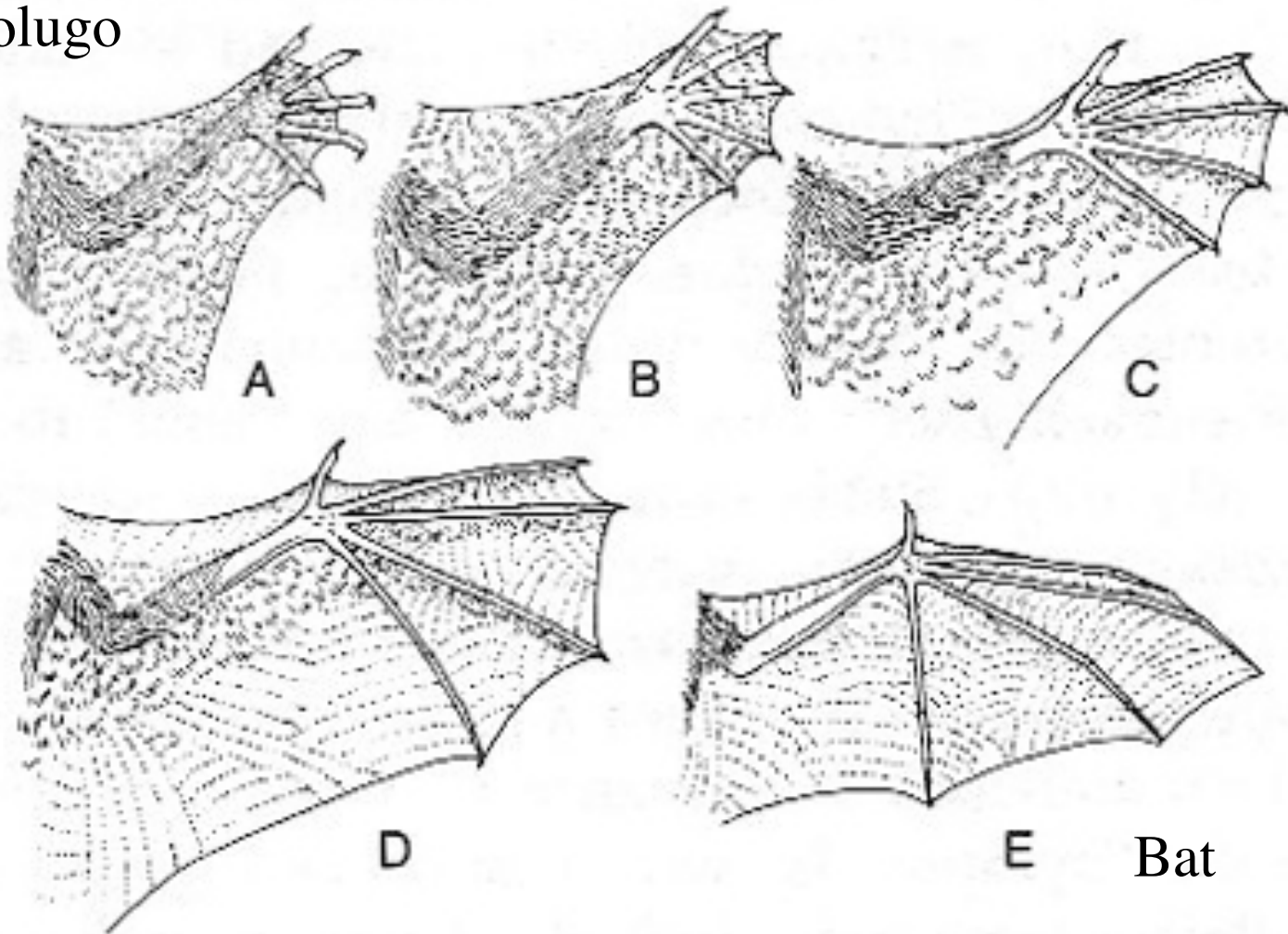


Evolution, ecology and distribution of bats

- Evolution
- Diversity
- Distribution
- Abundance

Hypothetical evolution of a bat wing

Colugo



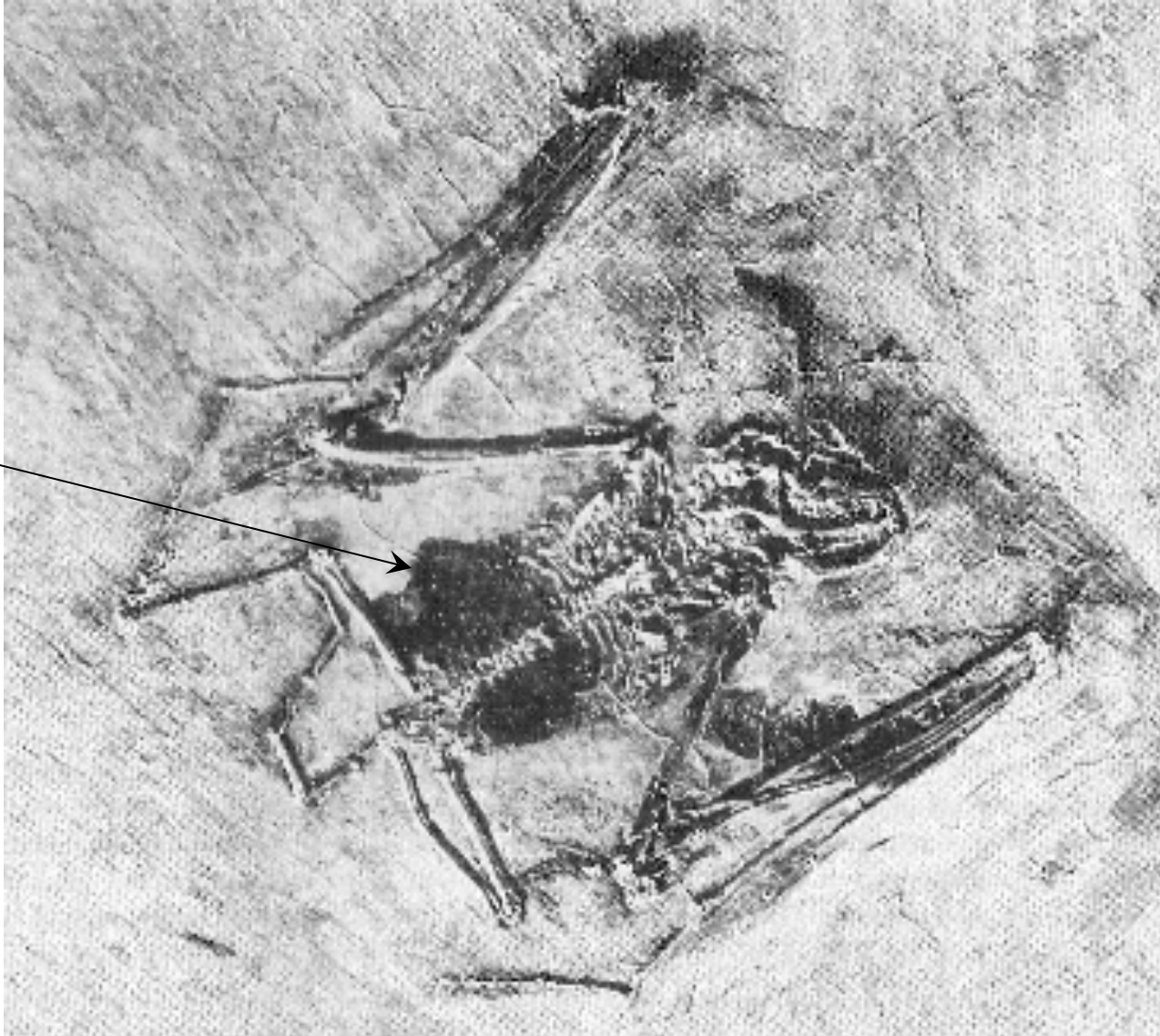
Flying lemur (colugo)



Paleochiropteryx tupaidon

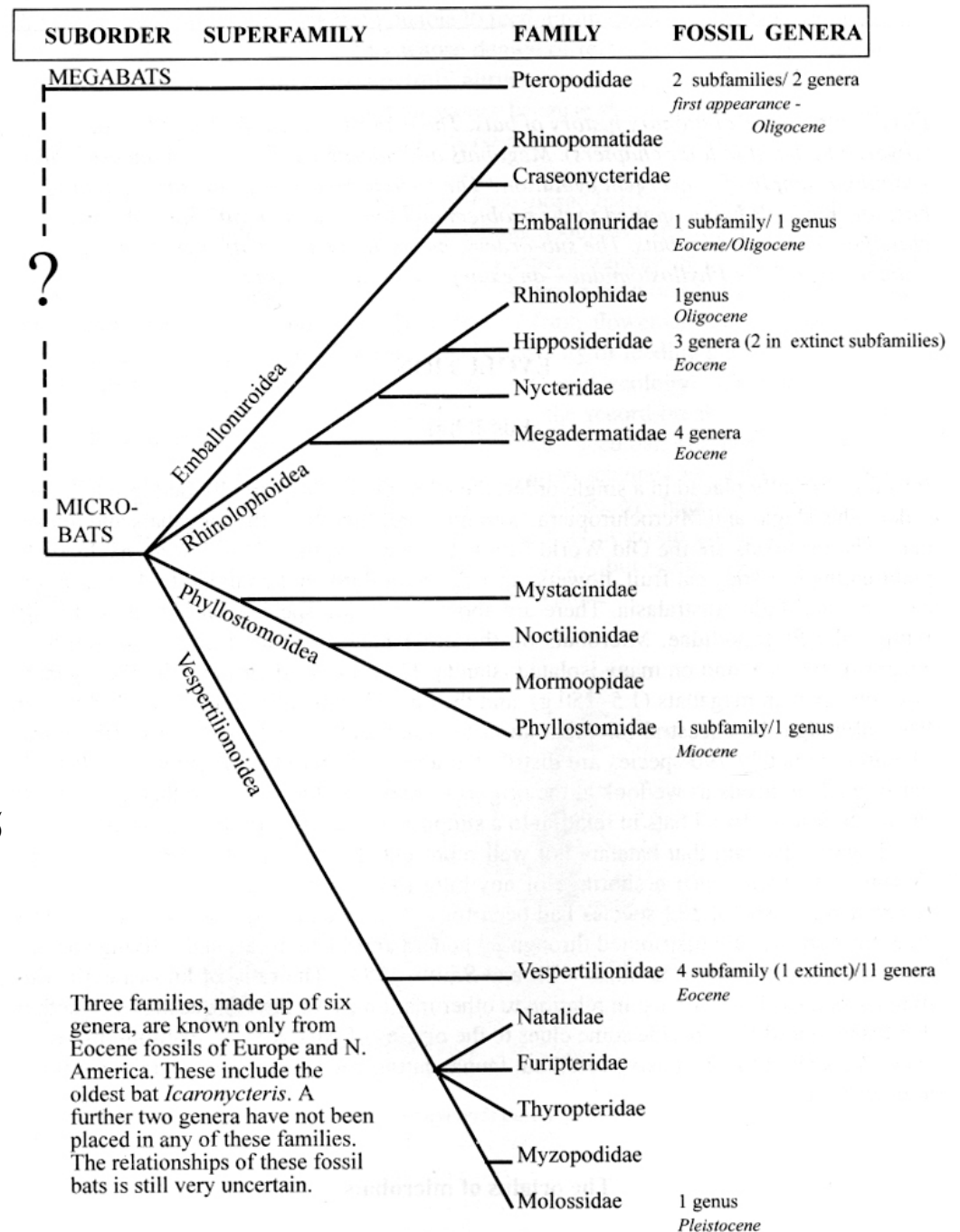
Darmstadt, Germany; Middle Eocene (60 MYA)

Moths



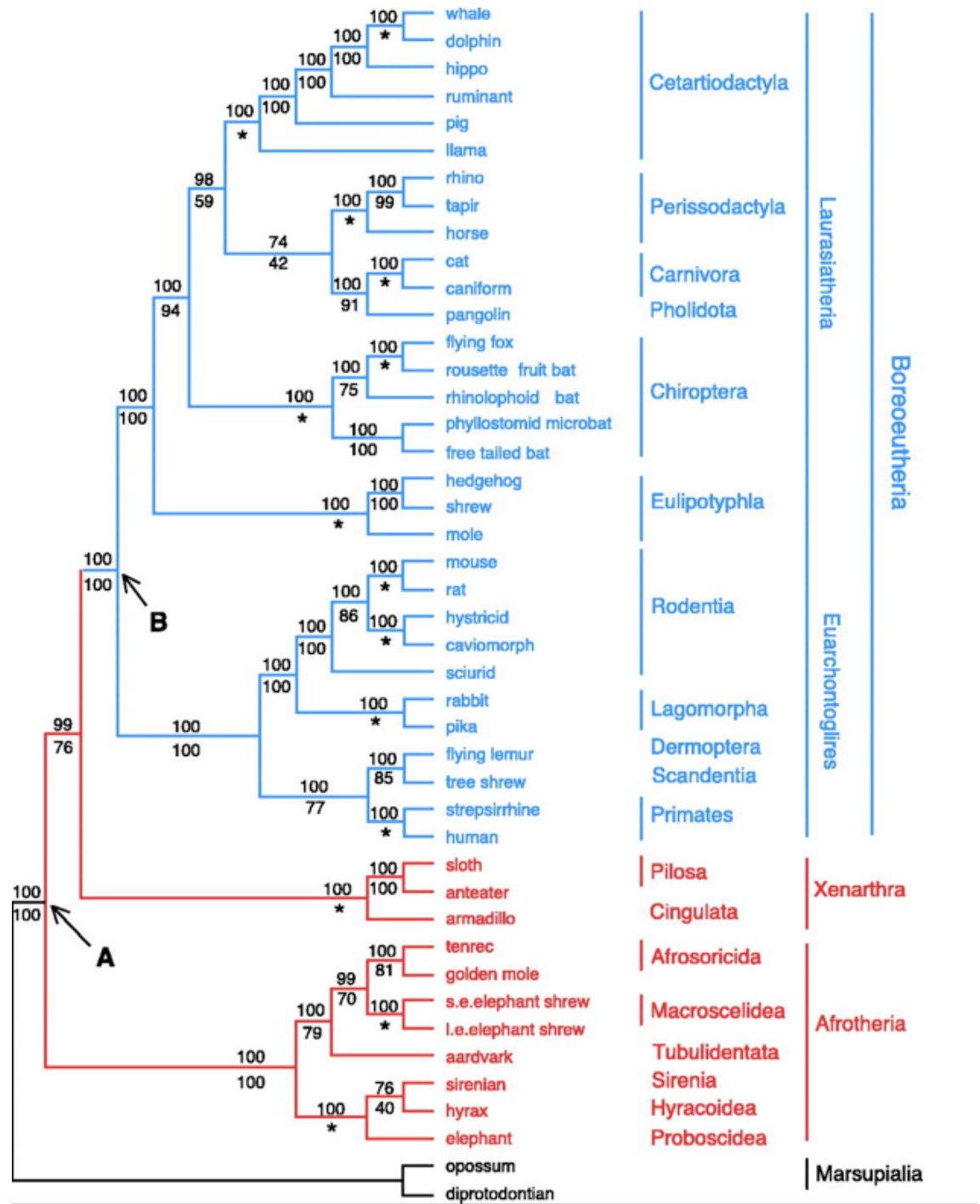
Traditional bat phylogeny

- Over 1000 extant species of bats
- Fossil bats have been found on all continents
 - Europe (Eocene: 37-53 MYA)
 - Africa (Oligocene: 26-36 MYA)
 - Asia (Miocene: 13-25 MYA)
 - North America (Eocene: 37-53 MYA)
 - South America (Miocene: 13-25 MYA)
- Oldest is 60 MYA
- But, most believe bats evolved 70-100 MYA due to distribution of primitive families



Current phylogeny of mammals

Based on sequence data from 70 genes



Current bat phylogeny

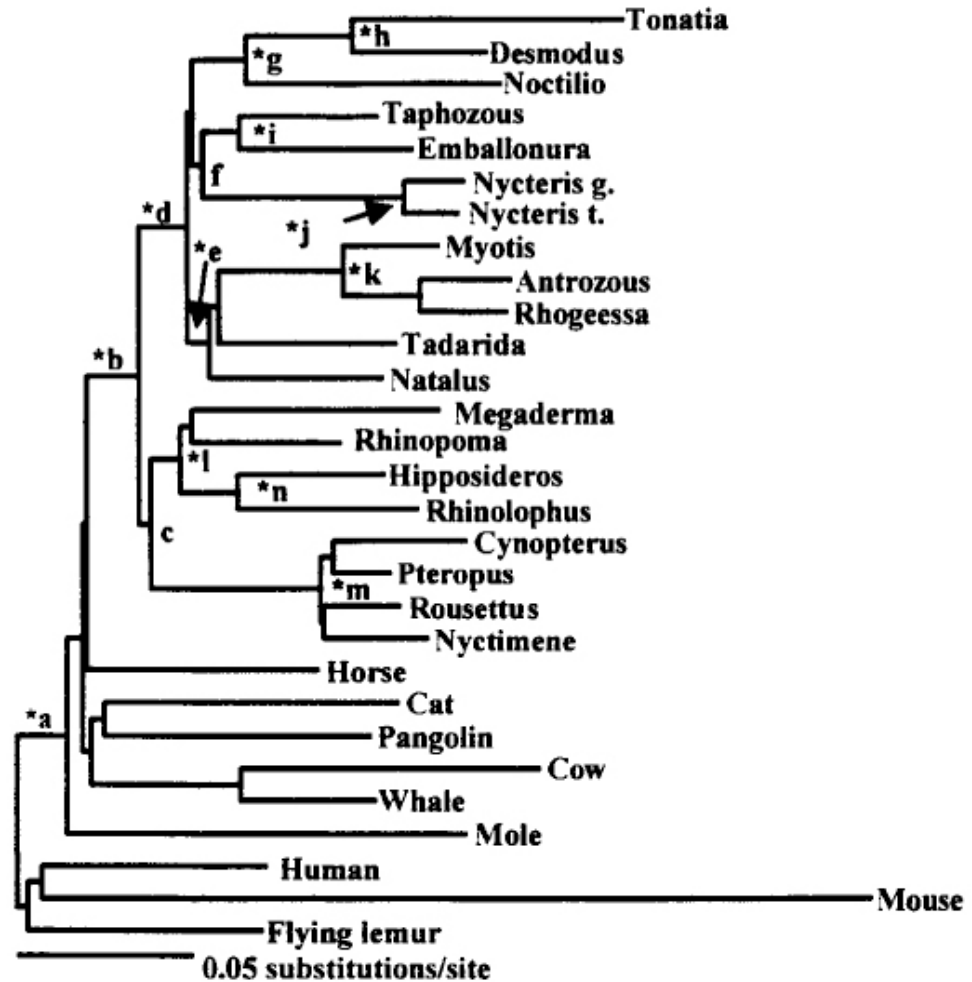
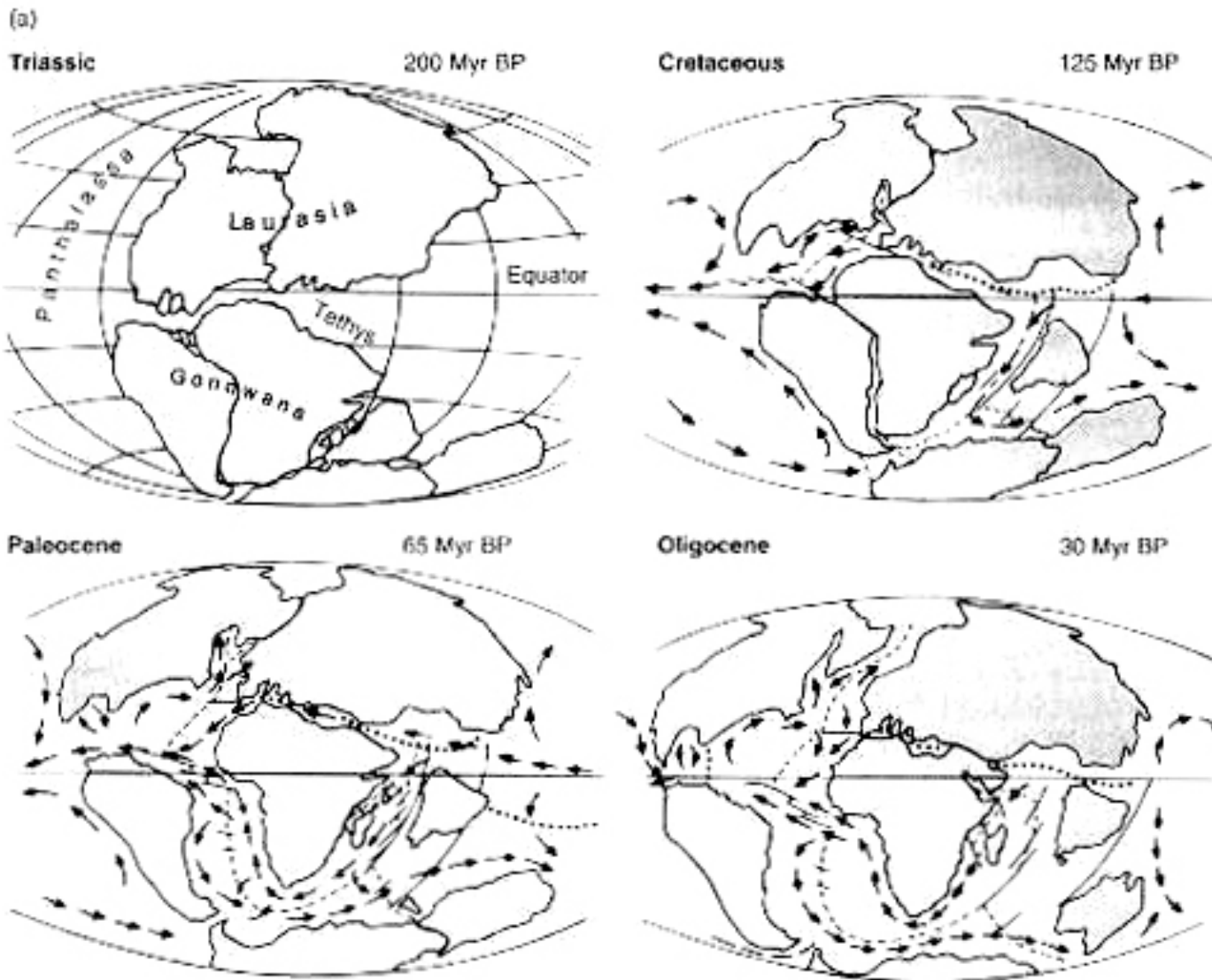


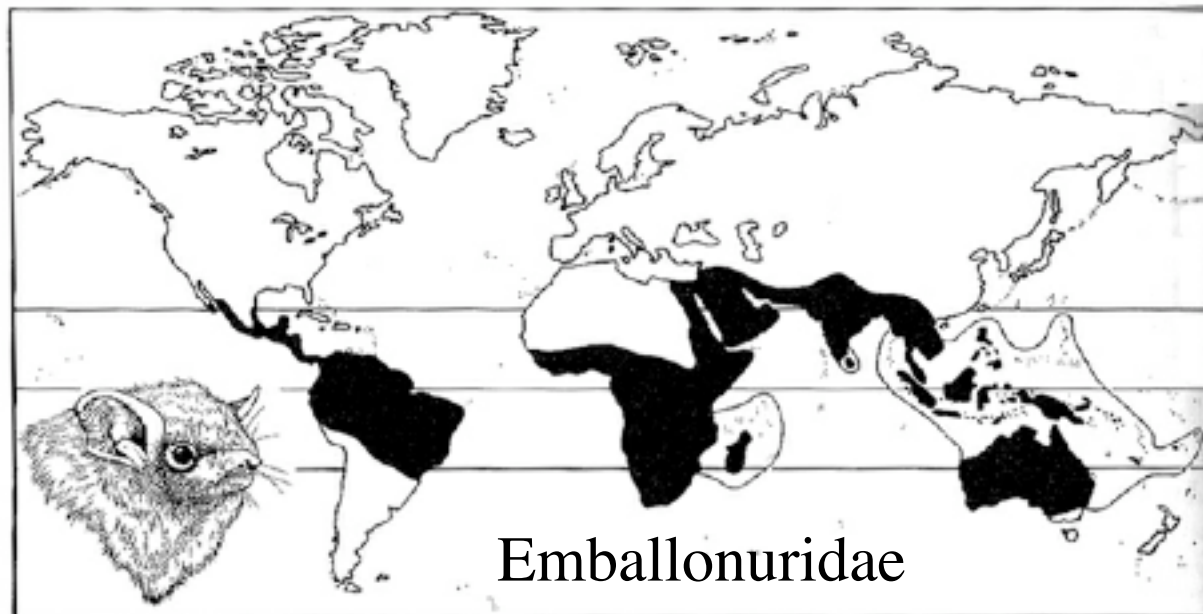
Fig. 1. The maximum likelihood tree ($-\ln$ likelihood = 62500.75) for the concatenated data set under the GTR + Γ + I model of sequence evolution. Asterisks indicate clades that were supported at or above the 90% bootstrap level in all analyses. Lowercase letters refer to clades that are discussed in the text.

Continental Drift



Biogeography

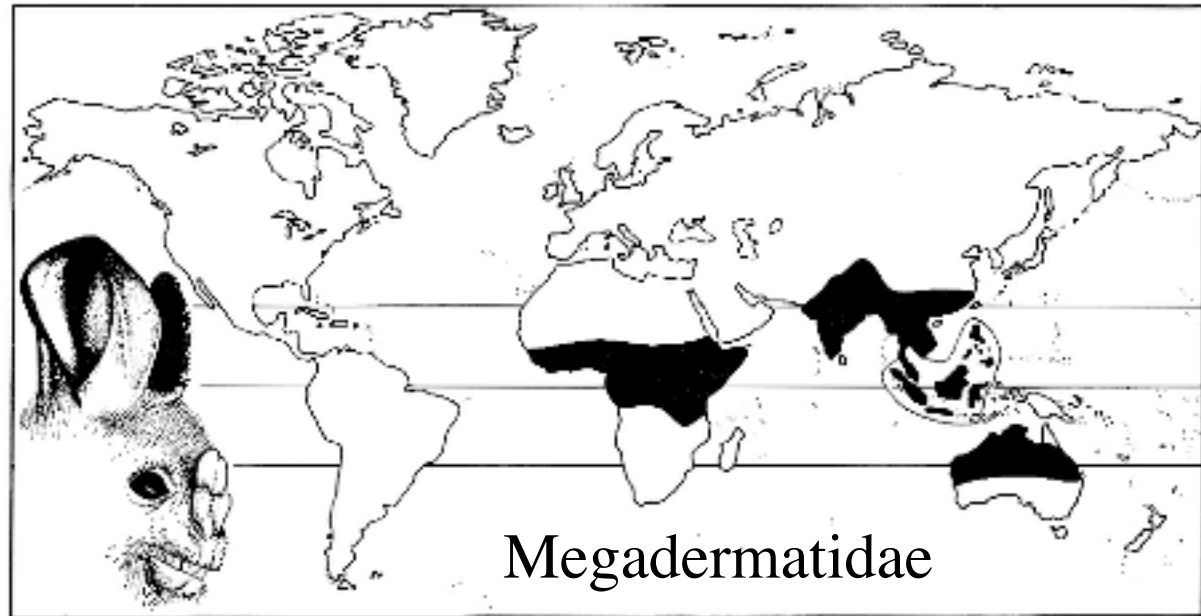
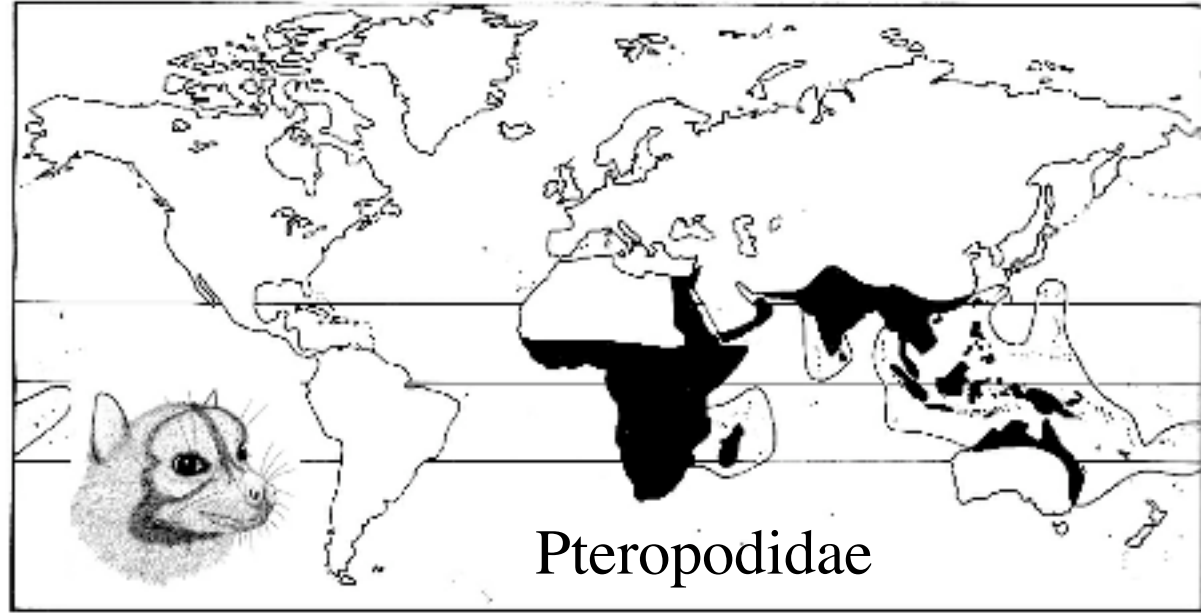
- Continental distributions of families
 - Reflects radiation before or after separation of early continents (vicariance) or
 - Dispersal and colonization after isolation



Family: Emballonuridae
13 genera, 51 species
Saccopteryx bilineata



Old World



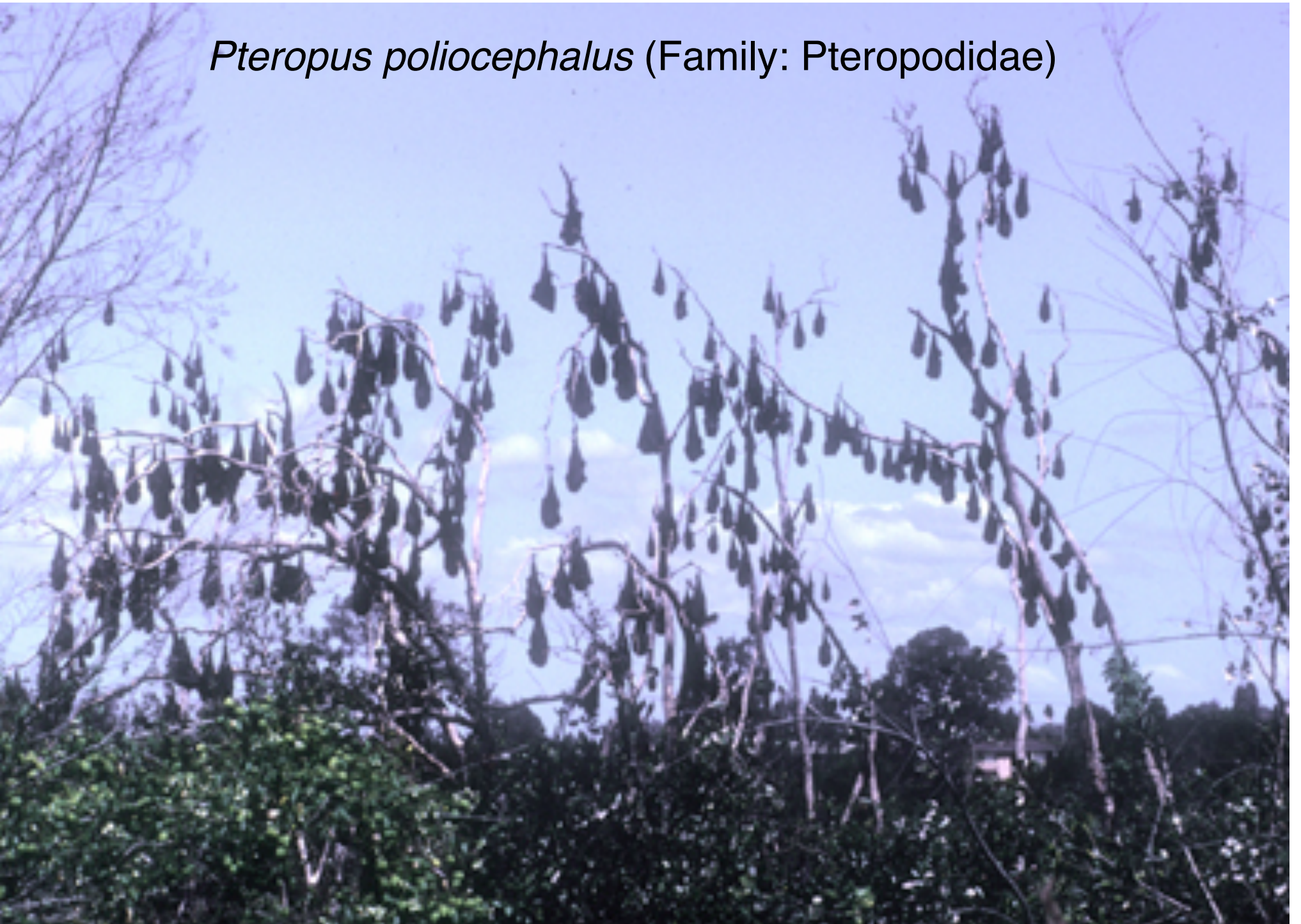
Pteropus rodricensis
(Family: Pteropodidae)



Pteropus rodricensis & *P. vampyrus*
(Family: Pteropodidae)



Pteropus poliocephalus (Family: Pteropodidae)



Cynopterus sphinx
(Family:Pteropodidae)



Family: Megadermatidae

4 genera, 5 species

Macroderma gigas

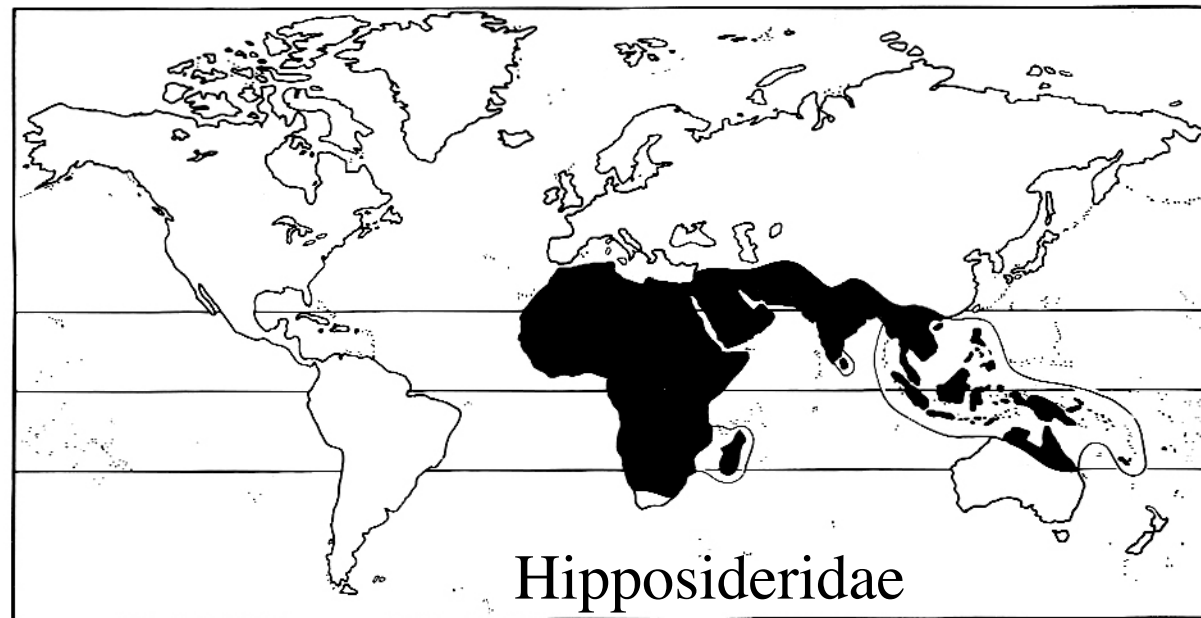
Australia



Megaderma lyra
(Family: Megadermatidae)
India



Old World



Family: Rhinolophidae

1 genus, 69 species

Rhinolophus ferrumiquinum



Rhinolophus simulator
(Family: Rhinolophidae)



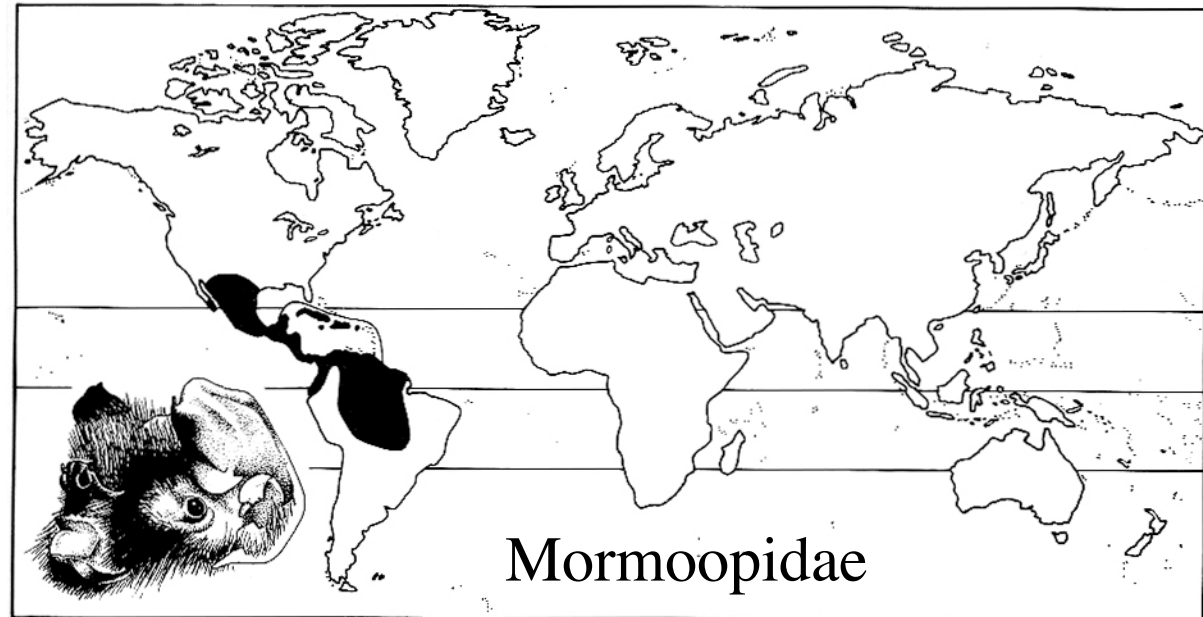
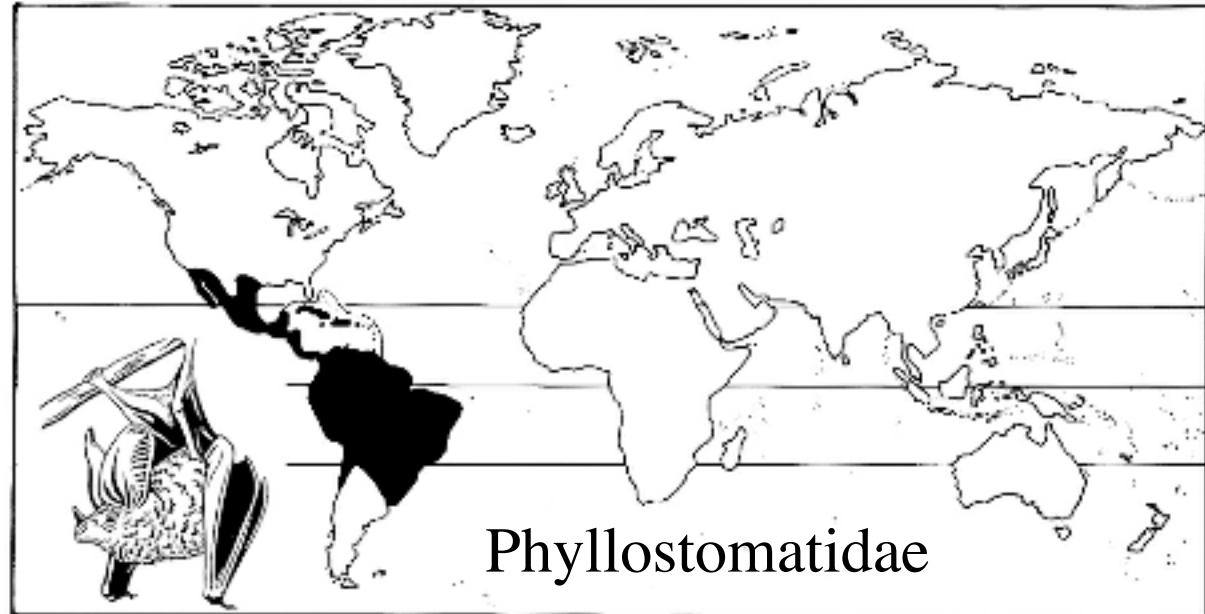
Family: Hipposideridae

9 genera, 60 species

Cleotis percivali



New World



Family: Mormoopidae
2 genera, 8 species
Pteronotus parnelli

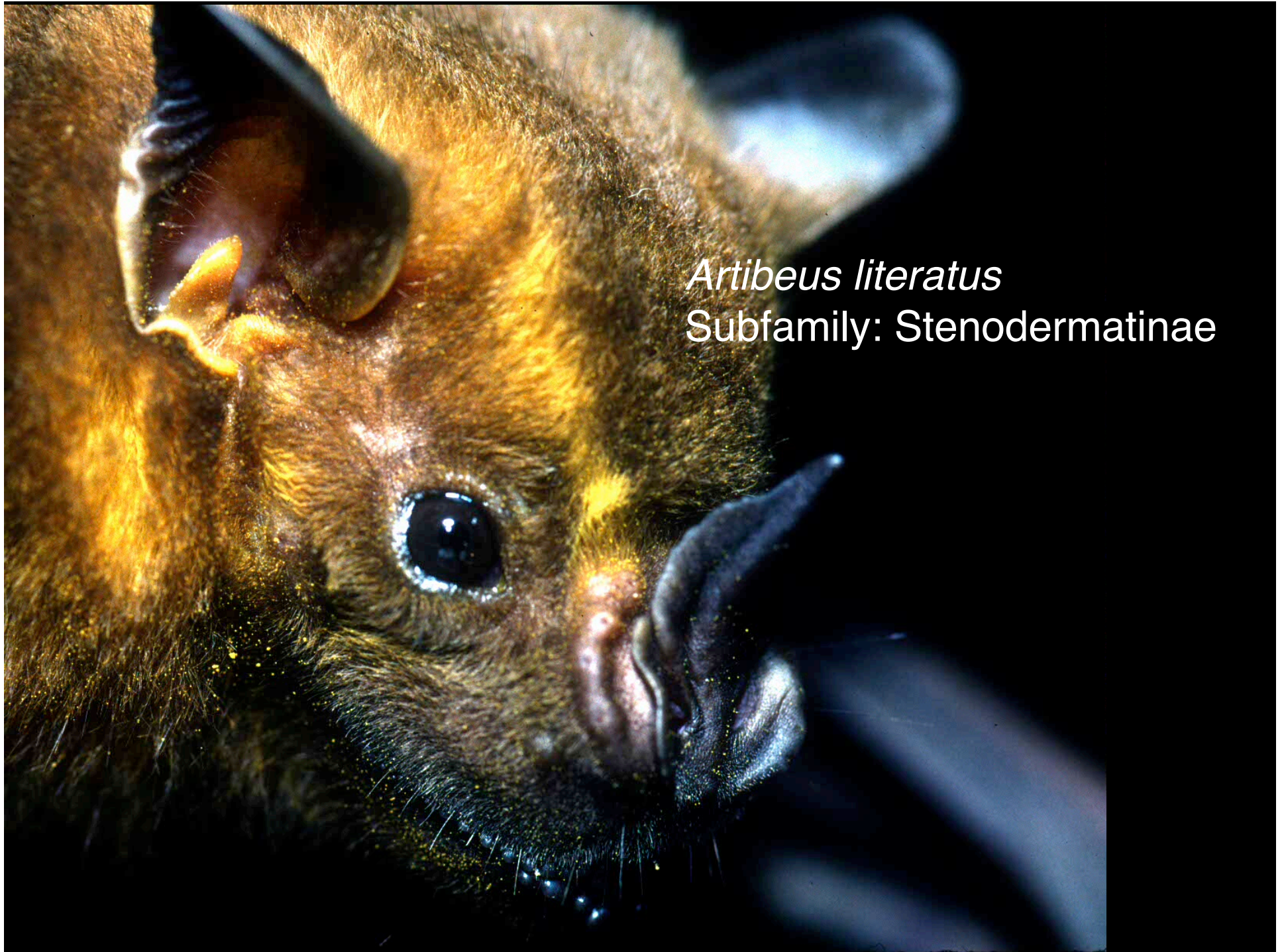




Family: Phyllostomidae
51 genera, 147 species
Subfamily: Carollinae
Carollia perspicillata

Choeroniscus mexicana
Subfamily: Glossophaginae





Artibeus literatus
Subfamily: Stenodermatinae

Ectophylla alba

Subfamily: Stenodermatinae



Chrotopterus auritus
Subfamily: Phyllostominae



Desmodus rotundus
Subfamily: Desmodontinae



Desmodus rotundus
Subfamily: Desmodontinae



Diaemus youngi
Subfamily: Desmodontinae





Diaemus youngi
Subfamily: Desmodontinae

Family: Noctilionidae

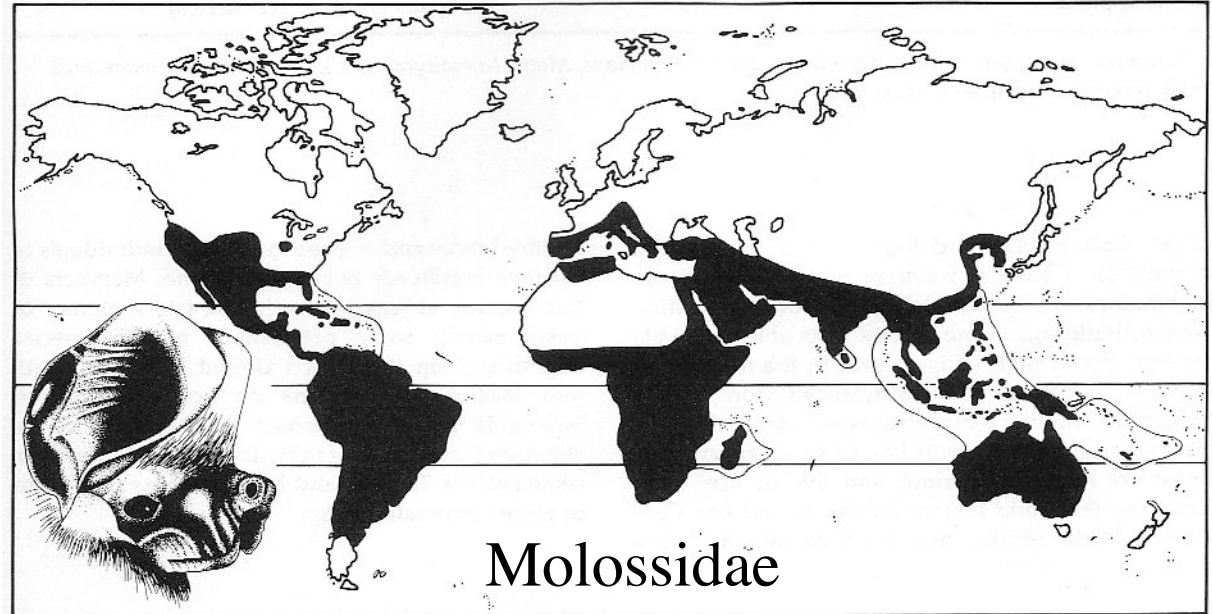
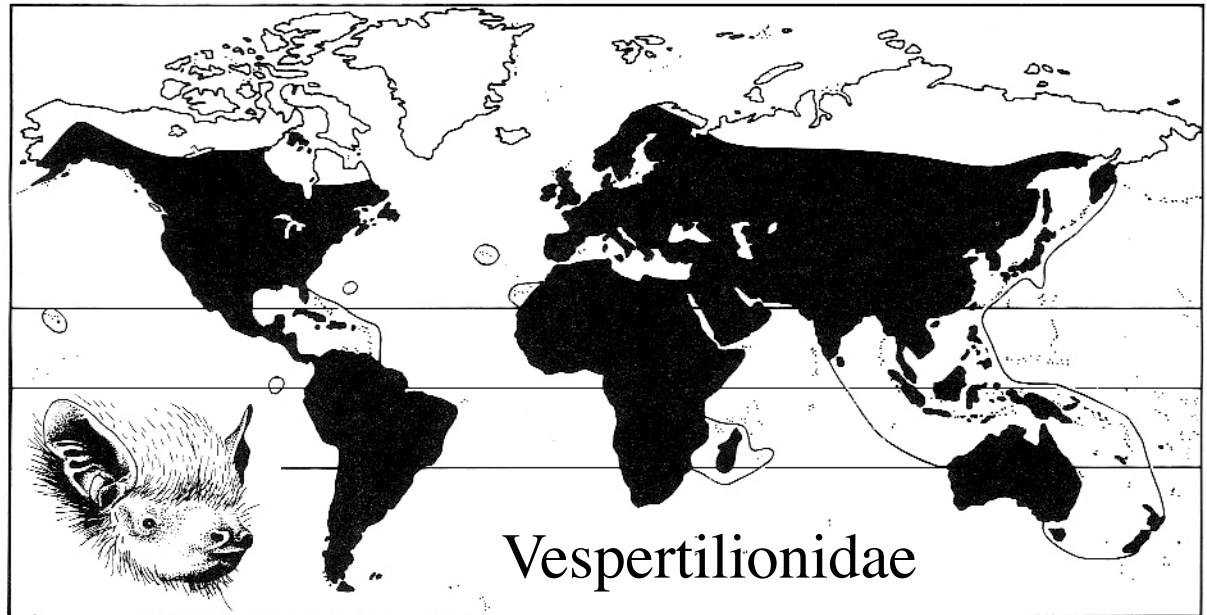
1 genus, 2 species

Noctilio leporinus



Cosmopolitan
ranges

strong flyers



Family: Vespertilionidae
41 genera, 330 species
Myotis lucifugus



Eptesicus fuscus (Family: Vespertilionidae)



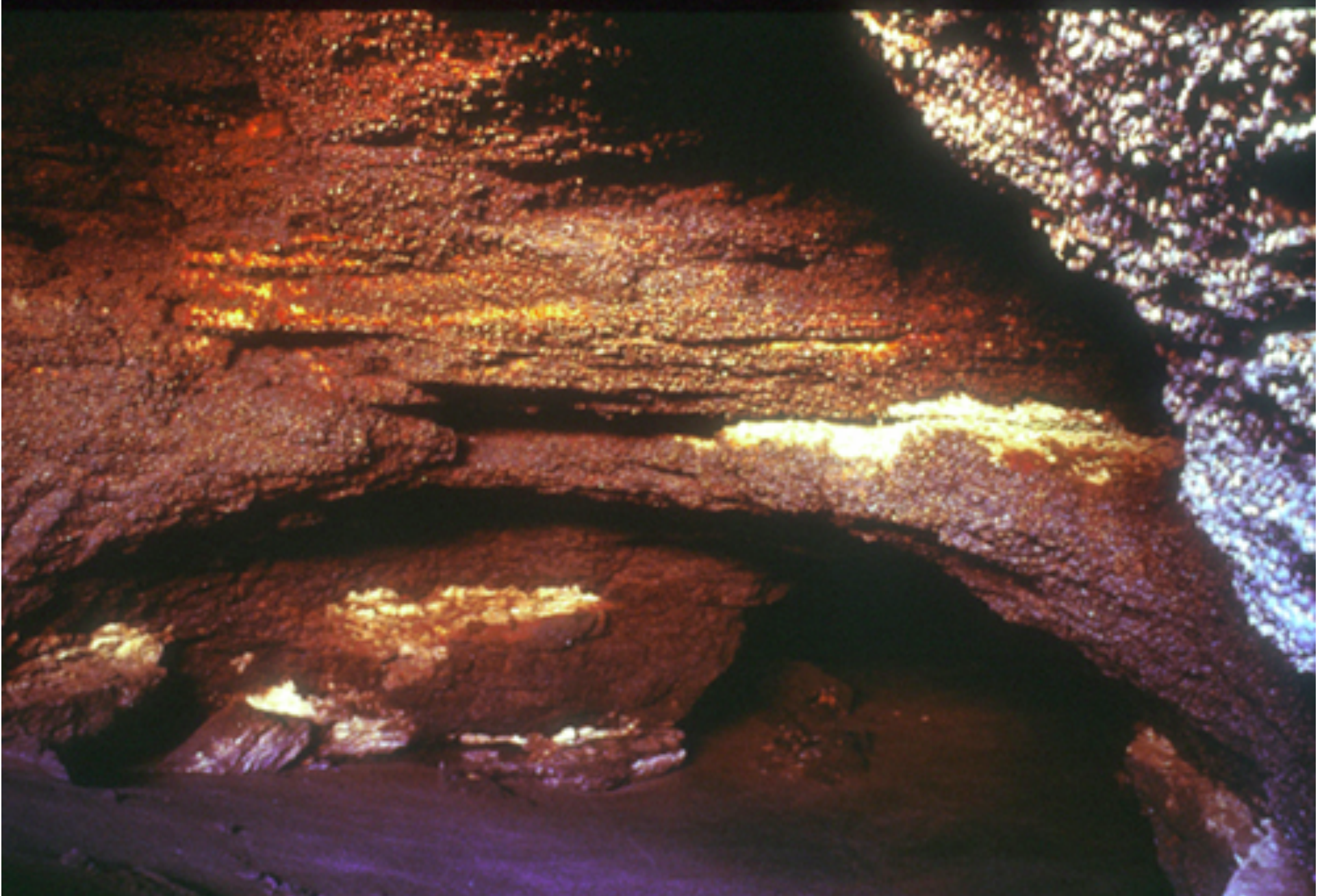
Lasiurus borealis
(Family: Vespertilionidae)



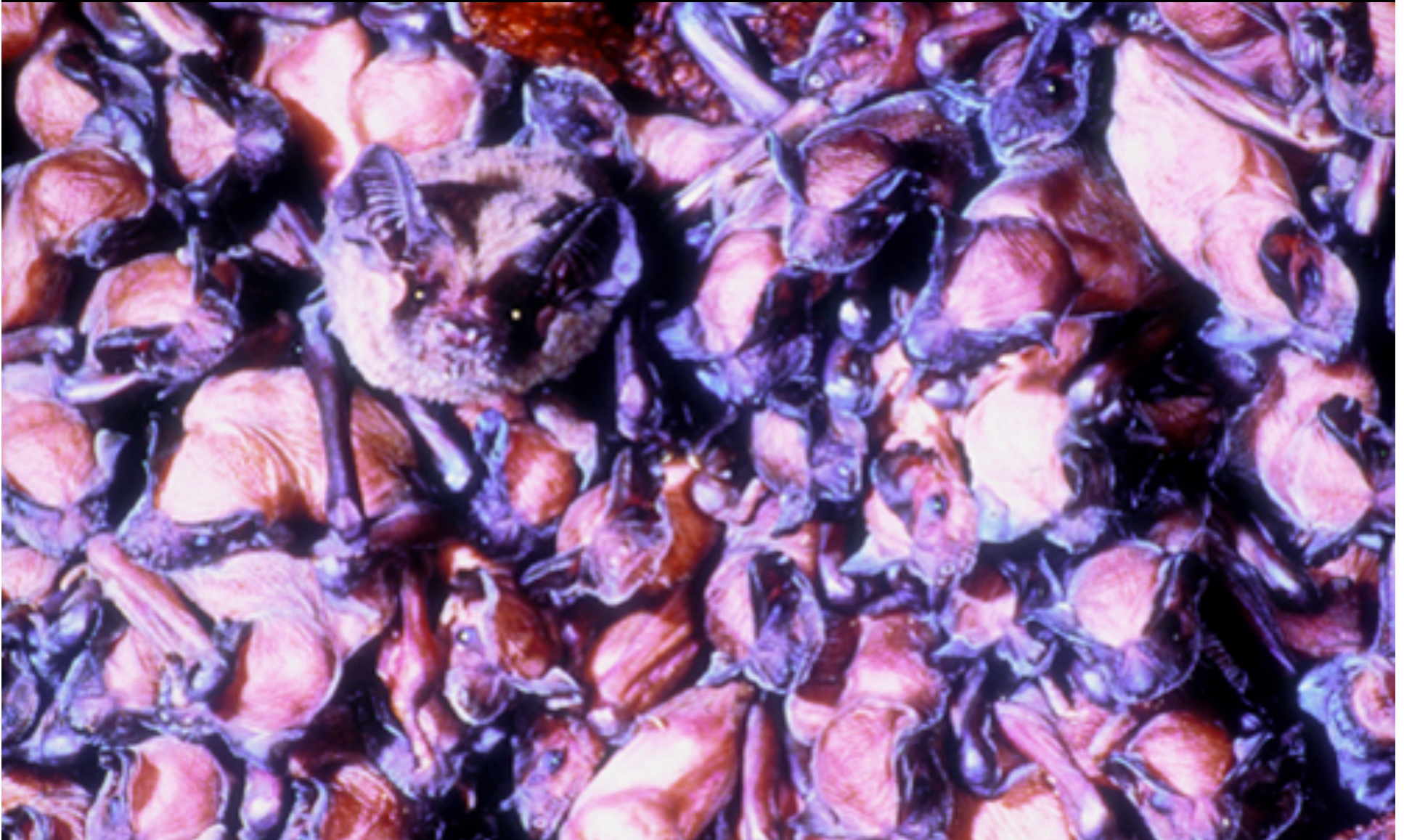
Tadarida brasiliensis (Family: Molossidae)



Tadarida brasiliensis (Family: Molossidae)



Tadarida brasiliensis (Family: Molossidae)



Bat species diversity

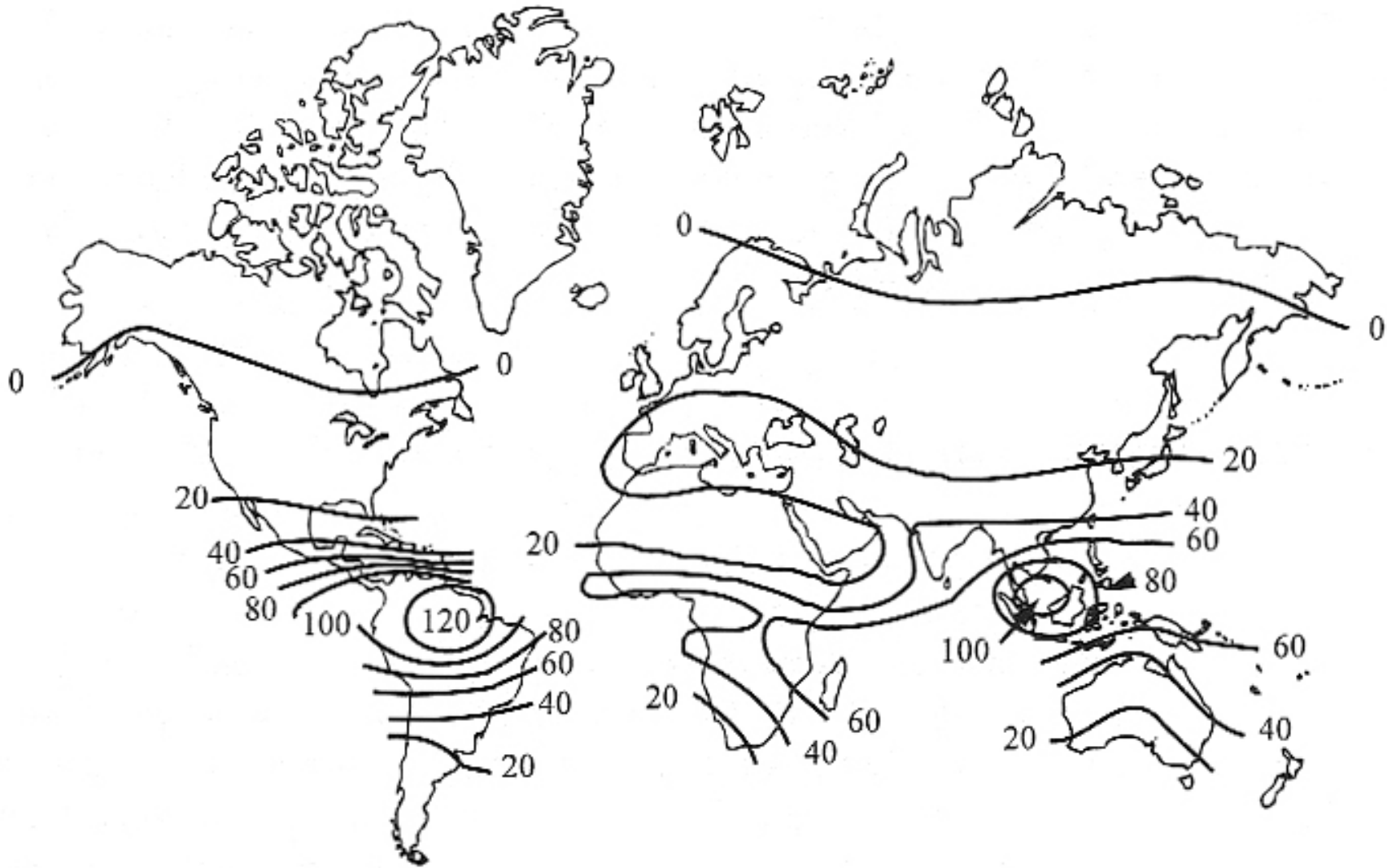


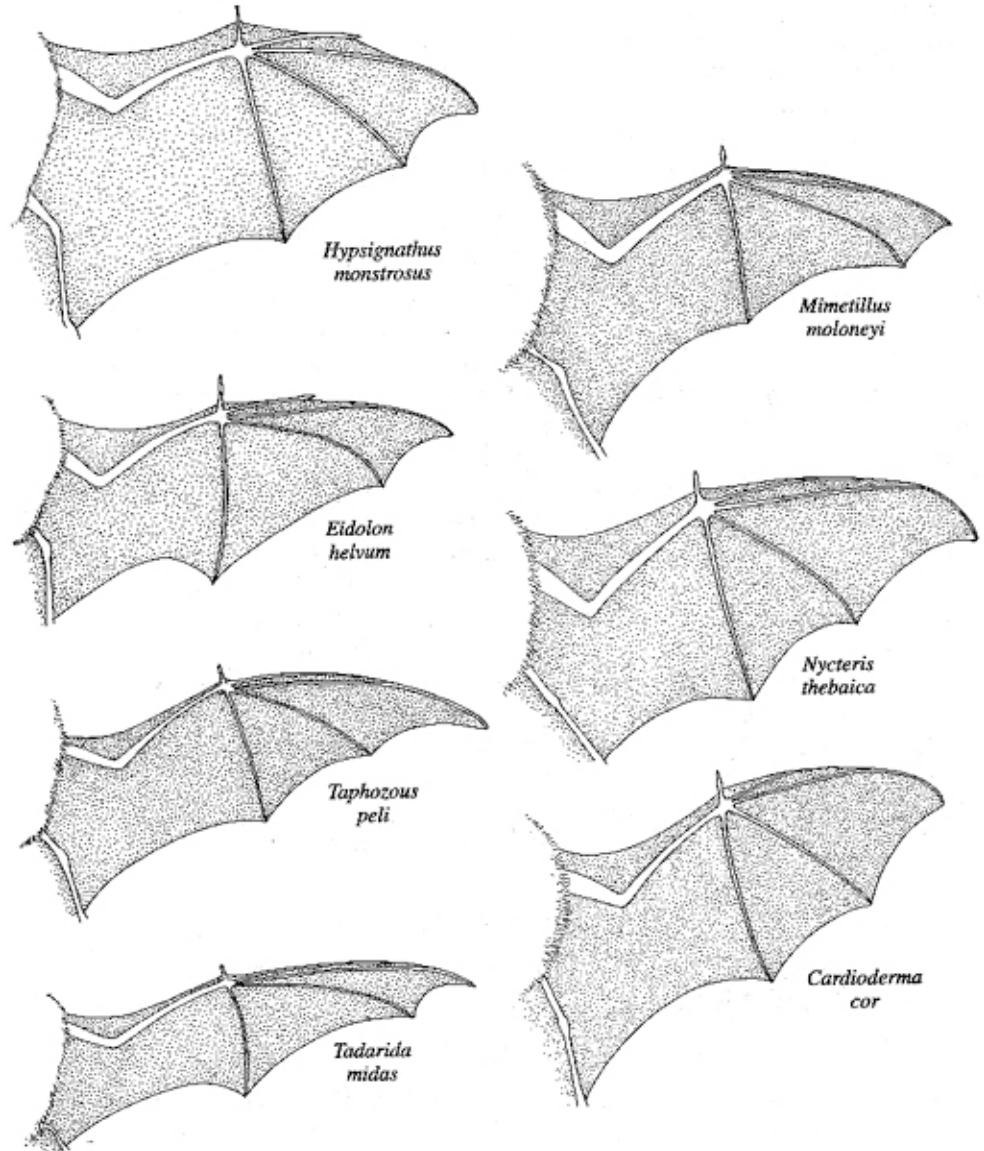
Fig. 1.11. The number of bat species in 500 km² quadrats in different parts of the world (adapted from Findley, 1993).

Reasons for tropical diversity

- Energy stability
 - more solar energy allows for more diversity
- Greater specialization
 - Habitat diversity is greater so there are more niches to fill
 - individual abundance decreases as diversity increases

Bat wing shape has been used to define feeding guilds

- Wing loading = mass/wing area
- Aspect ratio = wingspan²/wing area
 - Low AR = short, broad wings
 - High AR = long, narrow wings



Niche partitioning

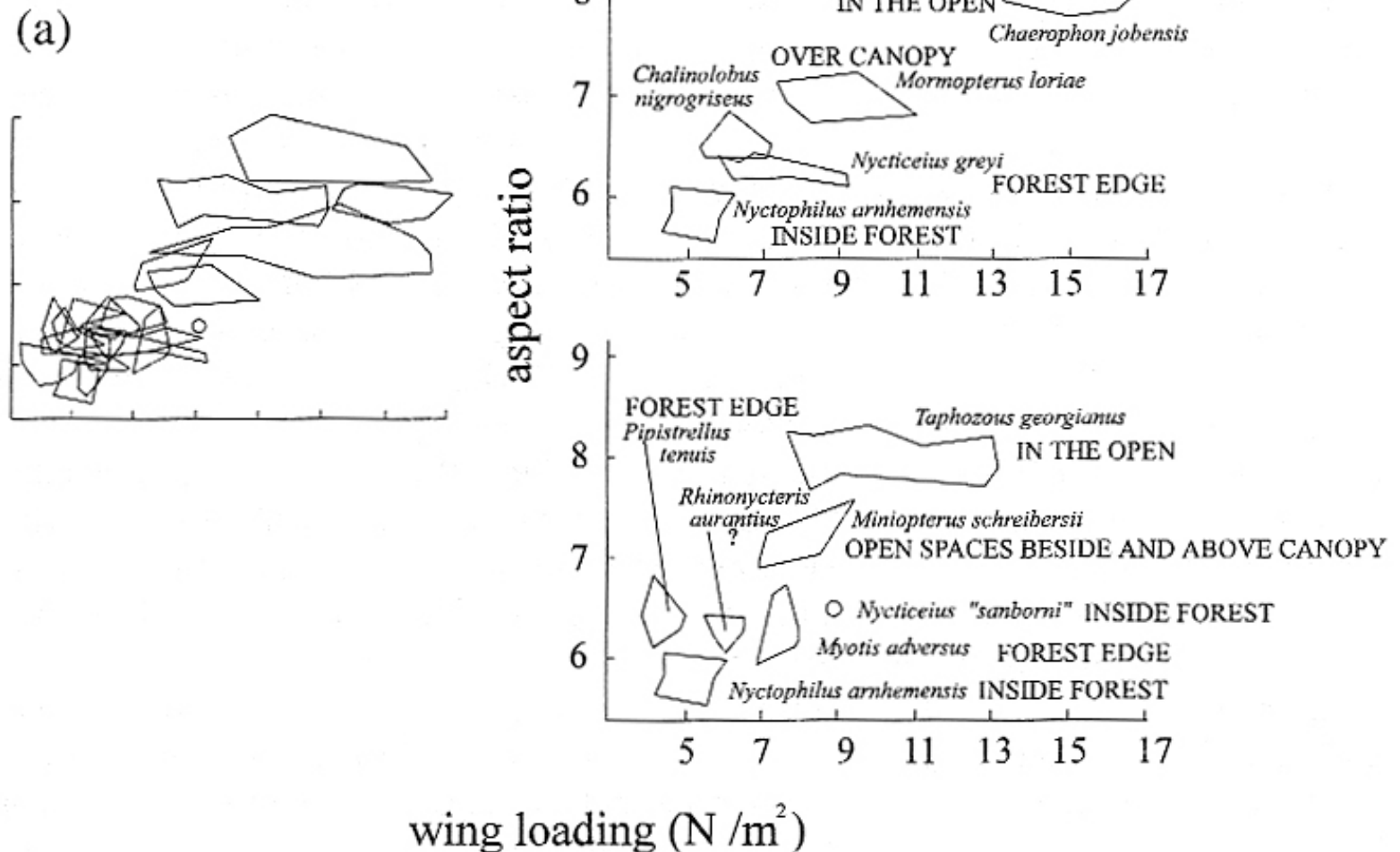
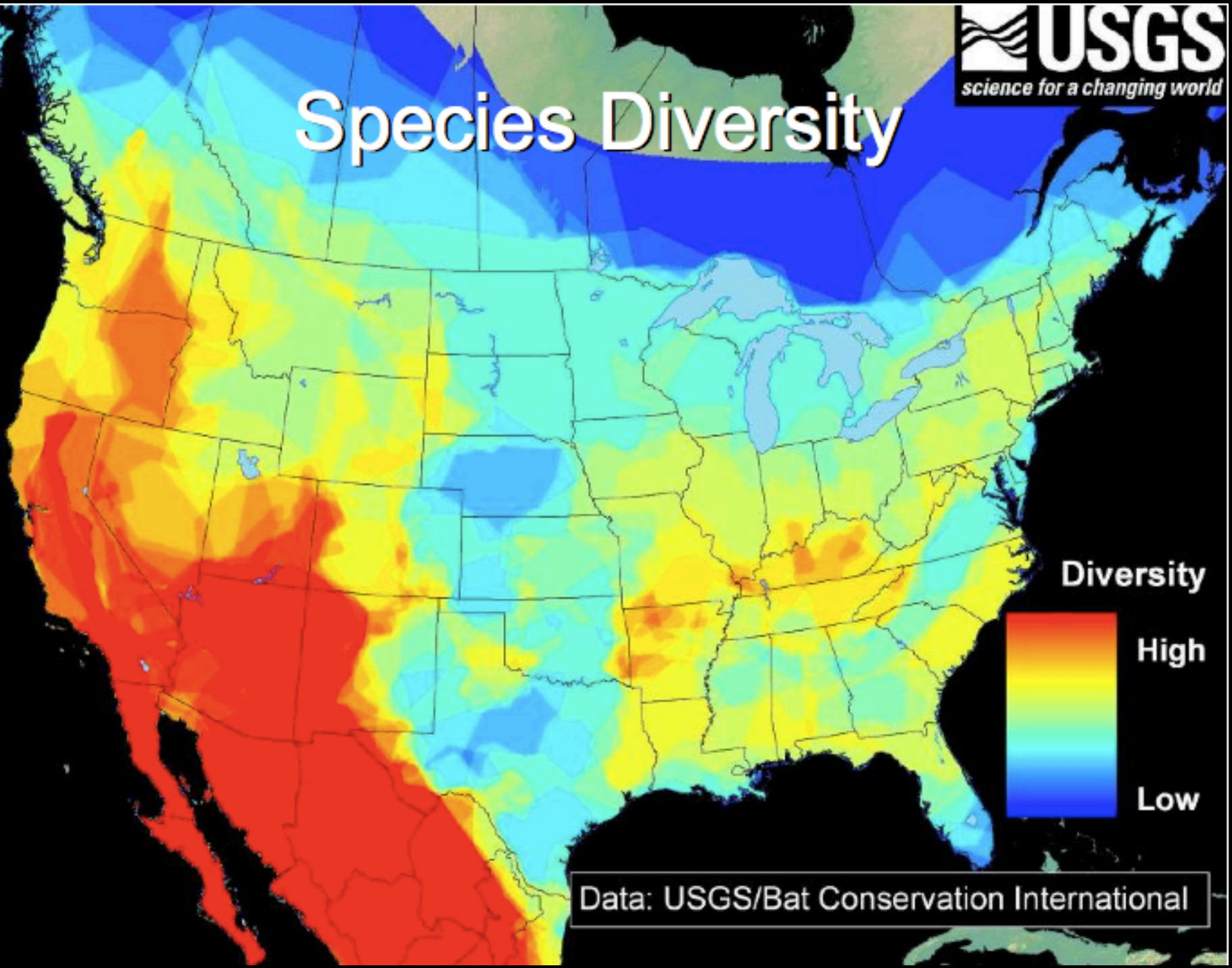


Fig. 7.7. Wing loading plotted against aspect ratio for an insectivorous bat community in an Australian mangrove forest. (a) All species in the region. (b) Examples of two of the six guilds studied, with the microhabitats in which each species foraged (adapted from McKenzie and Rolfe, 1986).

Species of bats in U.S.

<u>Species name</u>	<u>Common name</u>	<u>Species name</u>	<u>Common name</u>
1 <i>Mormoops megalophylla</i>	Ghost-faced bat	23 <i>Myotis ciliolabrum</i>	Western small-footed
2 <i>Choeronycteris mexicana</i>	Mexican long-tongued bat	24 <i>Myotis evotis</i>	Western long-eared myotis
3 <i>Leptonycteris nivalis</i>	Greater long-nosed bat	25 <i>Myotis grisescens</i>	Gray myotis
4 <i>Leptonycteris yerbabuanae</i>	Lesser long-nosed bat	26 <i>Myotis keenii</i>	Keen's myotis
5 <i>Macrotus californicus</i>	California leaf-nosed bat	27 <i>Myotis leibii</i>	Eastern small-footed myotis
6 <i>Antrozous pallidus</i>	Pallid bat	28 <i>Myotis lucifugus</i>	Little brown bat
7 <i>Corynorhinus townsendii</i>	Townsend's big-eared bat	29 <i>Myotis occultus</i>	Occult myotis
8 <i>Corynorhinus rafinesquii</i>	Rafinesque's big-eared bat	30 <i>Myotis septentrionalis</i>	Eastern long-eared myotis
9 <i>Eptesicus fuscus</i>	Big brown bat	31 <i>Myotis sodalis</i>	Indiana myotis
10 <i>Euderma maculatum</i>	Spotted bat	32 <i>Myotis thysanodes</i>	Fringed myotis
11 <i>Idionycteris phyllotis</i>	Allen's big-eared bat	33 <i>Myotis velifer</i>	Cave myotis
12 <i>Lasionycteris noctivagans</i>	Silver-haired bat	34 <i>Myotis volans</i>	Long-legged myotis
13 <i>Lasiurus blossevillii</i>	Western red bat	35 <i>Myotis yumanensis</i>	Yuma myotis
14 <i>Lasiurus borealis</i>	Eastern red bat	36 <i>Nycticeius humeralis</i>	Evening bat
15 <i>Lasiurus cinereus</i>	Hoary bat	37 <i>Parastrellus hesperus</i>	Canyon bat
16 <i>Lasiurus ega</i>	Southern yellow bat	38 <i>Perimyotis subflavus</i>	Eastern pipistrelle
17 <i>Lasiurus intermedius</i>	Northern yellow bat	39 <i>Eumops floridanus</i>	Florida bonneted bat
18 <i>Lasiurus seminolus</i>	Seminole bat	40 <i>Eumops perotis</i>	Greater mastiff bat
19 <i>Lasiurus xanthinus</i>	Western yellow bat	41 <i>Eumops underwoodi</i>	Underwood's mastiff bat
20 <i>Myotis auricolus</i>	Mexican long-eared myotis	42 <i>Molossus molossus</i>	Pallas' mastiff bat
21 <i>Myotis austroriparius</i>	Southeastern myotis	43 <i>Nyctinomops femorosacca</i>	Pocketed free-tailed bat
22 <i>Myotis californicus</i>	California myotis	44 <i>Nyctinomops macrotis</i>	Big free-tailed bat
		45 <i>Tadarida brasiliensis</i>	Brazilian free-tailed bat

Species Diversity



Data: USGS/Bat Conservation International

U.S. Endangered Species

Species name	Common name	Species name	Common name
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10 <i>Euderma maculatum</i>	Spotted bat	32 <i>Myotis thysanodes</i>	Fringed myotis
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		45 <i>Tadarida brasiliensis</i>	Brazilian free-tailed bat

U.S. Species of Concern

Species name	Common name	Species name	Common name
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		45 <i>Tadarida brasiliensis</i>	Brazilian free-tailed bat

Federal Register 61(235):64481-64485

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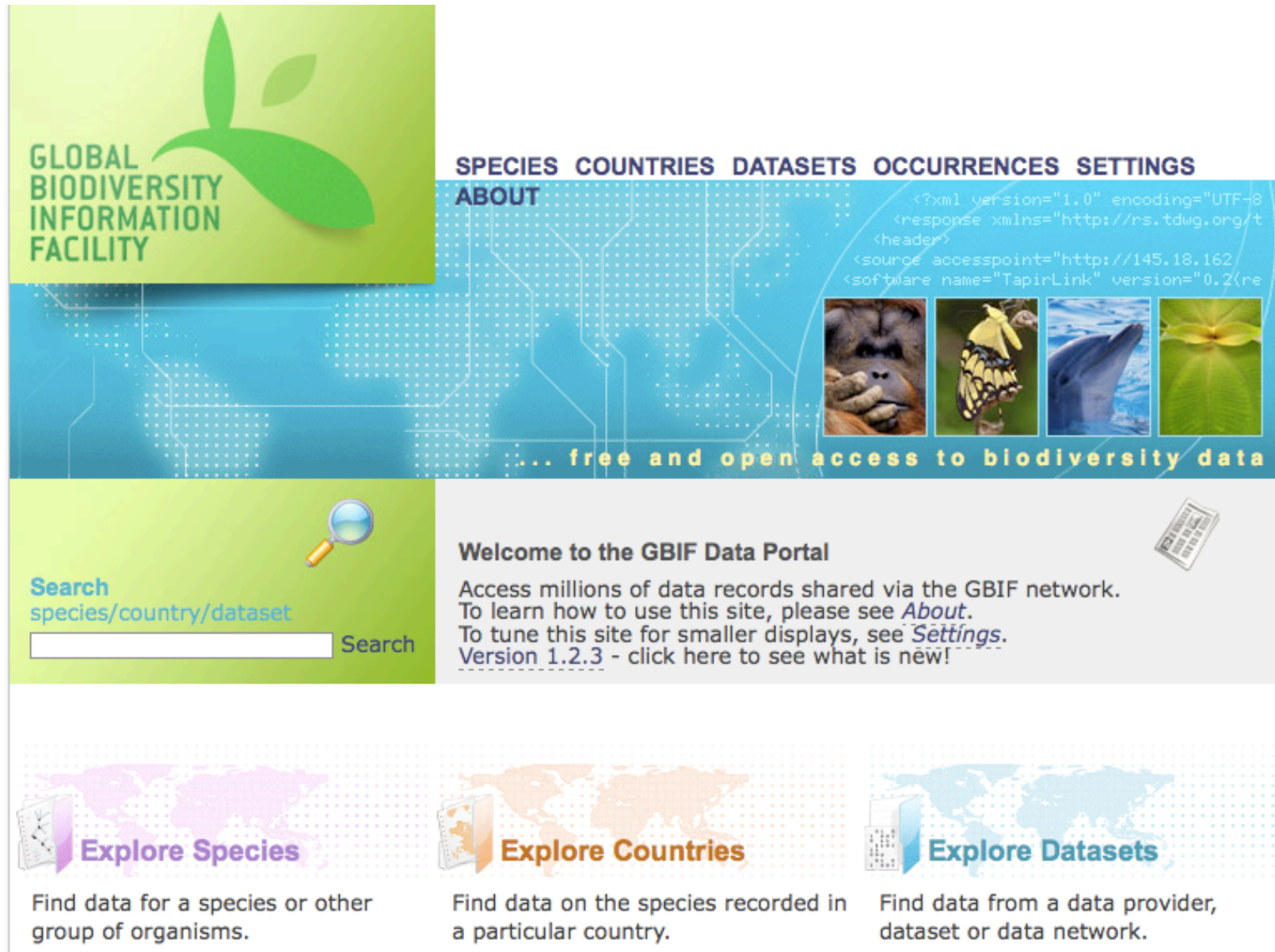
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- [Furipteridae](#) +
- [Megadermatidae](#) +
- [Molossidae](#) +
- [Mormoopidae](#) +
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- [Myzopodidae](#) +
- [Natalidae](#) +
- [Noctilionidae](#) +
- [Nycteridae](#) +
- [Phyllostomidae](#) +
- [Pteropodidae](#) +
- [Rhinolophidae](#) +
- [Rhinopomatidae](#) +
- [Thyropteridae](#) +
- [Vesperilionidae](#) +

Global Biodiversity Information Facility (GBIF)



The image shows a screenshot of the GBIF Data Portal homepage. The top section features a green header with the GBIF logo and navigation links for SPECIES, COUNTRIES, DATASETS, OCCURRENCES, and SETTINGS. Below this is a blue banner with a circuit-like pattern, containing a search bar, a magnifying glass icon, and a search button. The main content area is white and contains a welcome message, a search bar, and three world map icons with corresponding text: 'Explore Species', 'Explore Countries', and 'Explore Datasets'. The bottom section is a light blue footer with a grid pattern.

GLOBAL BIODIVERSITY INFORMATION FACILITY

SPECIES COUNTRIES DATASETS OCCURRENCES SETTINGS

ABOUT

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... free and open access to biodiversity data

Search
species/country/dataset

Search

Welcome to the GBIF Data Portal

Access millions of data records shared via the GBIF network.
To learn how to use this site, please see *About*.
To tune this site for smaller displays, see *Settings*.
Version 1.2.3 - click here to see what is new!

Explore Species
Find data for a species or other group of organisms.

Explore Countries
Find data on the species recorded in a particular country.

Explore Datasets
Find data from a data provider, dataset or data network.



USGS Bat Population Database for the United State and Trust Territories

The U.S. Geological Survey's Bat Population Database (BPD) is a work in progress. It is a compilation of information that relates primarily to colony size estimates or similar data for bats in the U.S. and Territories. The main objectives of the BPD when completed will be to test the utility of existing data as a framework for estimating trends in bat populations and to allow researchers and resource managers access to local historic information that may provide useful comparisons for planning new investigations on bat population trends. Macrobiogeographic and other analyses that involve bat colony sizes, roost types, and so forth may also find this database useful. It is also a source of bibliographic information related to bat populations. The BPD is not intended to be a database of species distribution records, although information it includes may be useful in this regard. Precise location information cannot be obtained directly from the BPD, but must be gathered through the original sources provided. For further information and recommendations on improving methods of monitoring populations please see the pdf file with the Interim Report of the Workshop on Monitoring Trends in U.S. Bat Populations.

This site is in a test mode. We welcome suggestions on format, additional sources of bat population data, and notation of errors by participants who visit the BPD web site while it is still in the process of compilation. It would be useful to cite the Obs ID number if you relay information to us about errors.

This project was developed by [Laura E. Ellison](#), [A. Lance Everette](#), and Diane M. Schneider of the U.S. Geological Survey's Fort Collins Science Center, under the direction of [Thomas J. O'Shea](#) and [Michael A. Bogan](#). Funding was awarded through a national peer-reviewed redirection competition under the now defunct National Biological Service, based in part on needs expressed by Department of the Interior resource management agencies for obtaining a better understanding of the status of bat populations in the U.S. and Territories. The U.S. Geological Survey's National Biological Information Infrastructure is facilitating final compilations, error scanning, and Internet serving. Susan Jojola-Elverum, John Crosby, Kevin Castle, and Laura Stone provided assistance with data entry. Paul Cryan and John Crosby checked the entire database for errors made during data compilation and entry. We are grateful to the many organizations that provided access to records on bat colony sizes for this database, including Natural Heritage programs and game and fish departments of several states, and others as credited in the data source columns accompanying each record.

Bat Population DBase

- ▶ [BPD Home](#)
- ▶ [Monitoring trends in bat populations of the United States and territories](#)
- ▶ [Species Search](#)
- ▶ [State Search](#)
- ▶ [Bibliographic Search](#)