

Main Points

1) Mammalian Characteristics:

Diversity, Phylogeny, and Systematics:

- **Infraclass Eutheria**
- **Orders Scandentia through Cetacea**

2) The Great American Interchange

- **dispersal versus vicariance**
- **example: recent range expansion of nine-banded armadillos**

3) Evolution of body size on islands

- **the island rule**
- **example: sloth evolution in the Caribbean**

4) Terms: arboreal, saltatorial, myrmecophagy, folivory, dispersal, vicariance, island rule, cursorial, ruminant, cecum, Cetartiodactyla

Pre-reading: Wednesday 16 Sep = Sykes et al 2014, MacLeod 2014

Monday 21 Sep = Nagasawa et al 2015

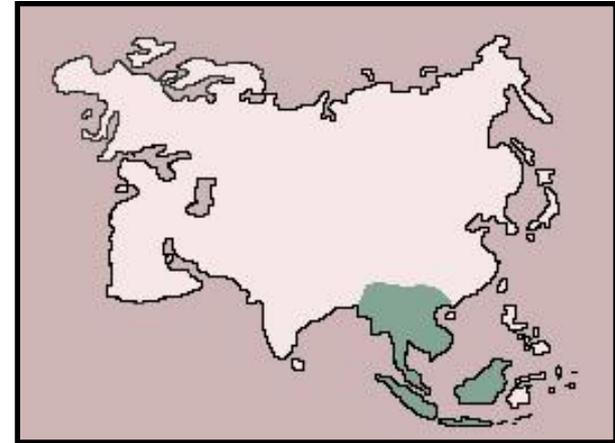
Order Scandentia: tree shrews

Taxonomy: 1 family, 19 species

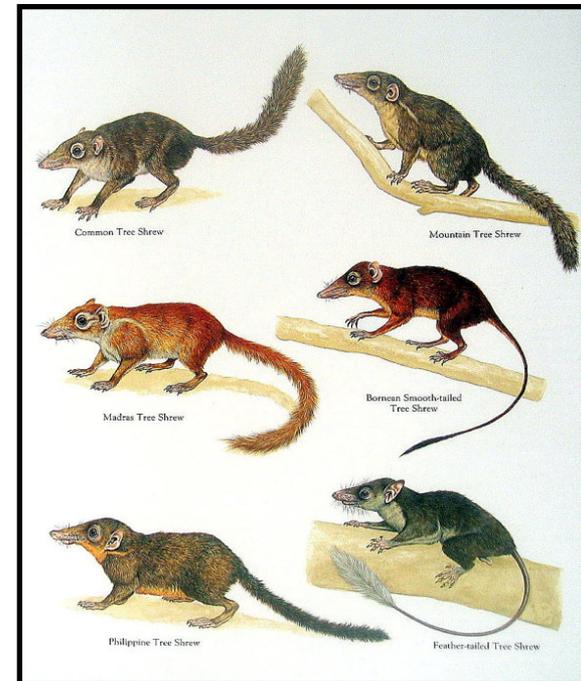
Distribution: Oriental

Characteristics:

- arboreal
- highest brain:body mass of any group of mammals



large tree shrew



Order Lagomorpha: hares, rabbits, pikas

Taxonomy: 2 families, 80 species

Distribution: cosmopolitan, except Australasia

Characteristics:

-- **incisors grow continuously**

-- **saltatorial with hind limbs longer than forelimbs**

black-tailed jackrabbit



mountain cottontail



American pika



Order Rodentia: rodents

Taxonomy: 29 families, 2024 species

Distribution: cosmopolitan

Characteristics:

- incisors grow continuously throughout life**
- skull and jaw musculature adapted for gnawing**

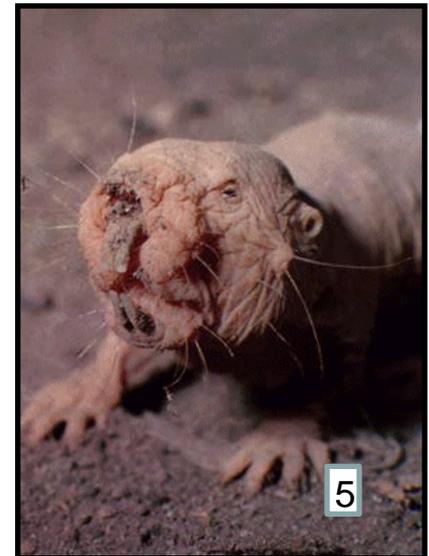
capybara



Lord Derby's anomalure



naked mole rat



Order Cingulata: armadillos

Taxonomy: 1 family, 21 species

Distribution: Neotropical, 1 species Nearctic

Characteristics:

- bony plates on head and body
- myrmecophagous

screaming hairy armadillo



giant armadillo

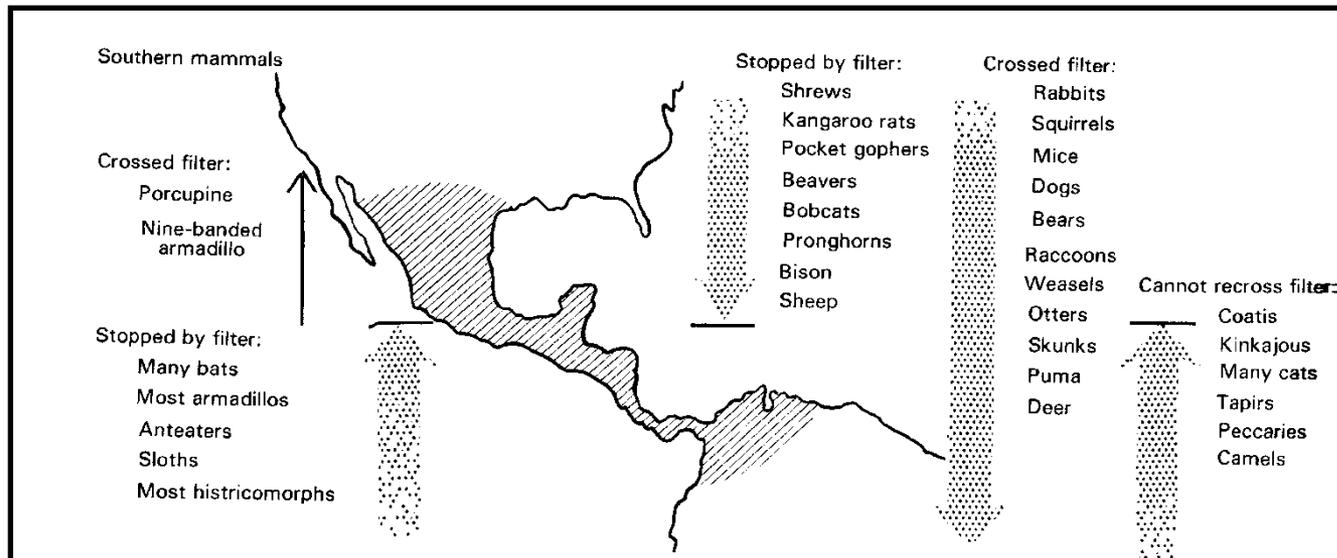


fairy armadillo

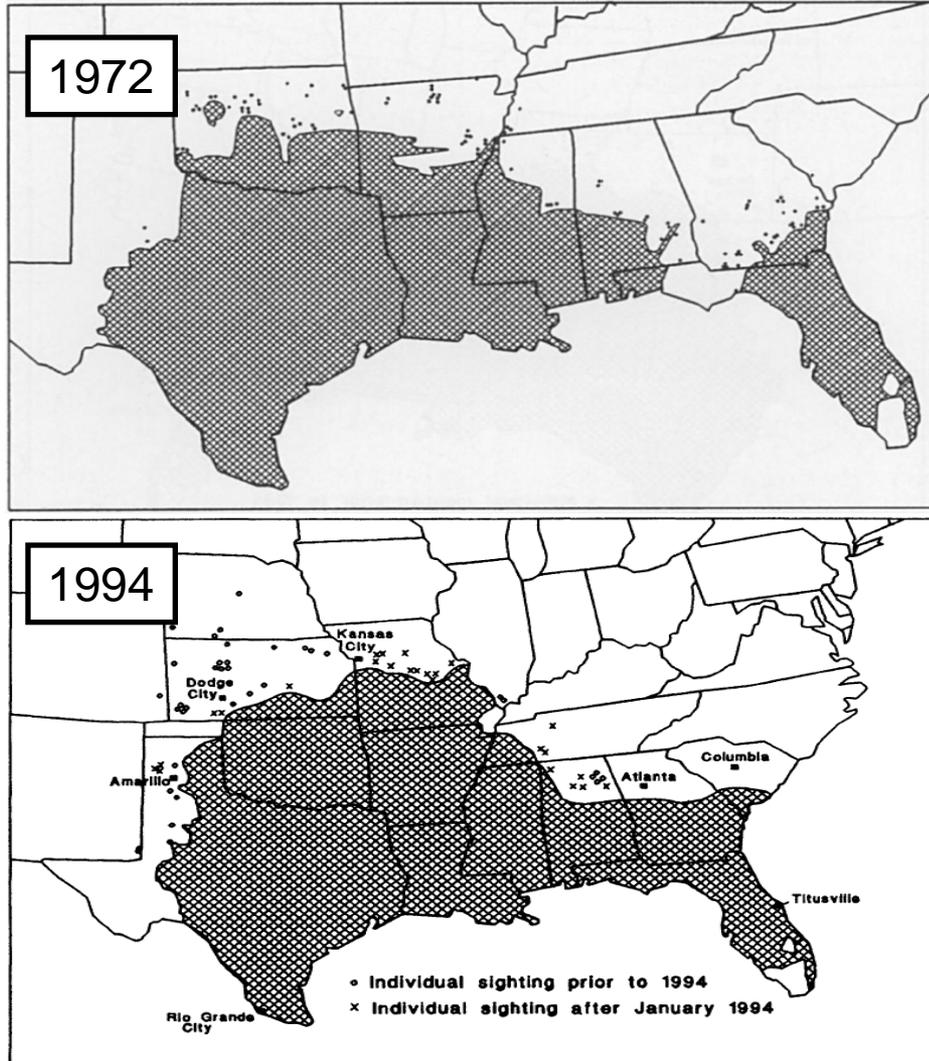


The Great American Interchange

- **Joining of Nearctic and Neotropical zoogeographic regions roughly 3 MYA**
 - many Nearctic taxa migrated southward; few Neotropical taxa migrated northward
 - mass extinctions of Neotropical metatherians



Recent range expansion by the nine-banded armadillo

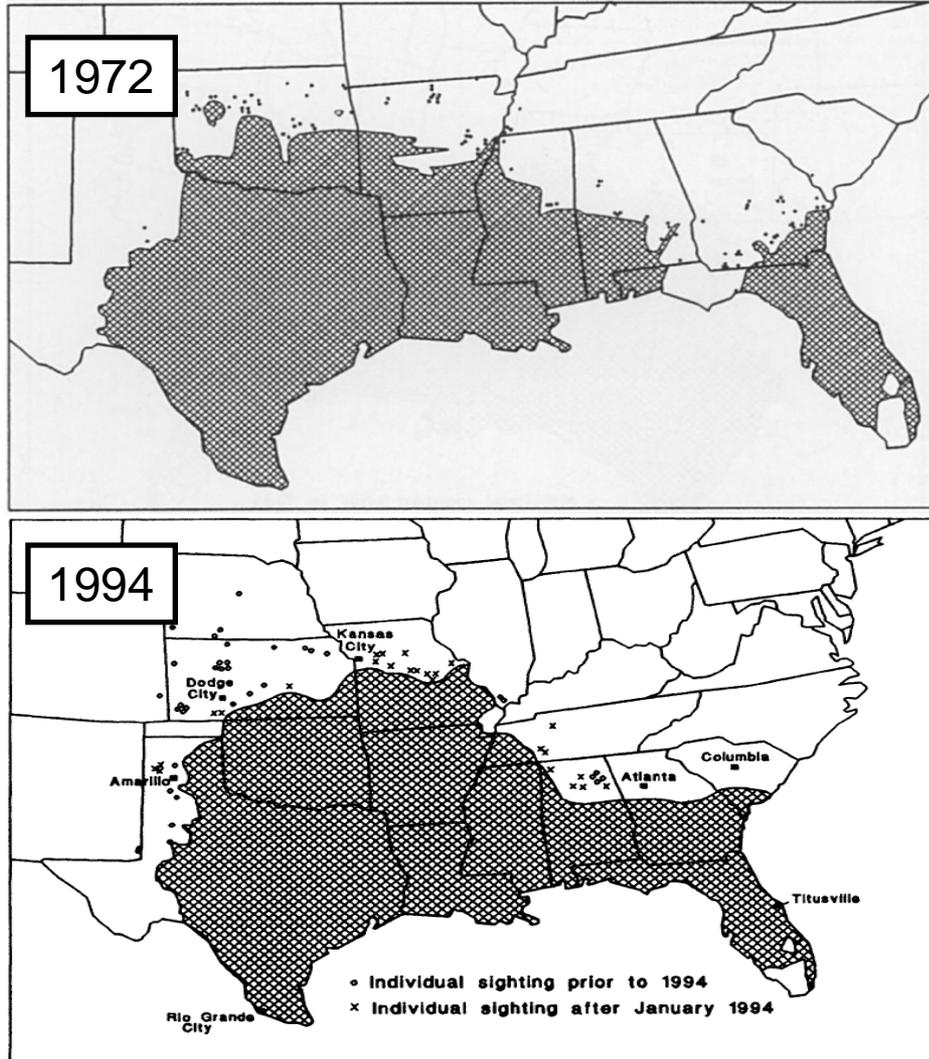


- Northward expansion of 10 km/year since 1940s

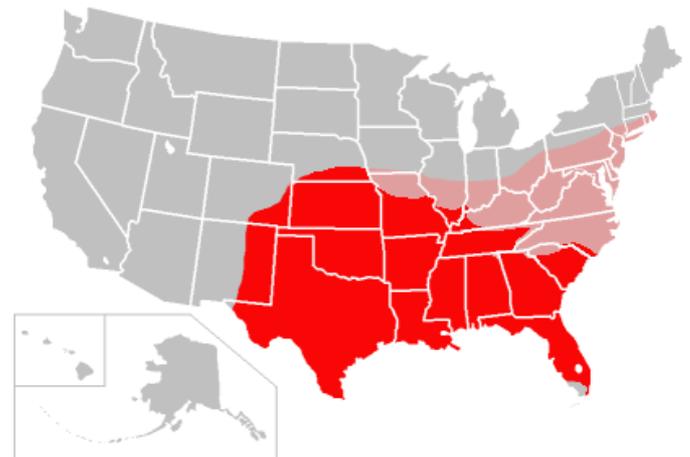
nine-banded armadillo



Recent range expansion by the nine-banded armadillo



- Northward expansion of 10 km/year since 1940s
- Ultimately might be limited by rainfall (to the west) and temperature (to the north)



Red = 2009 distribution
Pink = predicted future distribution

Historical Biogeography—Dispersal vs. Vicariance

- **Dispersal (biogeographic context) = migration across preexisting geographic barriers**

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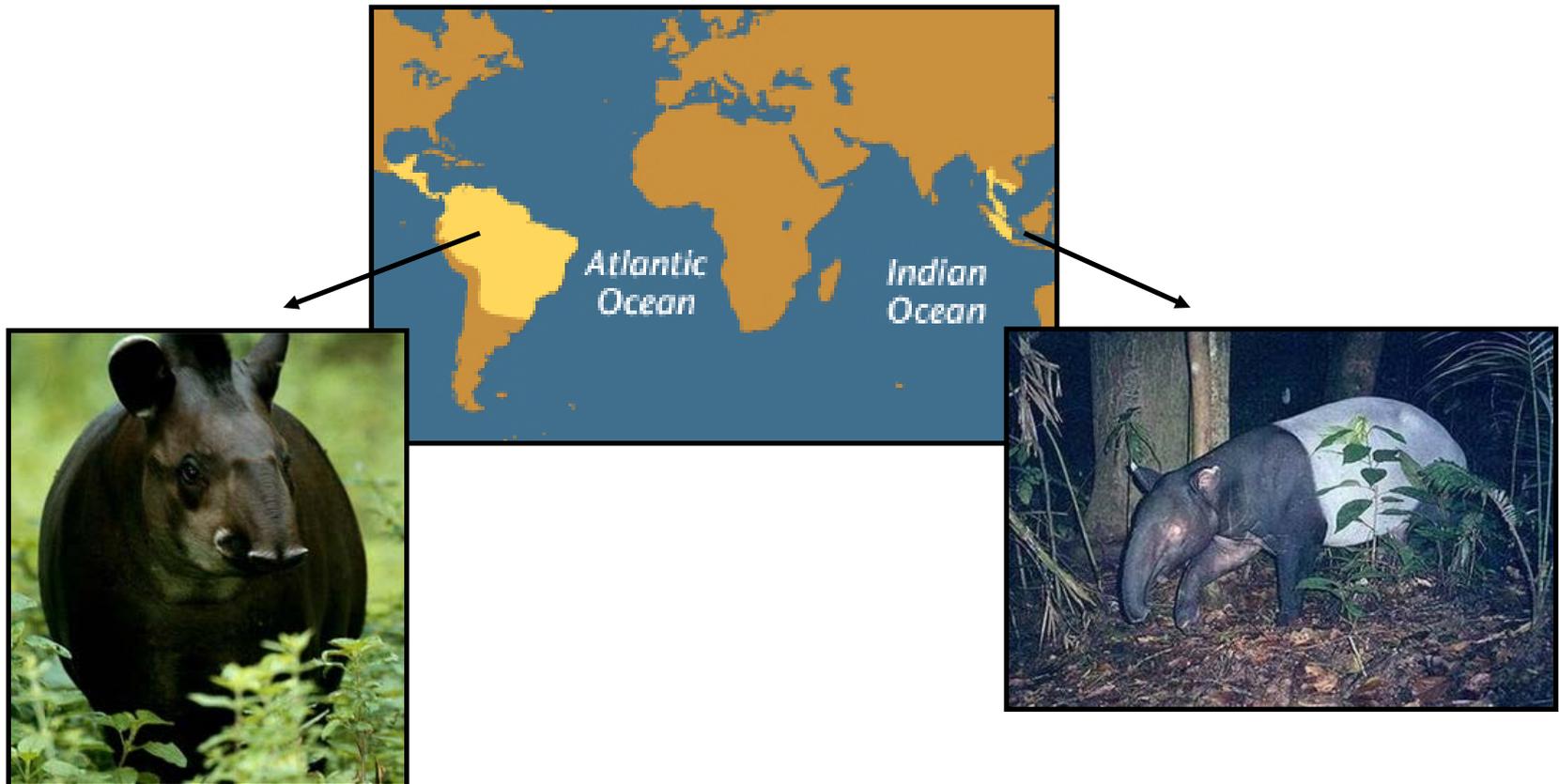


Historical Biogeography—Dispersal vs. Vicariance

- **Vicariance** = formation of geographic barriers across preexisting geographic ranges

Historical Biogeography—Dispersal vs. Vicariance

- **Vicariance** = formation of geographic barriers across preexisting geographic ranges



Order Pilosa: true anteaters and sloths

Taxonomy: 4 families, 10 species

Distribution: Neotropical

silky anteater



two-toed sloth



giant anteater



Order Pilosa: true anteaters and sloths

Characteristics:

- incomplete zygomatic arches
- no enamel on cheek teeth
- myrmecophagous (anteaters) or folivorous (sloths)



silky anteater



two-toed sloth



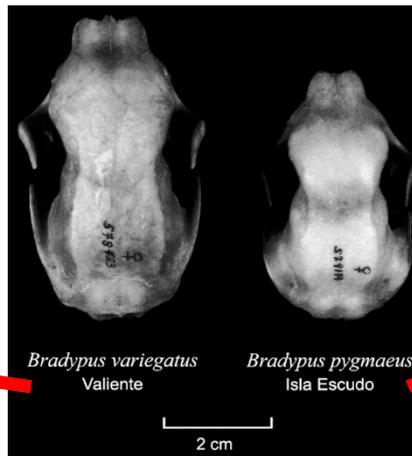
giant anteater



Evolution of Gigantism and Dwarfism

- island rule = on islands, the tendency for small species to increase in size (gigantism), and large species to decrease in size (dwarfism), over evolutionary time scales

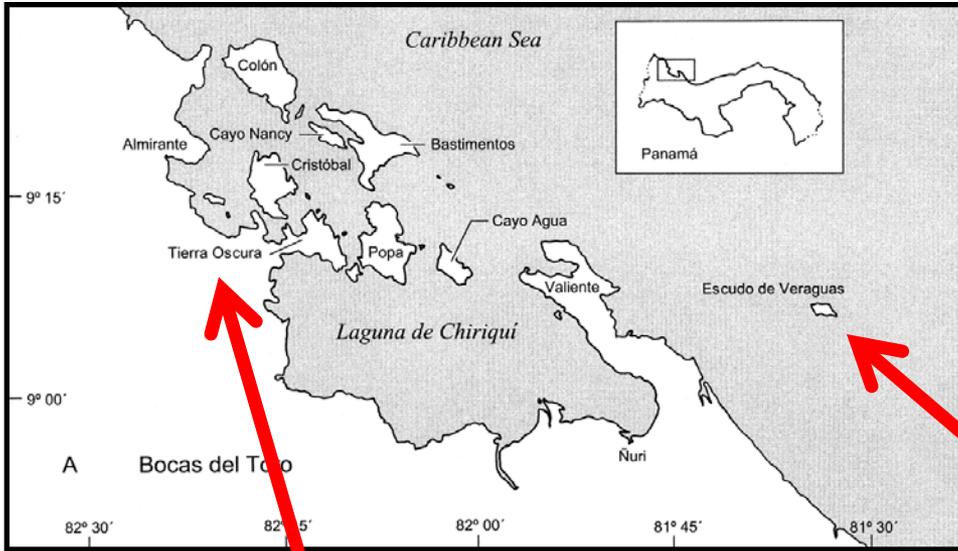
brown-throated sloth (~7 kg)



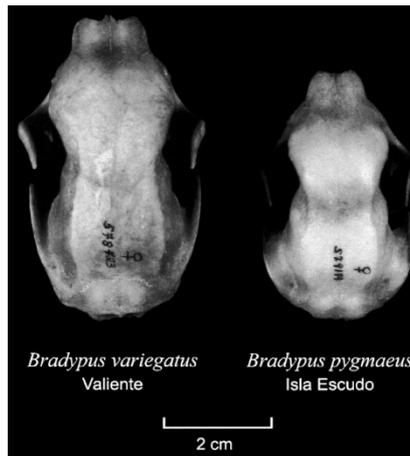
pygmy sloth (~3 kg)



Evolution of Gigantism and Dwarfism



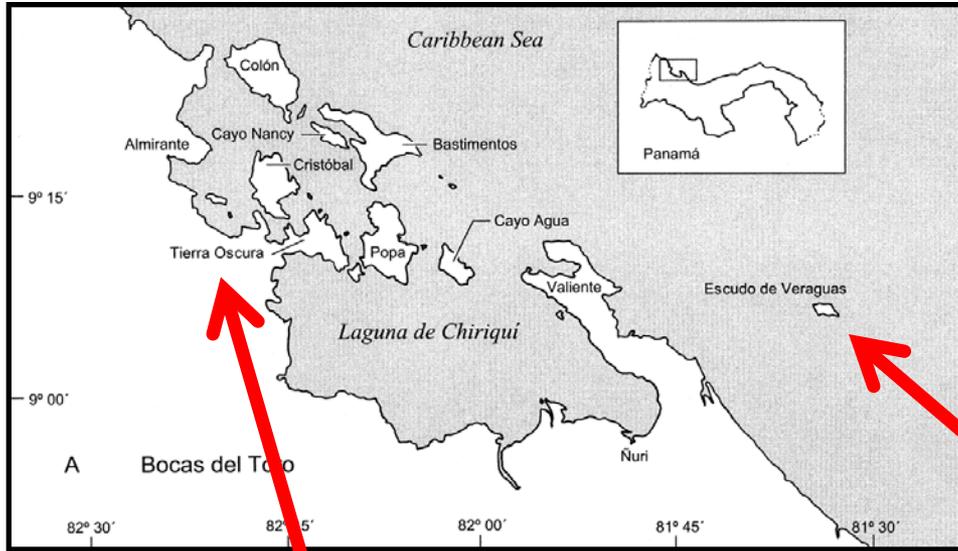
brown-throated sloth (~7 kg)



pygmy sloth (~3 kg)



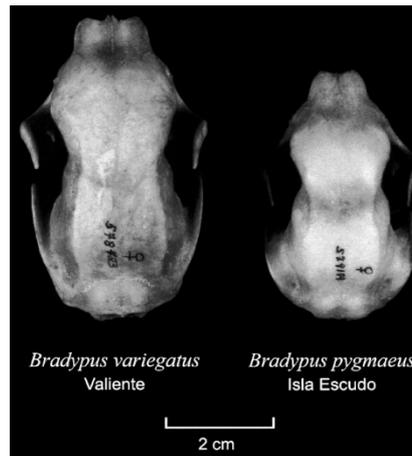
Discussion question: come up with a hypothesis for the island rule. What does your hypothesis predict?



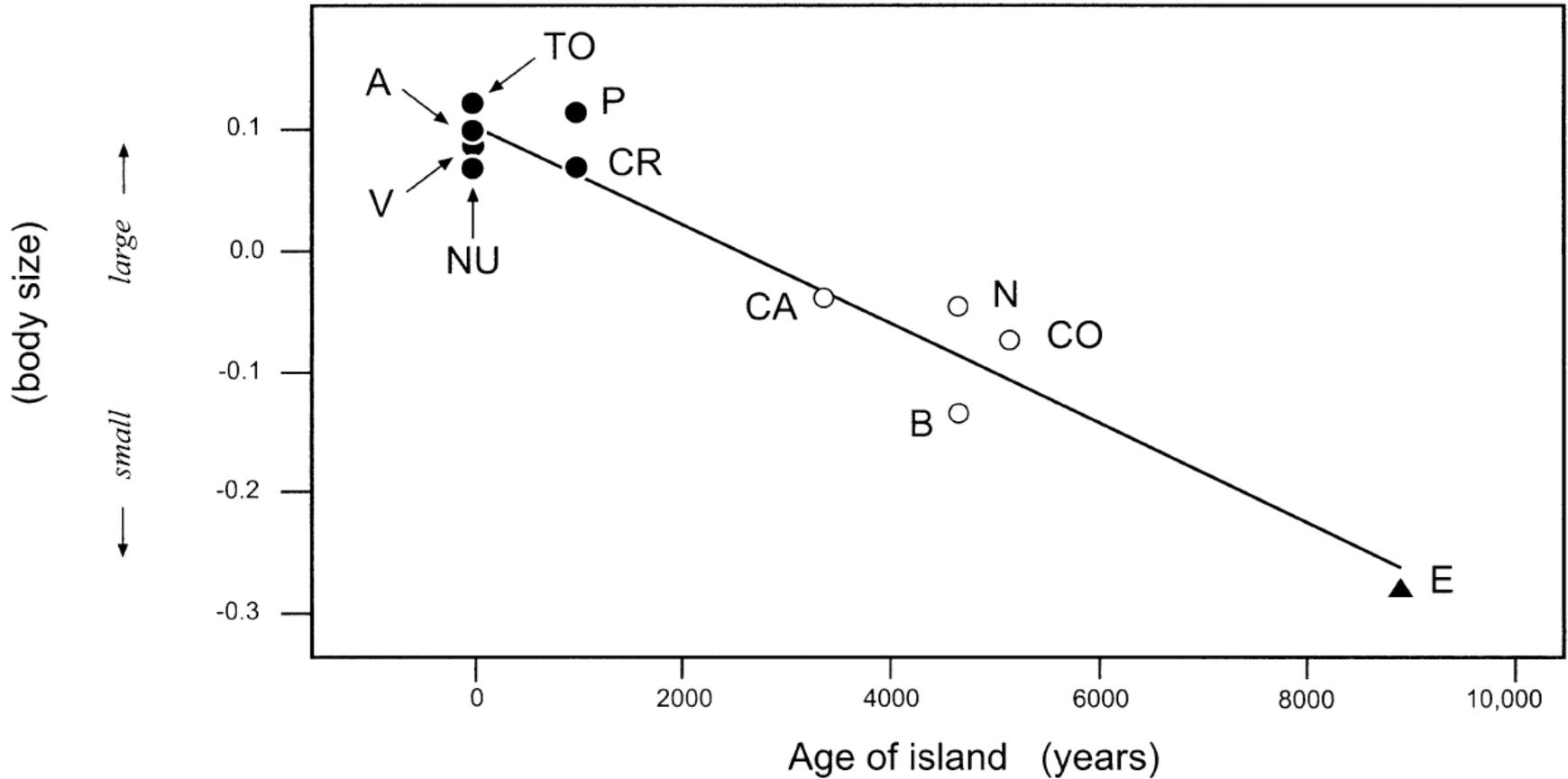
brown-throated sloth (~7 kg)



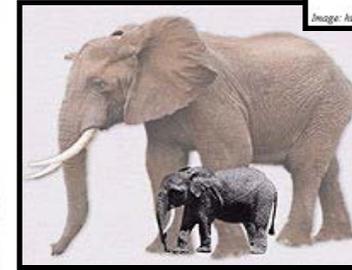
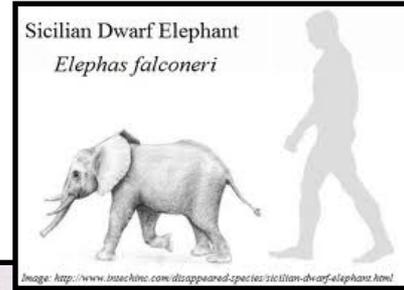
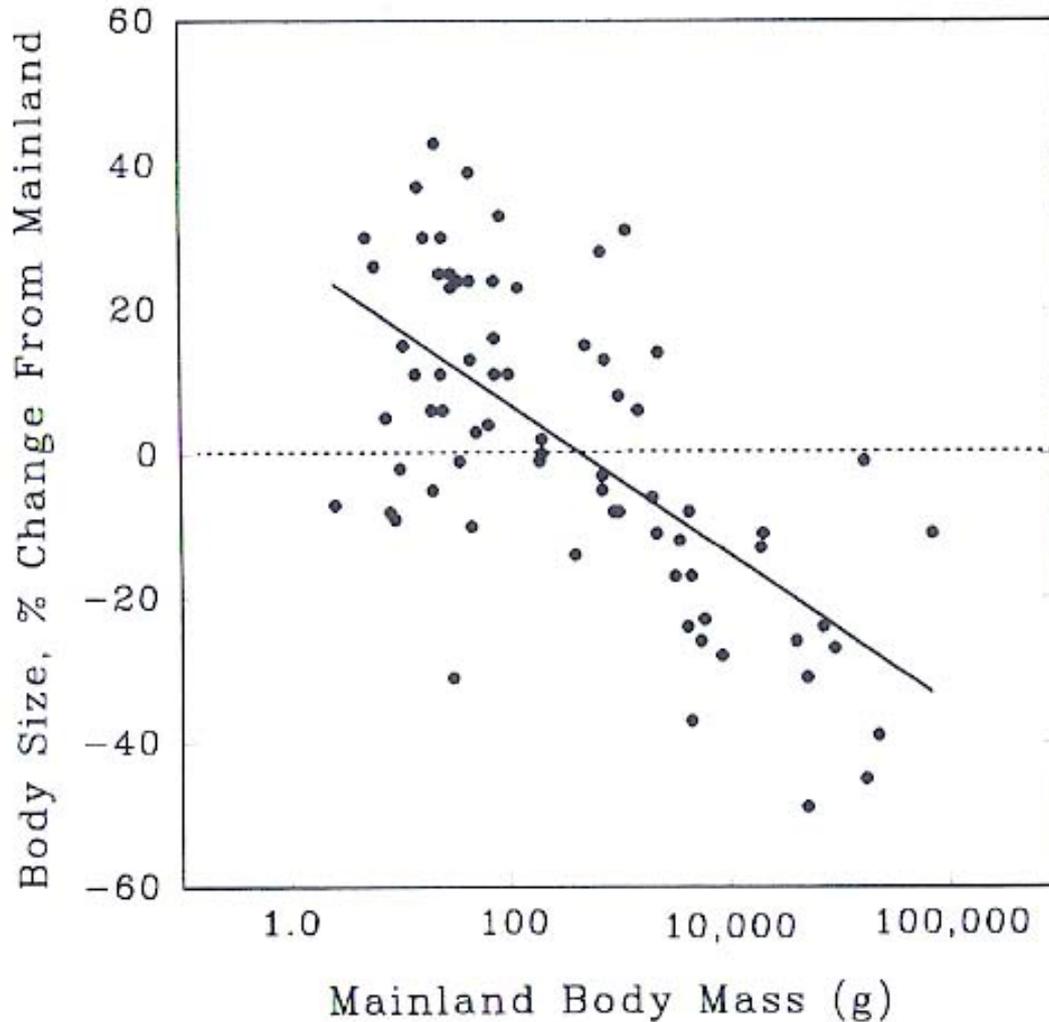
pygmy sloth (~3 kg)



Evolution of Gigantism and Dwarfism



Evolution of Gigantism and Dwarfism



island wood mouse
(35 g)



wood mouse (15 g)

Order Artiodactyla: even-toed ungulates

Taxonomy: 10 families, 220 species

Distribution: cosmopolitan, excepting Australasia

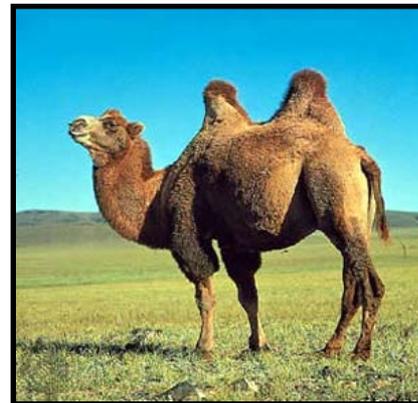
Characteristics:

- cursorial or aquatic
- weight borne on 3rd and 4th digit
- many with ruminant stomach or cecum

musk deer



bactrian camel



bighorn sheep



river hippopotamus



Discussion question: Wong describes the history of how artiodactyls (and hippos in particular) were discovered to be ancestral to whales.

To you, what was the most convincing piece of evidence for this?

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fossil whale

pronghorn

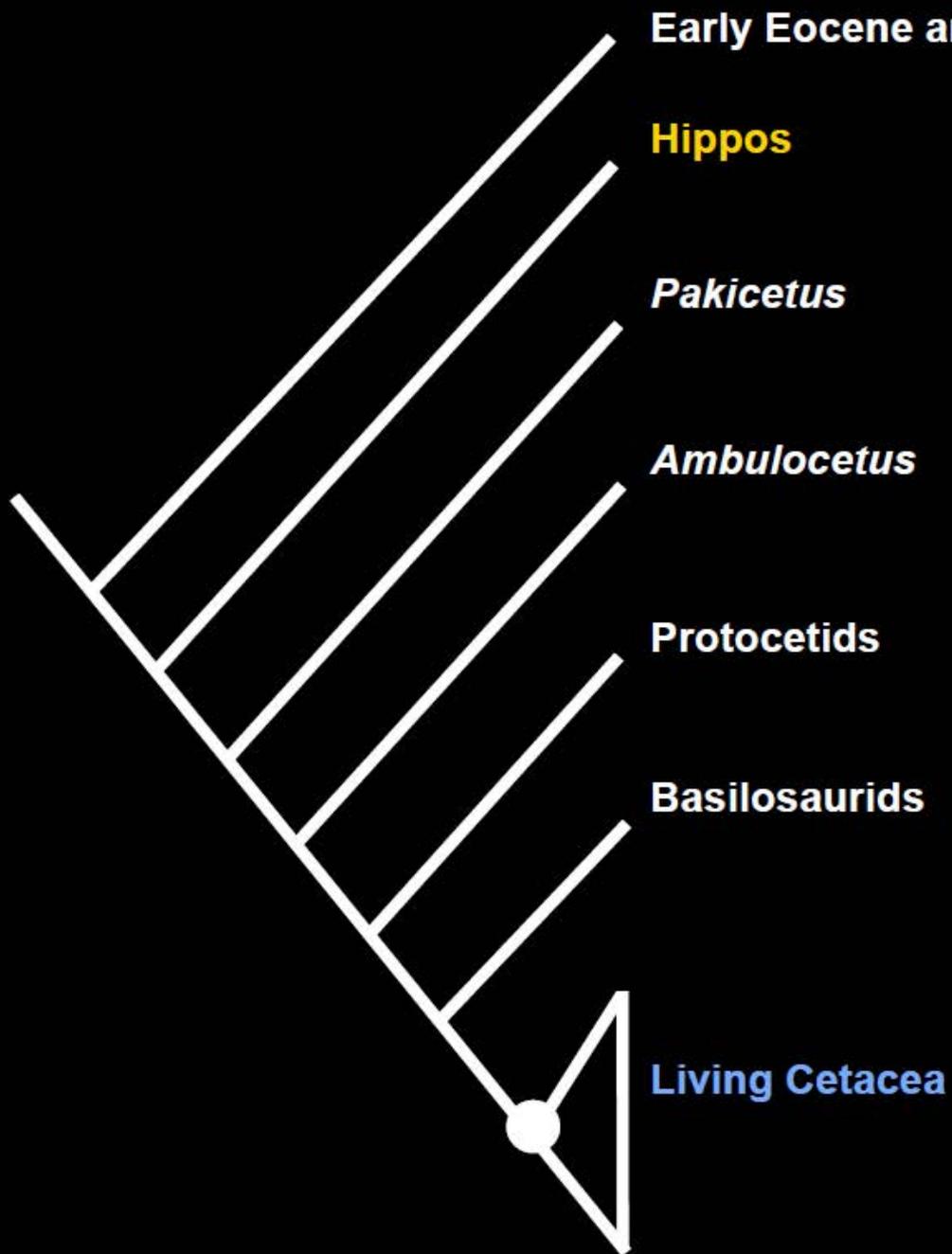
fossil whale

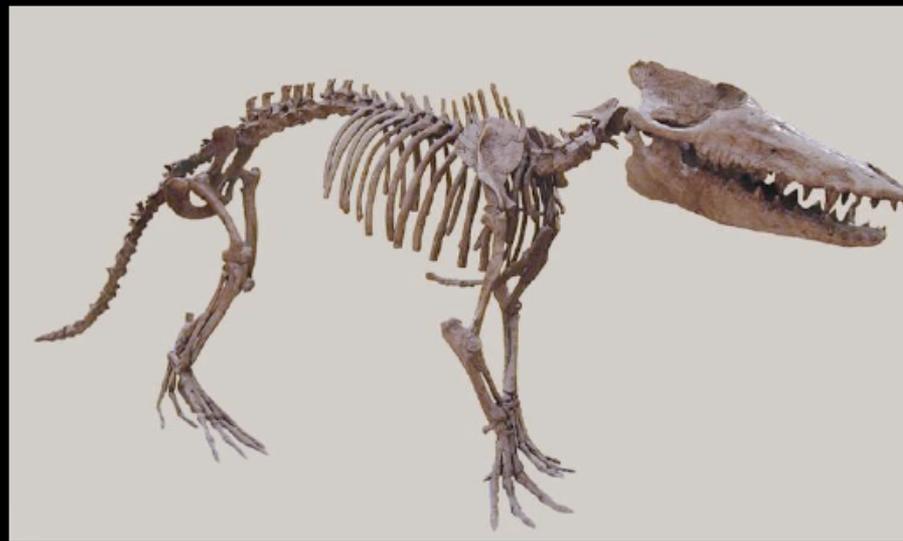
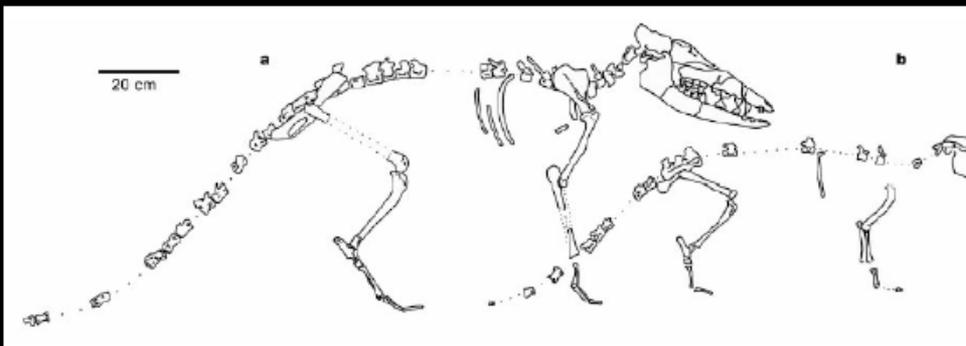
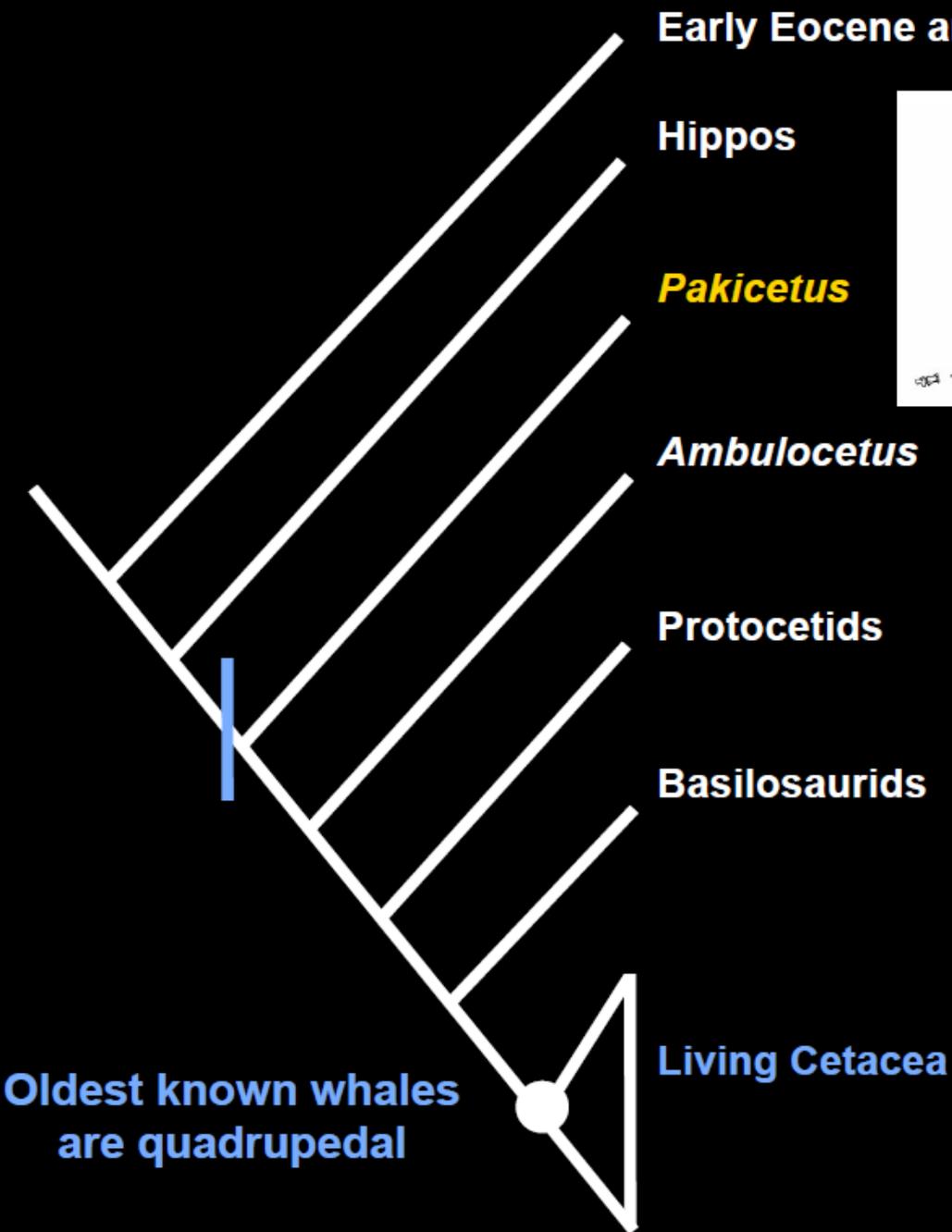


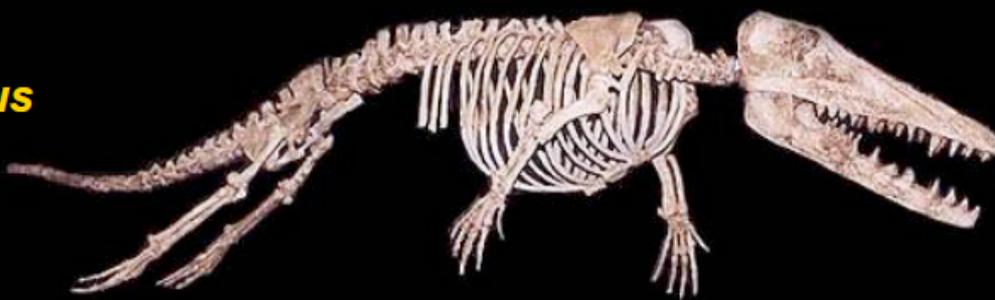
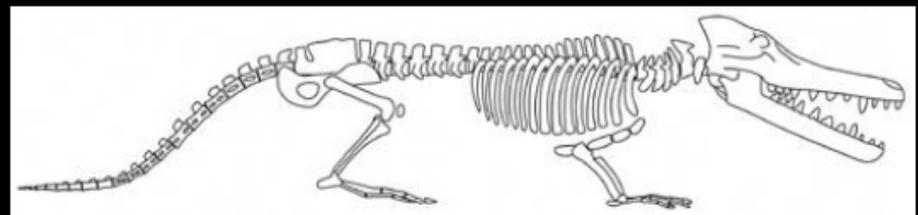
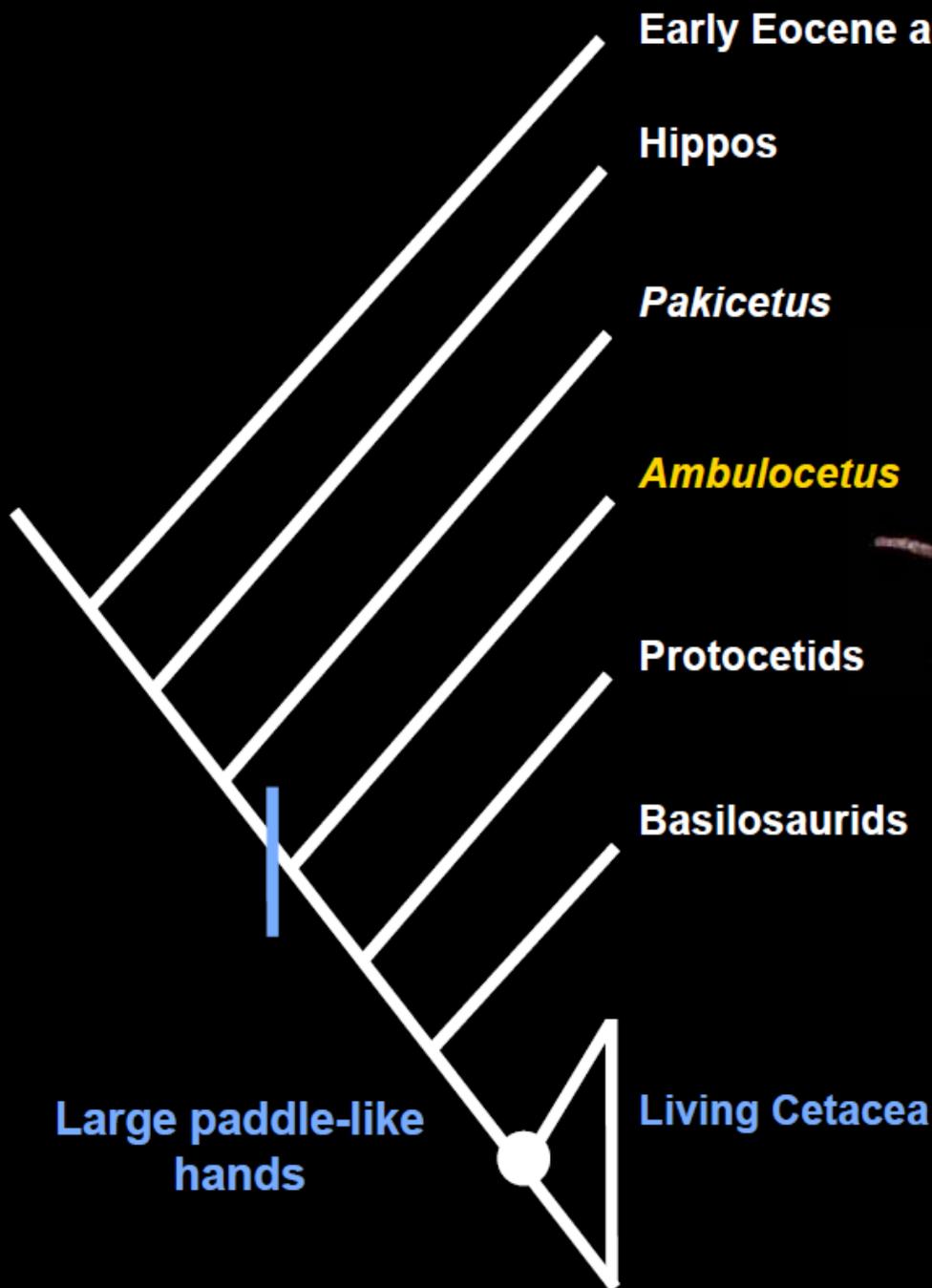
The origin of whales

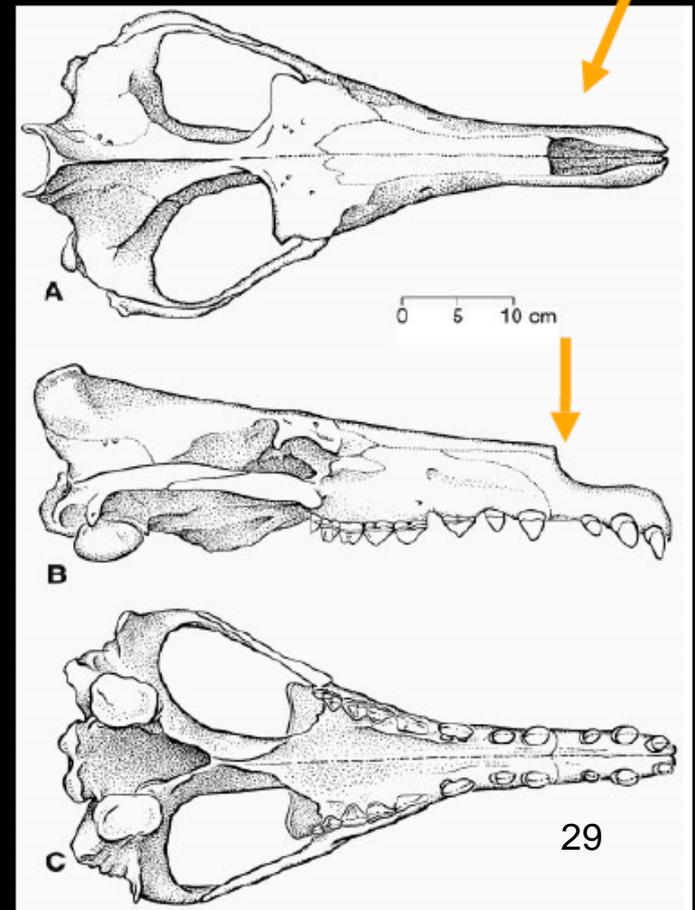
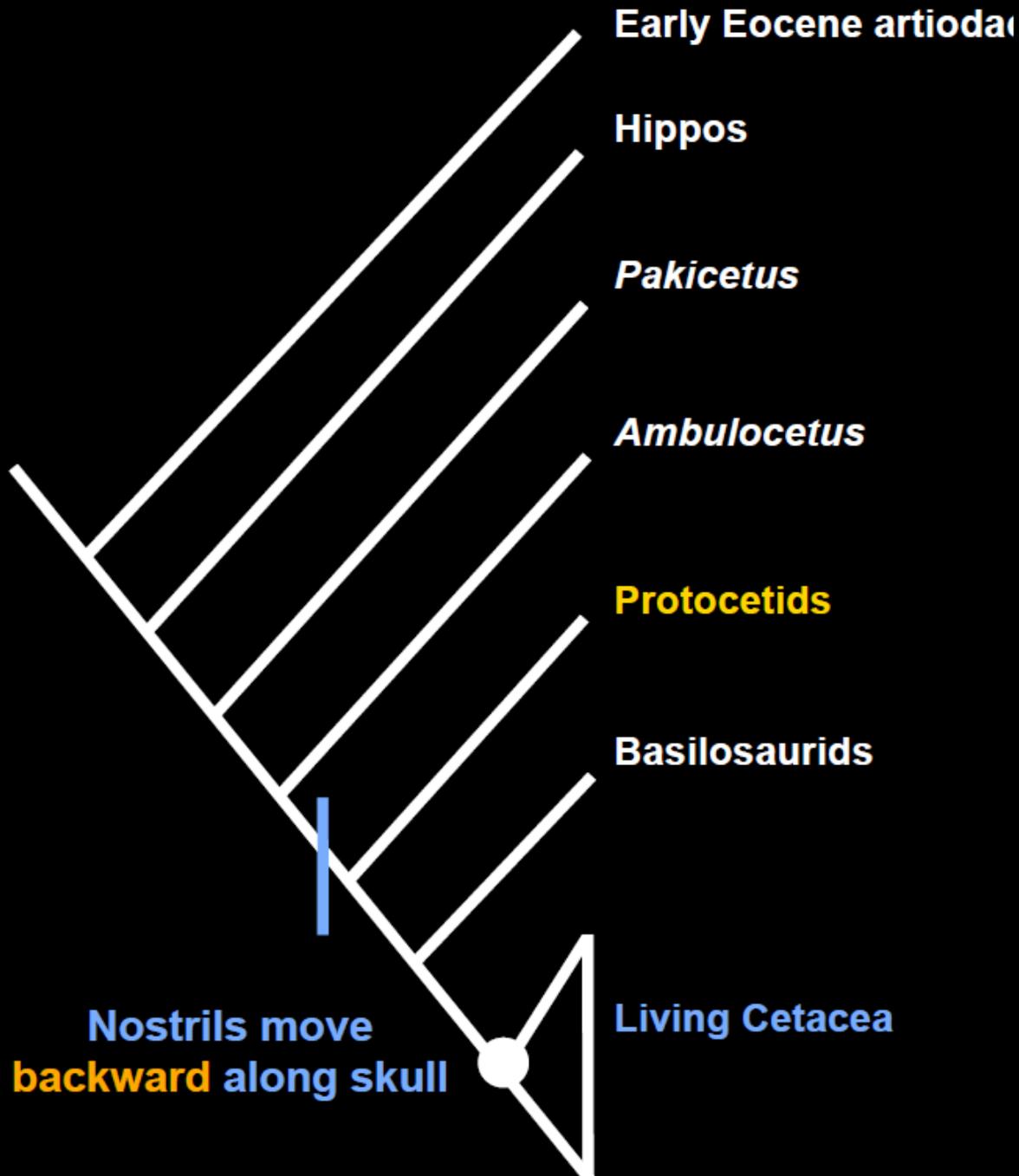
The absence of unambiguous transitional fossils is illustrated by the fossil record of whales. The earliest forms of whales occur in rocks of Eocene age, dated some 50 million years ago, but little is known of their possible ancestors. By and large, Darwinists believe that whales evolved from a land mammal. **The problem is that there are no clear transitional fossils linking land mammals to whales.**”

Of Pandas and People (pp. 101-102)









Early Eocene artiodactyls

Hippos

Pakicetus

Ambulocetus

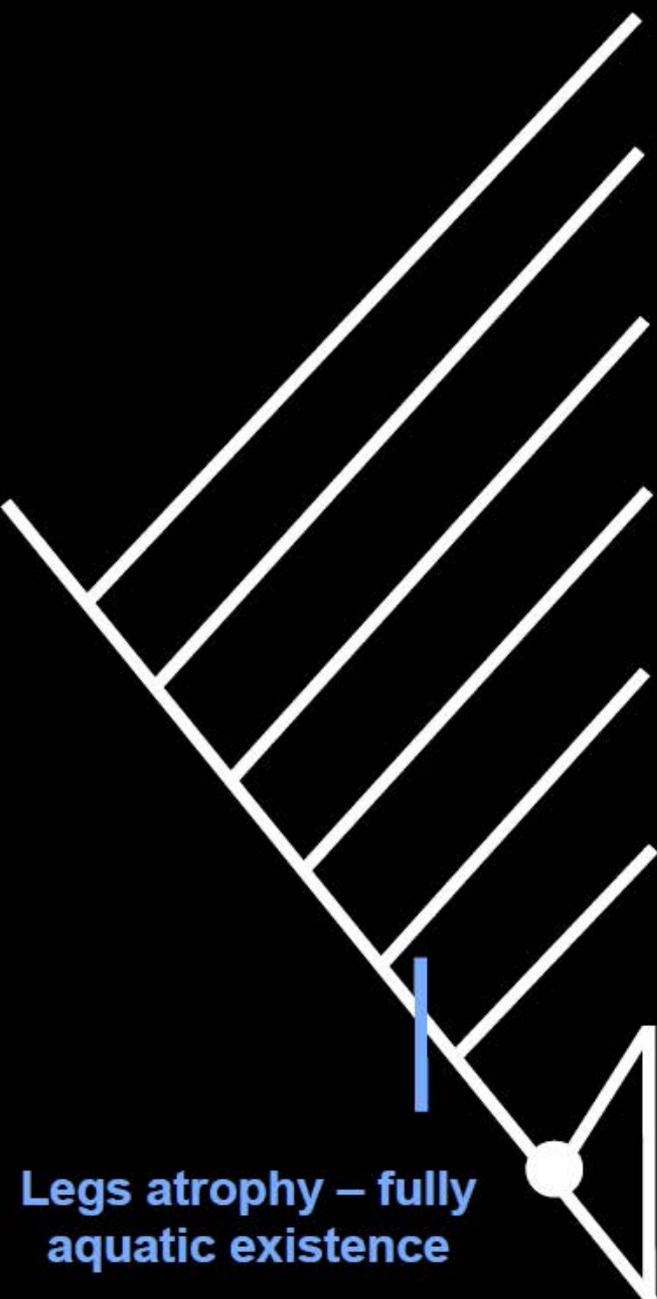
Protocetids

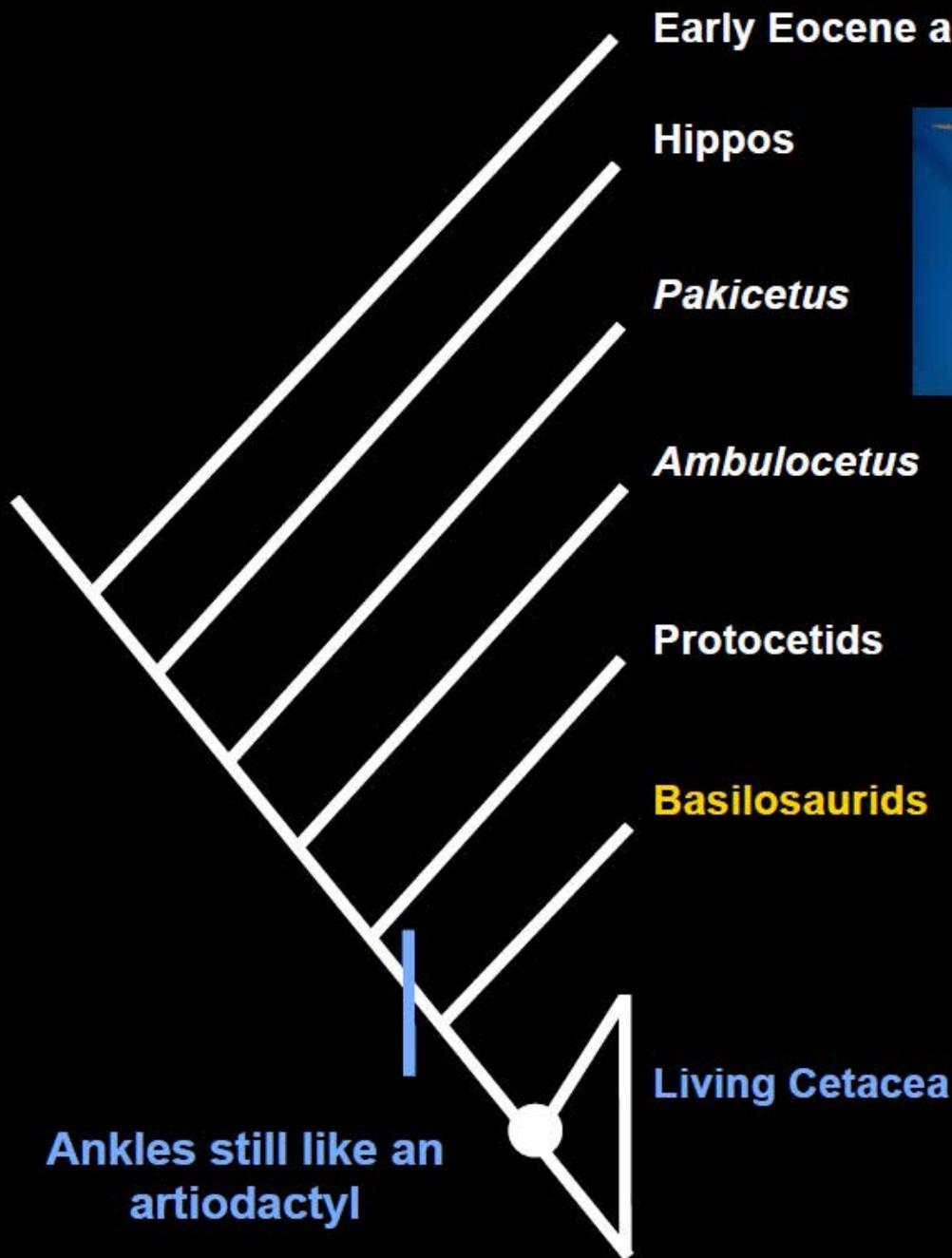
Basilosaurids

Living Cetacea



Legs atrophy – fully aquatic existence





Early Eocene artiodactyls

Hippos

Pakicetus

Ambulocetus

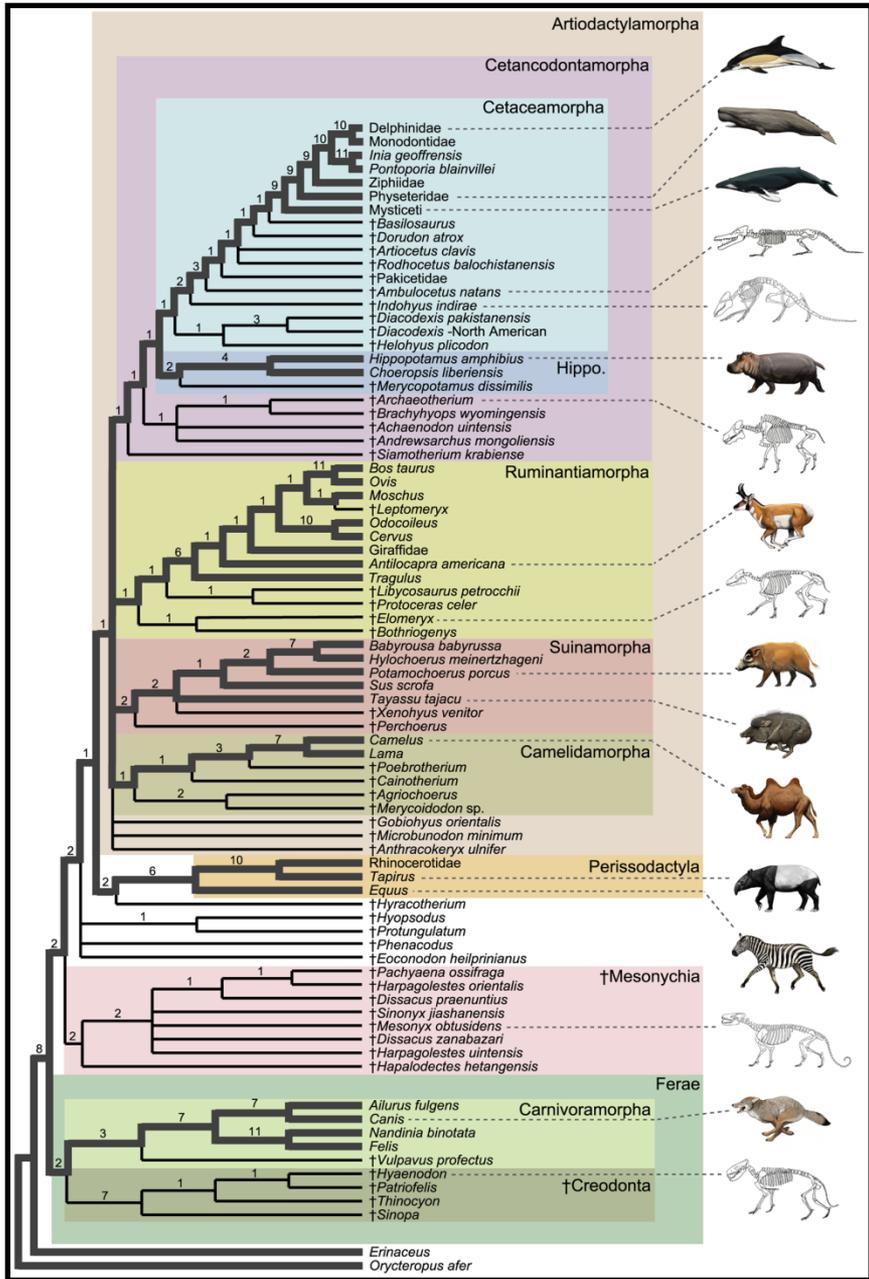
Protocetids

Basilosaurids

Living Cetacea

Ankles still like an artiodactyl





Cetartiodactyla

Order Cetacea: whales, dolphins, porpoises

Taxonomy: 10 families, 78 species

Distribution: Oceanic, rivers of Neotropical and Oriental

Characteristics:

- fusiform body with modified forelimbs and vestigial hind limbs**
- posterior migration of external nares**

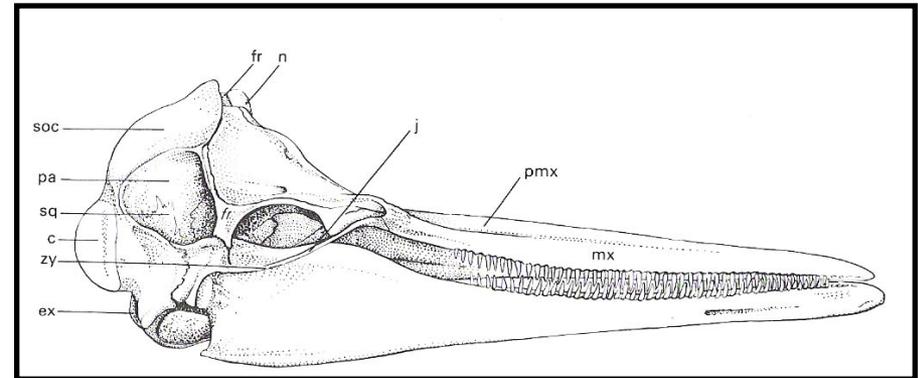
Suborder Odontoceti: toothed whales

Taxonomy: 6 families, 67 species

Distribution: Oceanic, rivers of Neotropical and Oriental regions

Characteristics:

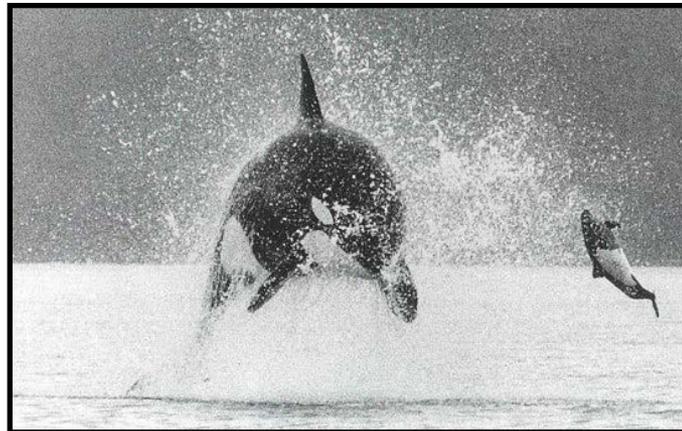
- single narial opening
- homodont dentition
- echolocation



narwals



orca and harbor porpoise



baiji



Suborder Mysticeti: baleen whales

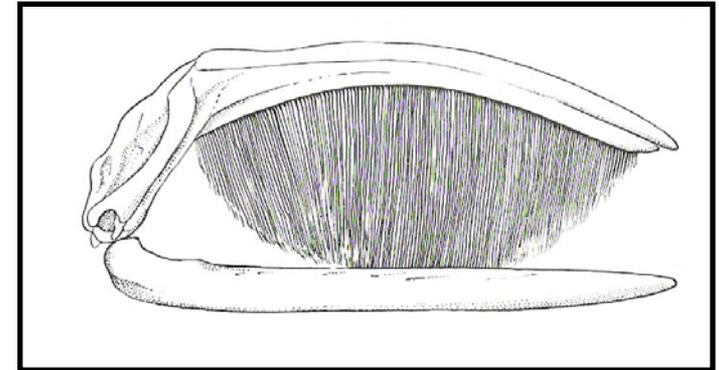
Taxonomy: 4 families, 11 species

Distribution: Oceanic (no rivers)

Characteristics:

- two narial openings
- baleen

blue whale



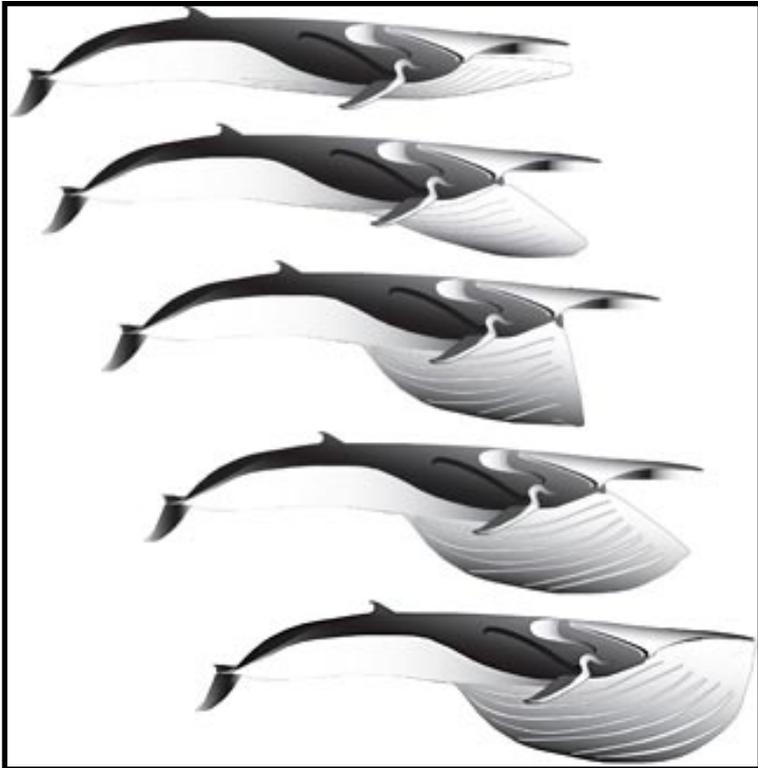
bowhead whale



Suborder Mysticeti: baleen whales

Characteristics:

- lunge feeding = feeding method in which whale accelerates toward food, expands mouth, gulps and then filters huge amounts of water and food.



Discovery of a New Organ (?!?) in a Vertebrate

