UCLouvain

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Un éventail de formations, une multitude d'horizons

Species, Biodiversity, and Values

Short Course @ YSU
April 29, 2026

How does natural selection lead to the creation of new species?

What's a Species?

First problem: we have a clear "pre-theoretic" idea of what species are, which leads to a clash between a "common-sense" concept and a "scientific" concept

“Taxonomic Disorder”

> The problem is manifested in the existence of scores of alternative definitions for the term “species,” no fewer than 24 of which have been designated as distinct species concepts. (de Queiroz 1263)

A Few (!) Examples

- BSC / interbreeding (either by reproductive isolation or by mechanisms for recognizing members of the same species)
- ecological (same ecological niche)
- phylogenetic (either cladist, or coalescence theory, or by qualitative characteristics)
- evolutionary (the evolution of separation between lineages)
- phenetic (only phenotypic characteristics)
- historical individuals (Hull)
- metapopulation lineages (de Queiroz; taken to be a minimal definition of what's shared by all the others)

All of them either explicitly or implicitly equate species with separately evolving (segments) of metapopulation lineages, where a metapopulation is an inclusive population made up of a set of connected populations, and a lineage (at the population level) is a population extended through time or an ancestral-descendant series of time-limited (instantaneous) populations. (de Queiroz 1263)

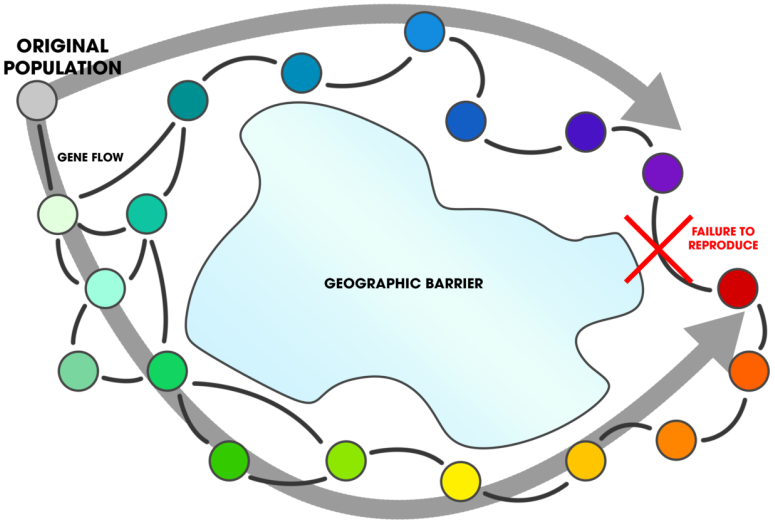
> [O]n the historical entity interpretation, similarity is a red herring; it is not the issue at all. What really matters is how many organisms are involved and how much the internal organization of the species involved is disrupted. If speciation takes place when a small, peripheral isolate succeeds in bringing about a genetic revolution, then the parent species can still be said to persist unchanged. (Hull 374)

Ambiguity of the Question

Second problem (de Queiroz): what even are we arguing about?

1. a metaphysical question: What are the necessary properties of a species?
2. an epistemic or methodological question: How do we distinguish species in nature?
3. the nature of speciation: What processes create and maintain species?

Ring Species



Different Answers?

Different Answers?

Phylogenetic analysis of the history of mitochondrial DNA, which is inherited matrilineally, reveals that the ancestors of polar bears and brown bears diverged into isolated lineages about 150,000 years ago. Phylogenetic analysis of nuclear DNA, on the other hand, which is inherited from both parents, reveals a much earlier divergence around 750,000 years ago. Did polar bears split from brown bears 150,000 years ago or 750,000 years ago? The answer is “yes.” (Haber and Molter 2019, 2)

Open Questions

- Does natural selection “optimize” for some particular quantity, or not? (cf. Grafen 2014)
- Is the formalism of group selection completely reducible to that of individual selection? (cf. Nowak et al. 2010)
- What is the empirical relationship between selection and drift? (cf. Wade & Goodnight 1998)
- Is natural selection “creative,” or not? That is, is selection part of the explanation for the *existence* of traits, or just the *distrbution* of traits? (cf. Beatty 2016, 2019)
- How do we understand, motivate, or defend “pluralism” about levels of selection, or concepts of species, or…?

Part 2: Biodiversity and Values

How is contemporary biology connected to evolutionary theory? How does it handle its commitments to social and ethical values?

Biodiversity

1. Carve up the world into “locations”
2. Pick a “surrogate” for biodiversity in each environment (some way that biodiversity expresses itself)
3. Pick an estimator of that surrogate that we can actually measure
4. Rank the places based on the measures of the estimator
5. Assess the future of the things we care about in each place
6. Develop and execute a management strategy for each place

Surrogates

- characters or traits
- species
- ecological communities
- environmental parameters
- morphological space

Preserving Groups

> Organisms (populations, species) are the result of a conspiracy between history, environment, and chance. Since those conspirators mark biological systems in different ways – affect their causal profile in different ways – it turns out that there is no single system for identifying all the similarities and differences between biological systems that matter. (Maclaurin and Sterelny, 11)

Estimators

- species richness
- environmental parameters
- soil types
- dominant vegetation
- species composition
- community composition
- higher-taxon composition
- subsets of species composition (keystone species)

Rank-orderings

- complementarity
- rarity

Biodiversity: A Coherent Concept?

> Put bluntly, the position that this paper will argue for is that biodiversity is to be (implicitly) defined as what is being conserved by the practice of conservation biology. (Sarkar, 132)

Biol Philos
DOI 10.1007/s10539-014-9426-2

Save the planet: eliminate biodiversity

Carlos Santana

HPLS (2019) 41:15
https://doi.org/10.1007/s40656-019-0252-3

ORIGINAL PAPER

Taxonomy and conservation science: interdependent and value-laden

Stijn Conix[1]

Biodiversity and Values

> Conservation biology differs from most other biological sciences in one important way: it is often a crisis discipline. Its relation to biology, particularly ecology, is analogous to that of surgery to physiology and war to political science. In crisis disciplines, one must act before knowing all the facts; crisis disciplines are thus a mixture of science and art, and their pursuit requires intuition as well as information. (Soulé 1985)

Biodiversity and Values

Common response: Ethical value judgments are acceptable in conservation, but should be **kept out of taxonomy.** So we can inventory species “neutrally,” and then we involve our values when we move toward conserving them.

But… does this actually work?