

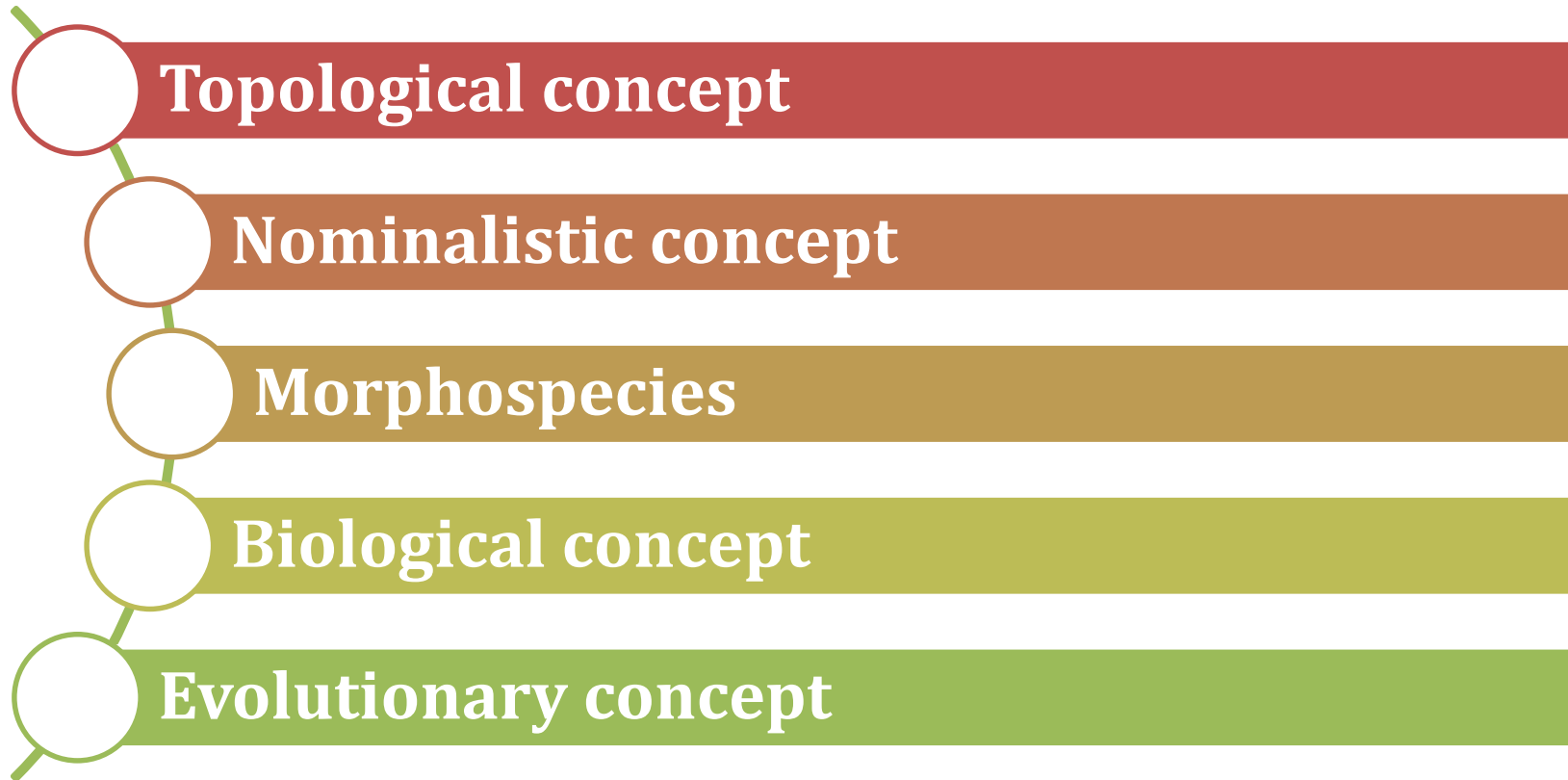


LECTURE (5)

Species and speciation

Species Concepts

Defining “a species” is not as simple as you might hope
There are many different “species concepts”.



Historical Species Concepts

- **Typological Species Concept**
 - species are a 'type' of organism
- **Lineaeus**
 - ***"Species are as many as were created in the beginning by the Infinite."***
 - ***Systema Naturae***, 10th ed. (1758)
establishes a catalog of 4,162 "types"

Historical Species Concepts

- **Nominalistic Species Concept:**

- a name given for convenience

- Darwin

- *"I look at the term species, as one arbitrarily given for the sake of convenience to a set of individuals closely resembling each other...."*

philosophical **Essentialism**

Only individuals exist, not universal classes.

Historical/Modern Species Concepts

■ **Morphospecies Concept**

- Species traditionally have been described and identified on the basis of morphological criteria
- According to this concept, species are “groups of individuals that are morphologically similar and clearly distinguishable from individuals of other groups”

Modern Species Concepts

- **Biological Species Concept**

- a reproductively isolated population

- Mayr

- ***"Species are groups of interbreeding natural populations that are reproductively isolated from other such groups."***
 - Historically, the most widely used concept among **ecologists**

Biological Species Concept- Key Concepts

- **"Interbreeding: => a *genetic* unit**
 - species are **gene pools: a coadapted gene complex**
 - Members of the same species resemble each other because they have common ancestors

Biological Species Concept- Key Concepts

- **"Natural Populations"** => an *ecological* unit

Biological Species Concept-

Key Concepts

- **"Reproductively isolated"** => a *reproductive unit*
 - **Reproductive Isolating Mechanisms**
 - features that prevent mating outside the species
 - **Species Recognition Mechanisms**
 - features that allow recognition of potential mates

Identifying Species Using the Biological Species Concept

- Biological Species Concept
 - suggests a **research program** that will allow scientists to identify species using this concept
 - the mark of a good theory

Identifying Species Using the Biological Species Concept

- (1) **Experiment: test cross**
 - **A** and **B** interbreed, but neither with **C**
=> **A** & **B** are conspecific
 - **C** is a separate species

Identifying Species Using the Biological Species Concept

- (2) **Field observations: a "species gap" exists**
 - Populations maintain identity when **sympatric** (occurring in the same place) & **synchronic** (occurring at the same time)

Odocoileus hemionus
Mule Deer

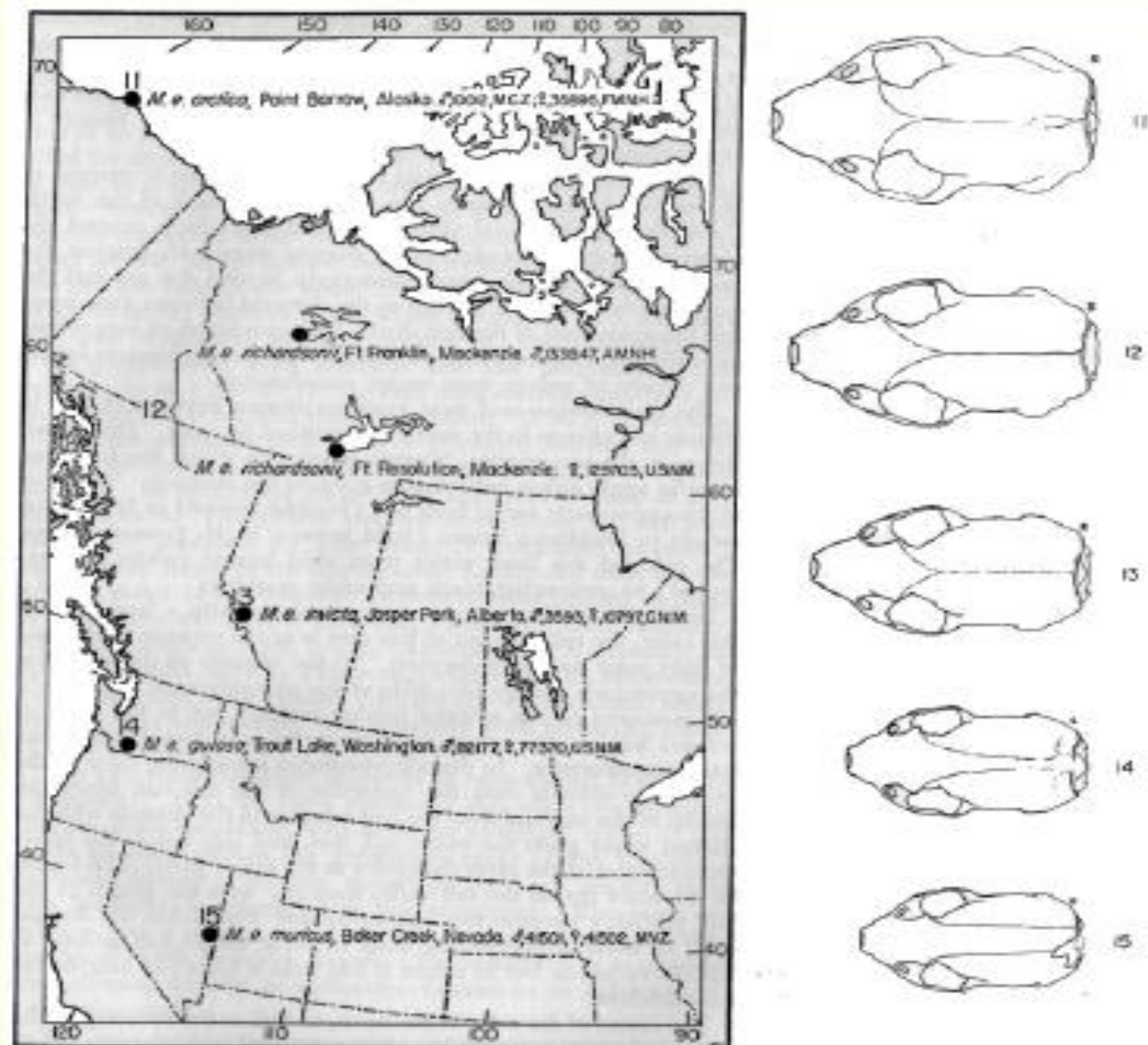


Identifying Species Using the Biological Species Concept

- (3) **Inference:** forms *'look different'*
- Many new species are described from single 'skin & skull' or small series.
Most commonly used criterion: inference is often weak.

Geographic Variation in Weasels

Mustela erminea



Identifying Species Using the Biological Species Concept

4) Genetic studies indicate no gene flow between forms

- fixation for **alternative alleles**

- distinct **DNA sequences**

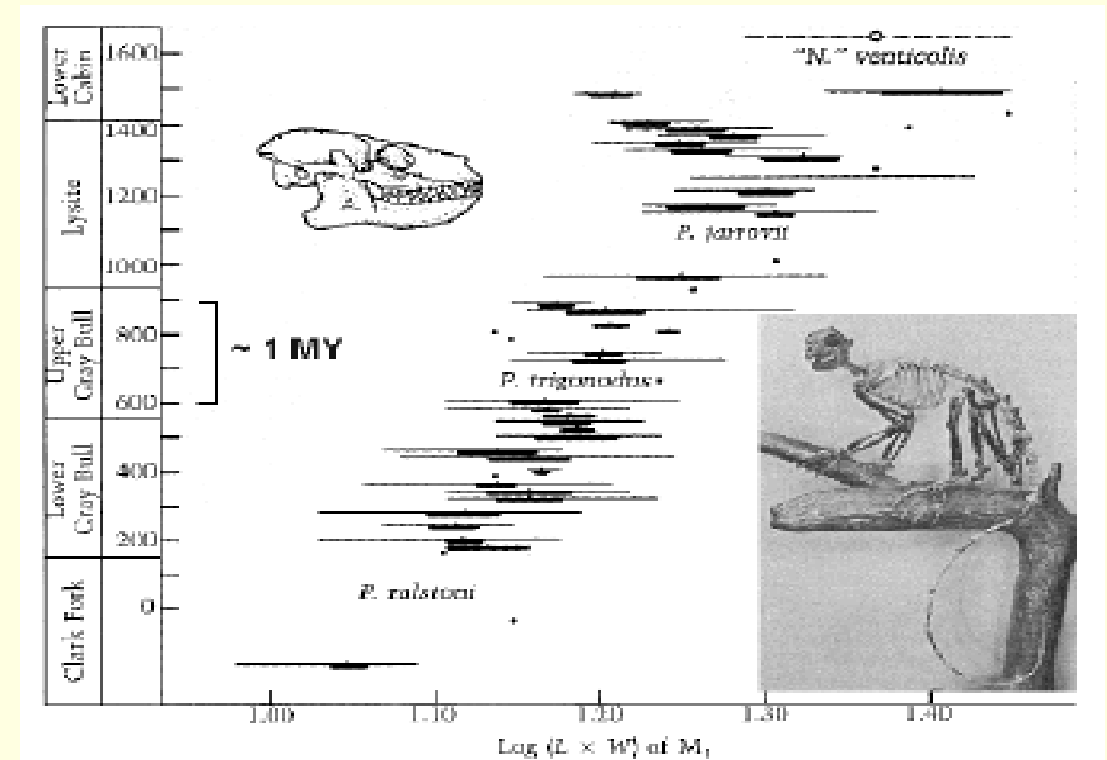
- distinct **karyotypes**

Evolutionary Species Concept

- **an evolving lineage**
 - *"An evolutionary species is a single lineage of ancestor-descendant populations which maintains its identity from other such lineages and which has its own evolutionary tendencies and historical fate."*
 - Historically, the most popular concept among **paleontologists**.
 - Used extensively in **comparative biology & phylogenetic systematics**

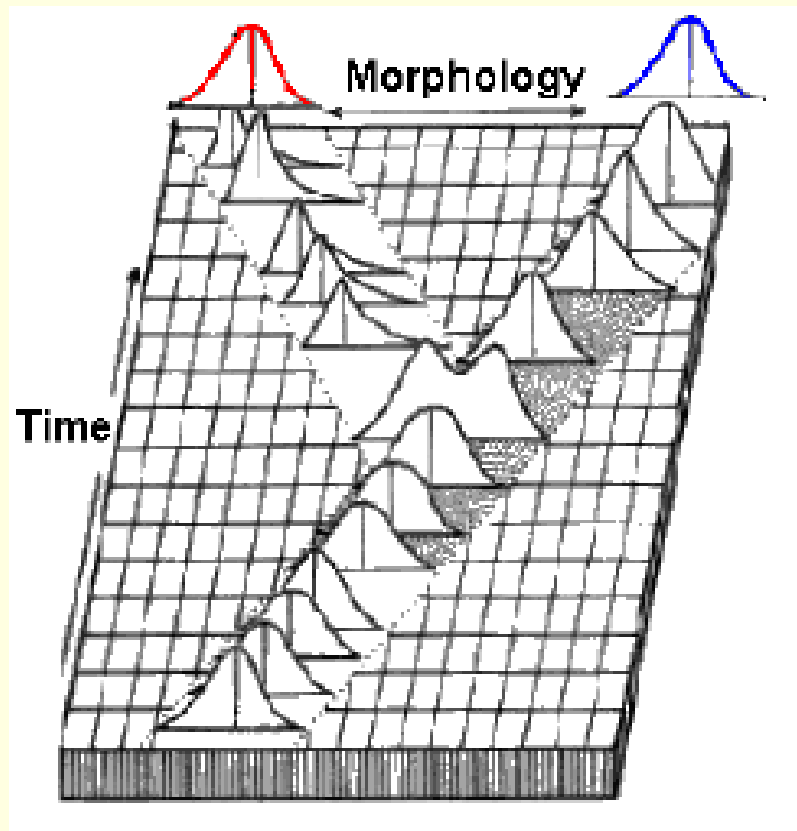
Evolutionary Species Concept

- (1) "Lineage": an ancestor-descendent series
 - **genealogy** is crucial: members of a species have a **common ancestor**
 - Research program of paleontology is inference of genealogy



Pelycodus
an early Eocene Primate

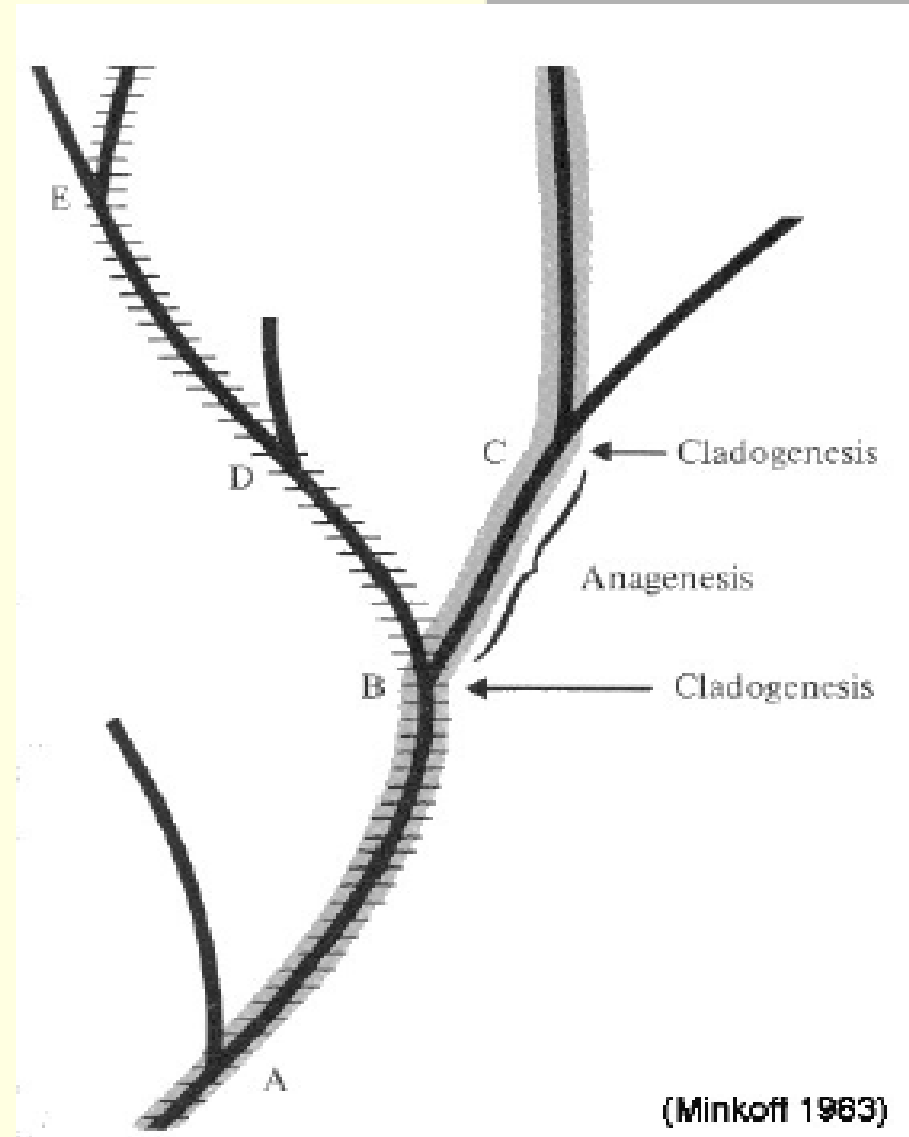
Evolutionary Species Concept



- (2) "Identity": a biologically distinct entity
 - Includes concepts associated with Biological Species,
 - the Biological Species Concept is the broadest general case of the Evolutionary Species Concept
 - [*i.e.*, a biological species is an *evolutionary species* at a particular point in time]

Evolutionary Species Concept

- (3) "**Tendencies & Fate**": a species is a historical entity
 - Species have an **origin** (by **cladogenesis** = 'splitting' of lineages)
 - undergo **evolution** (by **anagenesis** = change within lineages)
 - **disappear** (by **extinction** = termination of lineage).



Thank you