

## Species Concepts

1. What is evolution?
2. What is a species?
3. Three species concepts to consider
4. In-class workshop on species concepts

### 1. What is evolution?

...And, it is the single, unifying theory of biology. As famous biologist Theodosius Dobzhansky said: "*Nothing in biology makes sense except in the light of evolution.*"

#### Evolution's two main branches

In 1859, Darwin proposed natural selection as a unifying principle to explain two things: the *origin of species*, and the *adaptation of organisms to their environment*.

- **Systematics** is the study of speciation (the origin of species), a.k.a. macroevolution.
- **Evolutionary ecology** is the study of the adaptation of organisms to their environment, a.k.a. microevolution. This includes the study of interactions with members of their own and other species (the biotic environment) as well as the physical (abiotic) environment.

What do the prefixes *macro-* and *micro-* refer to...?

#### Hierarchical classification

Organisms are grouped by increasing similarity due to common ancestry (unobvious plural forms are in parentheses):

Kingdom  
Phylum (phyla)  
Class  
Order  
Family: typically ends in -eae  
Genus (genera)  
Species (species)

#### Some basic rules of names

The scientific (or Latin) name of a species includes the genus and species, in that order. Both words are italicized, the genus name is capitalized, the species name is not. (For a good rules summary, read Pielou chapter 2.)

E.g.: *Homo sapiens*. *Acer macrophyllum*. *Rhyacotriton olympicus*.

After a reference has been made to a particular species, the genus may be abbreviated.

E.g. *R. olympicus*.

The scientific names of species change sometimes, but they are more reliable than "common names," because in different parts of a region, more than one species may be called by the same common name. Common names for the organisms listed above are...?

## 2. What is a species?

Are species purely a human construct, used by us as a necessary semantic tool so that we can discuss the diversity that exists on this planet? Or are species a "real" thing? That is, do "species" exist as entities apart from human involvement? Put another way: *When a lineage evolves in a forest, and there's nobody there to name it — is it a new species?*

## 3. Species Concepts

There are almost as many species concepts as there are people who have tried to define species. The problem is, none of them work for all evolved life forms. A few of the most widely used species concepts include:

- Morphological Species Concept
- Biological Species Concept
- Evolutionary Species Concept

### Morphological Species Concept

Morphological similarity (or dissimilarity) is the sole criterion for determining species. This concept involves subjectivity in the definition through the degree of difference. Different species are organisms that look different. Some problems with the morphological species concept include:

### Biological Species Concept

"Groups of actually or potentially interbreeding natural populations which are reproductively isolated from other such groups" (Mayr '40).

Criteria include: interbreeding among conspecific populations and reproductive isolation from non-conspecific populations. Morphological distinctness is not a criterion. This is the dominant species concept in evolutionary literature today, at least among zoologists. The biological species concept posits that a species is a reproductive community, an ecological unit (interacting as a unit with other members of the same

species), and a genetic unit (individuals are seen as temporary vessels that contain a portion of the species' gene pool).

Problems:

### Evolutionary Species Concept

An evolutionary species "is a single lineage of ancestor-descendant populations of organisms which maintains its identity from other such lineages [in space and time] and which has its own evolutionary tendencies and historical fate" (Wiley 1981).

Developed (by G.G. Simpson) as a response to the biological species concept, which can not be applied to asexual organisms or extinct species. In theory, the evolutionary species concept deals with these problems.

Problems:

Does our inability to fix upon a single, always applicable species concept put the concept of species at risk?

### 4. In-class workshop

As a group, pick a species concept and defend it. You should address at least the following points:

1. Does this species concept have wide applicability? If not, on what basis have you chosen it?
2. Are there any types of organisms that are excluded by your definition? How do you justify excluding these organisms?
3. What are the problems with your species concept?
4. Are species delineated by your species concept likely to be replicated by the knowledge of local people? That is, will it allow you to come up with the same way of classifying the natural world as do the people who rely on that world for their livelihoods?
5. Would you feel comfortable handing this species concept over to a legislator who would use it to make policy decisions?