Topic 9: Biogeography
- What is biogeography?
- What are the different disciplines of biogeography?
- What are important concepts in biogeography?
- Herpetological examples

What is biogeography?
- Study of past and present ___________, _________ and _______ of organisms
- Based on premise that history of _______ and _________ are interconnected
- Addressing why organisms have the patterns of distribution that they have

What are the four disciplines of biogeography?
- _________ biogeography
- _________ biogeography
- _________ biogeography
- _________ biogeography
- Each of these focuses on different factors that influence distribution and abundance
- Each has something to say about why Amphisbaenidae are distributed

Important considerations when studying frog distributions
- Pipidae
- Pelobatidae
- Megophryidae

Next lecture
What are the four disciplines of biogeography?

- How would these distributions have come about?
Some species are chance...

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Ecological biogeography - Concepts
- How distributions have been shaped by organismal biology
- Physiological tolerances
  - Moisture
  - Altitude

Ecological biogeography - Example
- Pattern is pronounced all over the world
- Geckos & frogs fill similar niches
  - Both feed on small insects

Interspecific competition
- Availability of niches
- Availability of resources

Ecological biogeography - Example

Some species are better than others
- Leathery vs. hard eggs
- Starvation resistance
- Some move further than others
- Chance...

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Powell and Russell, 1992
Ecological biogeography - Example

- Elevational distributions of hylid frogs in Oaxaca
- Considerable _______ changes with _______
- Most diverse at mid-elevation

- Pond breeders at low elevations
- Stream breeders at mid-elevations
- Bromeliads used on Atlantic slopes
  - more moist

Island biogeography - Concepts

- How presence/absence and diversity are determined on islands
  - Important island factors
    - Proximity to _______
  - Important processes
    - _______

- Rate of Immigration/Extinction

- Near
- Size
- Proximity to mainland
- Important processes
  - Immigration
  - Extinction
  - With increased # of species
    - _______
  - increases
  - Results in equilibrium
- Large, near islands have
  - _______
  - _______
  - _______

Island biogeography - Concepts

- Important island factors
  - Size
  - Proximity to mainland
- Important processes
  - Immigration
  - Extinction
  - With increased # of species
    - _______
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Island biogeography - Concepts

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Island biogeography - Concepts

- Important island factors
  - Size
  - Proximity to mainland
- Important processes
  - Immigration
  - Extinction
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  - Results in equilibrium
- Large, near islands have
  - _______
  - _______
  - _______
Island biogeography
- Example

- Isolation by distance
  - Faunal similarity
  - Closer islands have more species in common

- Differences between frogs and snakes
  - ____________________
  - ____________________
  - ____________________
  - Ecological biogeography is also important...

Pough et al. 2004, Fig. 5-13
Island biogeography
- Not all islands are surrounded by water!
- Island biogeography applies to suitable patches of habitat.
- Habitat surrounded by obstacles/“bad” habitat.
- Examples:
  - Reefs
  - Oases of various kinds

Historical biogeography - Concepts
- How distributions have been shaped by the Earth’s history
  - Changes in __________
  - Changes in __________
- Much of Mesozoic (251-65 mya)
  - Forested
  - Warm
  - Home to many animals including reptiles

Historical biogeography - Concepts
- Changes in sea level
  - Land masses become connected...
  - ...or they become disconnected

Historical biogeography - Concepts
- Pangaea
  - Laurasia
    - Nearctic
    - Palearctic
    - Oriental
  - Gondwana
    - Neotropical
    - Ethiopian
    - Australian
    - Oriental

Historical biogeography - Concepts
- Fundamental force behind many changes
  - Huge driver of biogeographic patterns
  - The continents move!!!
- Continents are on tectonic plates
  - Compose the crust
  - Float on the mantle
  - Spread apart
  - Collide

Historical biogeography - Concepts
- Two major mechanisms behind patterns of distribution
  - Competing theories
  - Both clearly important
  - Much past controversy

Historical biogeography - Concepts
- Vicariance
  - Dispersal
Historical biogeography - Concepts

- The separation of a group of organisms by a geographic barrier becomes erected, splitting a population.
- Separated populations.
- Many possible vicariant agents: Plate tectonics, rivers changing course, canyon building, etc.

Historical biogeography - Concepts

- Vicariance: Example: Distribution of the Amphibiaeaiae
  - Multiple vicariant events giving modern distribution
  1. Break up of ____________
  2. Eastern movement of ____________ plate
  3. Drying of ____________

Historical biogeography - Concepts

- The permanent movement of organisms from one geographic location to another.
- Hard to test for, but clearly important.
- Many dispersal agents:
  - Some organisms move
  - Ocean currents & rivers
  - Humans

Historical biogeography - Example

- The Caribbean has a complex history.
- Heated debate about roles of vicariance and dispersal.
- Only when V is disproven, can you suggest D?
- How might we distinguish V & D?
Historical biogeography - Example

- Look at timing of phylogenetic divergences
- Dated divergences between species on different landmasses
- Distinct times when otherwise dispersal possible
- Anolis, Eleutherodactylus, Sphaerodactylus

Historical biogeography - Example

- Explaining a disjunct distribution pattern
- South America + Madagascar, but not Africa
- Malagasy Oplurinae are nested within the New World Iguanidae
- Why aren’t Iguanids in Africa?

Historical biogeography - Example

- Madagascar was more closely associated with (and India) than Africa
- Not complete picture
  - Why aren’t these herps in India?
  - Fossil Boid Madtox has been found all over Gondwana
  - Perhaps climate change and competition played a role

Historical biogeography - Example

- Climate: Africa has undergone considerable drying, but there are still wet areas, without these animals
- Competition: Ecologically analogous taxa exist

"Agamidae" and Pythoninae have similar ranges

- Origin in SE Asia with dispersal into Africa & Australia...