of southeastern Asia. *A. dongbacanus*, which was described in 2015, is found only in Vietnam, and *A. tricuspispidatus* is found on a few Oceanic islands, including Papua New Guinea. These species have a similar “trident” nose-leaf structure to the *Asellia* bats of Africa and share a common name with Rhinonycteridae bats.

Aselliscus bats are small-bodied insectivores that feed primarily on moths and other small insects. Diets vary seasonally. *A. stoliczkanus* uses very high frequency echolocation with a constant frequency

(CF) component at 119–120 kHz. These small bats are highly maneuverable with low wing loading and are adapted for flying and hunting in cluttered forested habitats. They catch insects aerially and can glean them from foliage. *A. stoliczkanus* roosts in caves or human-made subterranean features, such as mines and tunnels, located in mountainous areas with nearby forest. This species prefers smaller cave roosts or small chambers in large caves. In China, they hibernate from December to March.

ABOVE | *Aselliscus stoliczkanus* emerging from a cave roost in Vietnam. This species co-inhabits cave roosts with other cave-dwelling bats in Asia but prefers the innermost reaches of caves.



DISTRIBUTION

Asia and Oceania

SPECIES

Aselliscus dongbacanus,
A. stoliczkanus, *A. tricuspispidatus*

ROOSTING HABITATS

Caves and subterranean features

FORAGING HABITATS

Forests

SIZE

Small. Forearm length:
1.5–1.7 in (39–43 mm)

DIET

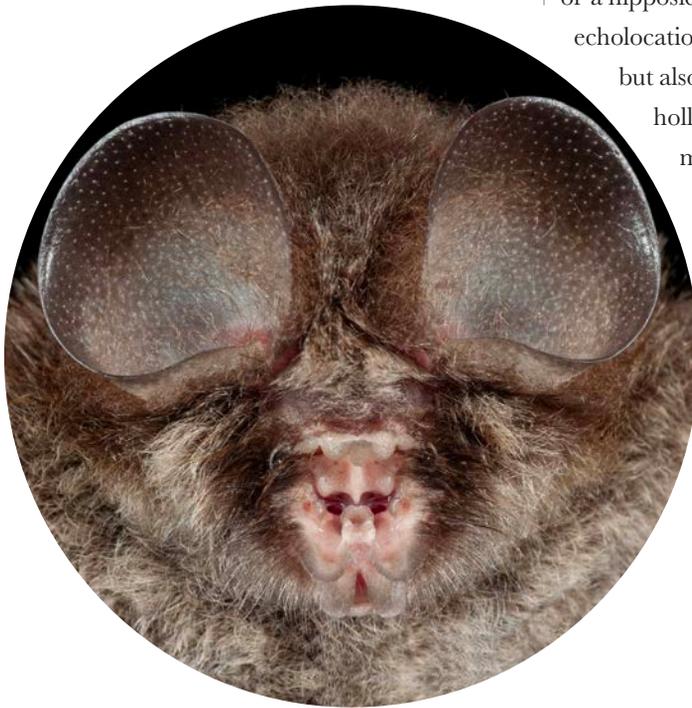
Insectivorous

HIPPOSIDERIDAE: COELOPS

TAILLESS ROUNDLEAF BATS

Three recognized bat species in the genus *Coelops* occur in Southeast Asia. These small insectivorous bats are known as the tailless bats because of their absence of an external tail. They have very rounded ears and long, soft fur. The Philippines Tailless Bat (*C. hirsutus*) was only recently recognized as a distinct species.

Coelops occur in lowland forests and forage in cluttered forest settings for small insects and spiders. Habitat loss of lowland forests in Southeast Asia is a primary threat. Hipposiderid bats use high-duty cycle echolocation with constant frequency (CF) specialized for detecting fluttering targets. A study of *C. frithii* showed it uses low-duty cycle echolocation with frequency modulated sweeps, making the first case of a hipposiderid bat using this form of echolocation. *Coelops* are primarily cave roosting but also make their homes in large tree hollows and human-made tunnels and mines. *Coelops* co-roost in caves with other hipposiderid or rhinolophid species. In Taiwan, *C. frithii* remains active in winter when other bats hibernate. *C. robinsoni* is noted to roost solitarily in caves.



LEFT | *Coelops frithii* have very rounded ears and are highly maneuverable in flight. These bats are adapted for foraging in dense forest understories in Southeast Asia.



DISTRIBUTION
Southeast Asia

SPECIES
Coelops frithii, *C. hirsutus*,
C. robinsoni

ROOSTING HABITATS
Caves, tree hollows, subterranean features

FORAGING HABITATS
Lowland forests

SIZE
Small. Forearm length: approximately 1.4–1.6 in (35–41 mm)

DIET
Insectivorous

HIPPOSIDERIDAE: *DORYRHINA*

CYCLOPS ROUNDLEAF BATS

There are only two recognized *Doryrhina* species: *D. cyclops* and *D. camerunensis*. *D. cyclops* is more common, occurring across West Africa and the Congo Basin. In contrast, *D. camerunensis* has relatively few capture records, occurring mostly in the Albertine Rift of Central Africa. *D. camerunensis* is the larger of the two species, but *Doryrhina* are sexually dimorphic with females larger than males. Both species have woolly, lustrous fur with gray frosting and their ears are large and pointed. Males have a special genital sac that when everted reveals tufts of stiff, red-brown hair, while females have similar tufts of stiff hair above their vagina.

Doryrhina are forest-dwelling bats, relying on lowland to montane forests. They roost in tree hollows, sometimes in small colonies with one male and several females or

in pairs. These bats hunt for large insects and remove the wings of their insect prey, littering the bottom of their tree hollows with identifiable insect parts. Insect prey includes cicadas and hawk moths, as well as beetles and other flying insects.



RIGHT | The long, dense fur of *Doryrhina cyclops* can appear camouflaged against tree bark. Male bats can roost alone.



DISTRIBUTION

Africa

SPECIES

Doryrhina cyclops, *D. camerunensis*

ROOSTING HABITATS

Tree hollows

FORAGING HABITATS

Lowland to montane forests

SIZE

Medium/large. Forearm length:
2.3–3.1 in (59–80 mm)

DIET

Insectivorous

LEAF-NOSED OR ROUNDLEAF BATS



There are five recognized species of *Macronycteris* bats from Africa, with two species (*M. gigas* and *M. vittata*) having widespread ranges across equatorial Africa. Three species are island endemics: *M. commersonii* and *M. cryptovalorona* occur on Madagascar and *M. thomensis* on the island of São Tomé in the Gulf of Guinea.

These are the largest-bodied bats within the Hipposideridae family. They have a muscular build and powerfully strong jaws. Their fur tends to be short and dense, with variation in color from pale to darker brown. Their noseleafs are large and distinctive.

LEFT | The Striped Roundleaf Bat (*Macronycteris vittata*) hunts for large beetles by “perch hunting”—waiting on a tree branch to sally out and capture a beetle before returning to eat its prey.

OPPOSITE | Striped Roundleaf Bats (*M. vittata*) roost in large colonies in caves in Africa. In coastal Kenya, some caves are threatened by development. Bat Conservation International is working with Kenyan biologists to protect these habitats.



DISTRIBUTION
Africa, including Madagascar and São Tomé

SPECIES
Macronycteris commersonii,
M. cryptovalorona, *M. gigas*,
M. thomensis, *M. vittata*

ROOSTING HABITATS
Caves

FORAGING HABITATS
Forests and savannas

SIZE
Medium/large. Forearm length: approximately 3.1–4.2 in (80–106 mm)

DIET
Insectivorous



Macronycteris primarily hunt large beetles. They have broad wings for maneuverable flight and hunt in open habitats and forests. They hunt by perching in trees and fly out to capture beetles, returning to their perch to eat. *Macronycteris* use constant frequency (CF) echolocation and the CF range varies by species, with 54–46 kHz for *M. gigas* and 62–66 kHz for *M. vittata*.

Macronycteris bats typically roost in caves in colonies of several hundred to several thousands. In large caves, they co-roost with other bat species.

Some species are also known to roost in trees in forested habitats. For several months before the mating season, males of *M. vittata* engage in territorial behaviors, which can result in injuries. Like most bats, females give birth to a single pup, and timing of parturition varies geographically, so that young are born during local wet seasons. Some populations are regionally migratory, moving to different roosts and areas presumably to track seasonal shifts in prey.

HIPPOSIDERIDAE: *HIPPOSIDEROS*

ROUNDLEAF BATS



The *Hipposideros* genus is one of the more speciose genera of bats, with 74 recognized species. *Hipposideros* species occur throughout Africa, Asia, and Oceania. Southeast Asia has the highest species diversity, with 54 recognized species. In comparison, Africa has 11 recognized species, and 6 species occur in Australia.

Hipposideros bats have a rounded nose-leaf structure that has a rounded basal portion as well as complex lateral flaps, called leaflets, and a raised central ridge structure, called the sella. *Hipposideros* echolocate through their noses, and the complexity of the nose-leaf helps direct and modulate their

ABOVE | The Pomona or Andersen's Roundleaf Bat (*Hipposideros pomona*) lives in southern India and is listed as Endangered by IUCN. Females have just one pup per year. Protecting maternity colonies is critical for their conservation.

RIGHT | The Dusky Roundleaf Bat (*Hipposideros ater*) is found throughout Southeast Asia. Like many *Hipposideros* bats, it roosts in caves and has slow maneuverable flight for hunting for small insects in tropical forests

OPPOSITE | Bats drink on the wing, swooping down to lap water from still surfaces, as shown here by this Fawn Roundleaf Bat (*Hipposideros cervinus*), as species from Southeast Asia.



DISTRIBUTION
Africa, Asia, Oceania

GENUS
Hipposideros (74 recognized species)

ROOSTING HABITATS
Caves, trees

FORAGING HABITATS
Forests, savannas, shrublands

SIZE
Small/large. Forearm length:
1.2–4.3 in (30–110 mm)

DIET
Insectivorous



echolocation calls, which can have both constant frequency (CF) as well as frequency modulation (FM) components. They typically have broad wings with low wing loading, although some larger-bodied species have higher wing loading.

In general, *Hipposideros* species are adapted for high maneuverability and many excel at foraging in cluttered forest settings. Foraging styles include aerial hawking and gleaning insects from surfaces. Some larger-bodied *Hipposideros* bats use perch hunting. The diet of most species consists of flying insects, but some consume spiders or other flightless arthropods.

Many species roost in caves or other subterranean features. Some *Hipposideros* bats also roost in tree hollows or use human-made structures such as buildings or abandoned mines. Most species roost gregariously, with colony sizes ranging from a few bats to the thousands. Some species have harem mating structures, with males defending a group of females. Females often form maternity colonies to give birth synchronously and timed with seasonal peaks in insect availability, usually local wet seasons.

HIPPOSIDERIDAE: *HIPPOSIDEROS LAMOTTEI*

LAMOTTE'S ROUNDLEAF BAT

Lamotte's Roundleaf Bat is endemic to a single mountain range (Mount Nimba) in Guinea, West Africa. *Hipposideros lamottei* has reddish to brown fur and appears similar to the widespread and common *H. caffer/ruber* (see page 66).

H. lamottei is listed as Critically Endangered because of its restricted geographic range and is under threat from iron-ore mining on Mount

Nimba. This small bat is only found at higher elevations of the mountain, and extensive surveys in surrounding lowlands have failed to detect it.

H. lamottei's roosts are in old mines in a mining concession on the Mount Nimba Strict Nature Reserve World Heritage Site. The species roosts gregariously, with colony sizes ranging up to a few hundred bats. Natural caves at higher-elevation areas of Mount Nimba were probably its historic roost habitats.

H. lamottei likely forages at the interface of grasslands and gallery forests, but its foraging ecology remains unstudied.

The species uses a constant frequency (CF) call with peak frequency of 123 kHz and is thought to hunt for small insect prey such as flies.



LEFT | The Lamotte's Roundleaf Bat (*Hipposideros lamottei*) is endemic to the Nimba Range in Guinea, West Africa. This species is Critically Endangered and under immediate threat from mining activities in the region.



DISTRIBUTION
Mount Nimba, Africa

SPECIES
Hipposideros lamottei

ROOSTING HABITATS
Abandoned mines, caves

FORAGING HABITATS
High-elevation grasslands and gallery forests

SIZE
Small. Forearm length:
2.1–2.2 in (53–55 mm)

DIET
Insectivorous

HIPPOSIDERIDAE: *HIPPOSIDEROS LARVATUS*

INTERMEDIATE ROUNDLEAF BAT

The species *Hipposideros larvatus* occurs across Southeast Asia in forested habitats ranging from sea level to 6,500 ft (2,000 m). It may represent a species complex with cryptic species that have not yet been taxonomically resolved. Even within a single cave, there can be two groups using different peak frequencies in echolocation (85 kHz vs. 98 kHz).

These bats have cinnamon-brown dorsal fur and a typical hipposiderid nose-leaf structure. They are medium sized with no evidence of sexual dimorphism. There is no delay between copulation

and fertilization and pregnancy in *H. larvatus*. Females give birth to a single pup once a year.

H. larvatus are adapted for agile flight in the forest understory. There is little known about their diets, but at least one study found they feed mostly on beetles. *H. larvatus* roosts in caves, abandoned mines, and buildings. They often co-roost with other species. Colony sizes vary from small to large colonies up to several hundred individuals. Colonies may move between caves seasonally, presumably to track the seasonal availability of resources.



RIGHT | *Hipposideros larvatus* taking flight to emerge from its cave roost in Langkawi, Malaysia. *H. larvatus* shares cave roosts with other bat species and can form colonies of hundreds of bats.



DISTRIBUTION
Southeast Asia

SPECIES
Hipposideros larvatus

ROOSTING HABITATS
Caves, mines, buildings

FORAGING HABITATS
Forests

SIZE
Medium. Forearm length:
2.2–2.4 in (55–62 mm)

DIET
Insectivorous

KUNZ'S BICOLORED ROUNDLEAF BAT

The species *Hipposideros kunzi* was first described in 2018 as one distinct from *H. bicolor*. It occurs commonly in karst areas of Peninsular Malaysia and southern Thailand and is one of several cryptic species described in 2018 within the *H. bicolor* group. The species was named in honor of Tom Kunz, a notable bat biologist who worked globally on bat ecology and conservation.

The species is not yet assessed by IUCN, demonstrating the challenge of keeping updated with bat taxonomy.

H. kunzi is a small bat, one of the more diminutive species in the *H. bicolor* group. Fur color varies from medium to dark brown to bright orange. The peak frequency of its echolocation calls is around 143 kHz, which is higher than other *H. bicolor* and helped identify the species.

H. kunzi typically roosts in humid caves and mines with standing water. Colony sizes range from a few individuals to several hundred.

H. kunzi likely forages in forests and may be tolerant of degraded or disturbed habitats.



LEFT | *Hipposideros kunzi* in flight showing its bright orange color phase. The species co-roosts with several other bat species in humid caves.

OPPOSITE | *Hipposideros diadema* hunts by perching on a tree branch and waiting for large-bodied insects to fly by. The dramatic white fur patches are a distinguishing characteristic.



DISTRIBUTION

Peninsular Malaysia and southern Thailand

SPECIES

Hipposideros kunzi

ROOSTING HABITATS

Caves, mines

FORAGING HABITATS

Forests and disturbed habitats

SIZE

Small. Forearm length: 1.5–1.8 in (39–45 mm)

DIET

Insectivorous

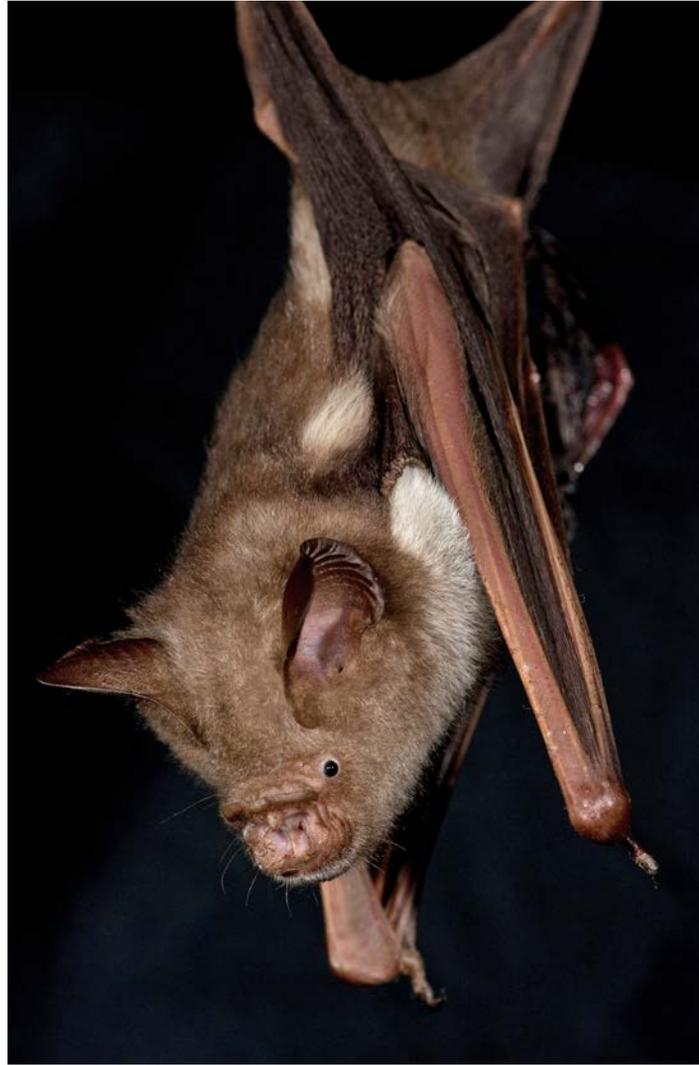
HIPPOSIDERIDAE: *HIPPOSIDEROS DIADEMA*

DIADEM ROUNDLEAF BAT

The species *Hipposideros diadema* is widespread across Southeast Asia, including northeast Australia. The species is one of the larger *Hipposideros* in Southeast Asia and has distinctive patches of white or pale-orange fur on the sides of its body. Its larger body size results in higher wing loading, making it less maneuverable than most other *Hipposideros* species.

H. diadema is primarily a perch hunter, hunting for large beetles or moths by sallying from a tree branch. It prefers foraging in gaps or open areas, and the discarded parts of large beetles and moth wings can be found under its perches. In Australia, bird feathers were found in its feces, indicating it is occasionally carnivorous.

H. diadema roosts in caves as well as buildings, mines, and hollow trees. Colony sizes vary based on the roost structure, from under 100 bats to several thousand bats, and *H. diadema* can be found co-roosting with other bat species. This species is adaptable and occurs in lowland forests and disturbed habitats, including agricultural areas.



DISTRIBUTION

Oceania, including northeast Australia, Southeast Asia

SPECIES

Hipposideros diadema

ROOSTING HABITATS

Caves, tree hollows, human-made structures

FORAGING HABITATS

Forest gaps, and includes open and degraded habitats

SIZE

Large. Forearm length: 2.3–3.8 in (58–96 mm) (variable among island populations)

DIET

Insectivorous, carnivorous

HIPPOSIDERIDAE: *HIPPOSIDEROS CAFFER*, *HIPPOSIDEROS RUBER*

SUNDEVALL'S ROUNDLEAF BAT AND NOACK'S ROUNDLEAF BAT

BELOW | A Sundevall's Roundleaf Bat (*Hipposideros caffer*) in flight. These bats have broad wings and can maneuver through dense vegetation to hunt small nocturnal insects like moths and beetles.

The species *Hipposideros caffer* and *H. ruber* are widespread African hipposiderids that are part of a species complex noted as *Hipposideros cf. ruber*. These species are similar enough in morphology that they can be indistinguishable when captured. The *H. cf. ruber* complex highlights that some bat species in Africa have yet to be described and identified using modern phylogenetics. *H. caffer*, *H. ruber*, and the *H. cf. ruber* complex have been recorded throughout equatorial Africa, extending into southern Africa. The peak frequency of their constant frequency (CF) echolocation calls varies geographically, which may represent regional dialects but could also support the hypothesis that cryptic species remain undescribed.



DISTRIBUTION
Sub-Saharan Africa

SPECIES
Hipposideros caffer, *H. ruber*,
H. cf. ruber

ROOSTING HABITATS
Savannas and forests

FORAGING HABITATS
Caves, buildings, abandoned mines,
hollow trees

SIZE
Medium. Forearm length:
1.6–2.2 in (40–55 mm)

DIET
Insectivorous



These bats have two color phases: the fur can be a bright orange or a duller grayish brown. What causes these color phases and how it relates to timing of molting, age, or reproductive status remains uncertain. Roosting habits are flexible and include caves, mines, tree hollows, and buildings. Colony sizes can vary from several hundred thousand individuals in caves to small colonies of less than 20 bats in a tree hollow. Females give birth once a year, and timing of parturition varies geographically with seasonality differences across their wide range.

Diet analysis of *H. caffer* and *H. ruber* indicate a very high proportion of moths, indicating they are specialists of this insect. These bats are flexible in their foraging habits and will use semi-natural habitats, including agriculturally fallow lands. In general, *H. caffer* is associated with savanna habitats, whereas *H. ruber* is associated with forested habitats.

ABOVE | Noack's Roundleaf Bat (*Hipposideros ruber*) and Sundevall's Roundleaf Bat (*H. caffer*) are cave-dwelling species that often roost in large numbers, frequently using the same cave as other bat species.

RIGHT | A close-up photo of this Noack's Roundleaf Bat (*H. ruber*) shows the typical *Hipposideros* ear shape of large, rounded ears with a pointed tip. Delicate fur is visible on the inside of the ear.



FAMILY: MEGADERMATIDAE

FALSE VAMPIRE BATS



The Megadermatidae is a small family of bats with only six species, each in its own genus. Their common name is the false vampire bats, but none are blood-feeding. Instead, megadermatid bats are usually carnivorous, hunting large insects, frogs, birds, fish, small mammals, and even other bats. Two species live in Africa, three in Asia, and one in Australia. The Ghost Bat (*Macroderma gigas*; see page 71) is the largest carnivorous bat in Australia and predates on other bats.

All six species are relatively large-bodied bats. Their facial features tend to be particularly striking, with large ears connected to each other at the base and complex nose-leaf structures that help direct their echolocation calls. They have broad wings adapted for slow, maneuverable flight. Their morphological features, such as large ears and broad wings, reveal their hunting style, which uses passive listening for the sounds of their prey.

LEFT | The Ghost Bat (*Macroderma gigas*) is Australia's largest echolocating bat, named for its pale fur and translucent wings. Ghost bats are carnivorous, hunting small vertebrates, and live in caves and mines.



DISTRIBUTION

Asia (East Asia, South and Southeast Asia, west and central Asia), Africa (Sub-Saharan Africa), Oceania

GENERA

Cardioderma, *Eudiscoderma*, *Lavia*, *Lyroderma*, *Megaderma*, *Macroderma*

ROOSTING HABITATS

Caves, rock crevices, human-made structures, tree foliage and hollows

FORAGING HABITATS

Forests, shrublands, savannas

SIZE

The largest bat in this family is the Ghost Bat (*Macroderma gigas*): body mass 4.6–6 oz (130–170 g); forearm length 3.8–4.4 in (96–113 mm). The smallest bat in this



ABOVE | The Yellow-Winged Bat (*Lavia frons*) lives in equatorial Africa and can be found hanging in acacia trees during the day and sallying forth to perch hunt for beetles at night.

family is the Yellow-Winged Bat (*Lavia frons*); body mass 0.9–1.2 oz (25–35 g); forearm length 2–2.2 in (50–55 mm)

DIET
Carnivorous, insectivorous

Their echolocation calls are frequency modulation (FM) sweeps and are relatively quiet, which likely aids in their stealth-hunting tactics. The roosting habits of the Megadermatidae are quite diverse. Some species, like the Greater False Vampire Bat (*Lyroderma lyra*; see page 70) in Asia, are gregarious and often form large colonies in caves or human structures. The Yellow-Winged Bat (*Lavia frons*; see page 73) forms pair bonds and roosts in small family groups, hanging in tree foliage in the African savanna. Deforestation, roost disturbance and destruction, and pollution from mining are primary threats.

Of the six species, IUCN lists Thongaree's Disk-Nosed Bat (*Eudiscoderma thongareeae*) in Thailand as Critically Endangered, the Ghost Bat (*Macroderma gigas*) in Australia as Vulnerable, and the other four species as Least Concern.

MEGADERMATIDAE: *LYRODERMA LYRA*

GREATER FALSE VAMPIRE BAT



The species *Lyroderma lyra* is a carnivorous bat with large ears and a spear-shaped nose-leaf that occurs across Asia. It is one of the largest of six species of Megadermatidae, and displays characteristics of a rounded anterior nose-leaf, oval ears joined above the forehead, a forked tragus (the small cartilaginous projection within the ear), and a tail membrane with no bony tail. *Lyroderma* was considered a subgenus of *Megaderma* until 2015.

Females are larger than males and carry small young while foraging. Young grasp onto their mother's "false" (pubic) nipples. Lactation lasts around 70 days, but young are fed prey by their mothers after 30–40 days. *Lyroderma* has flexible foraging using perch hunting, aerial hawking, and

gleaning prey from surfaces. It has well-developed eyes and large ears used for visual cues and passive listening to find prey.

The species also uses complex echolocation calls with multi-harmonics and downward-modulated frequency sweeps to distinguish prey from surfaces such as trees, rocks, or water. The diet is diverse and contains large insects and small vertebrates, including frogs, rodents, fish, reptiles, birds, and other bats.

ABOVE | *Lyroderma lyra* occurs in diverse habitats across Asia, roosting in caves and temples, and displaying unusual flexibility for carnivorous hunting in both forested and human-modified landscapes.



DISTRIBUTION

Asia

SPECIES

Lyroderma lyra

ROOSTING HABITATS

Caves and human structures, including temples, tunnels, buildings

FORAGING HABITATS

Diverse habitats, including lowland forests and disturbed areas

SIZE

Medium/large. Forearm length: 2.2–2.8 in (56–72 mm)

DIET

Carnivorous

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