Species Without Definitions

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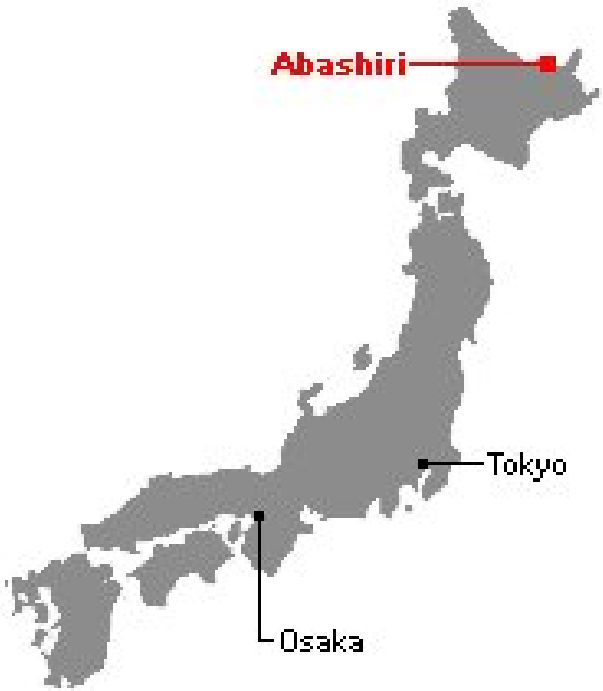

Figure : Drift Ice

Contents

Introduction

- Topic: The species problem.
- Motivation: Definitions have long been at the centre of the species controversy. But biologists often deploy the notion of species without advocating a particular species concept (non-definitional reasoning).
- I shall discuss its implications to the extant attempts to resolve the species problem.

Game Plan

1. Introduction
   - Species theorists have focused on definitions.
   - But there is another way of reasoning about species.
2. Non-definitional reasoning about species
   - *Good species* as a prototype of *species*
3. Implications to the species problem

Background — What is the Species Problem?

The Species Problem

- What is the nature of species?
- What is the “right” definition of species?

Current situation

- Over 20 species definitions have been proposed.
  - **Biological Species Concept:** A species is a reproductively isolated group
  - **Phylogenetic Species Concept (history-based):** A species is the smallest monophyletic group.

Morphological Species Concept (Taxonomic Species Concept)

A species = a morphologically distinct group

> *Species are the smallest groups that are consistently and persistently distinct, and distinguishable by ordinary means. (Cronquist 1978, p. 3)*

Problems

- How much should two populations differ so that they count as two species?
- Sibling species (morphologically very similar but reproductively isolated populations)

Biological Species Concept (BSC)

Ernst Mayr: A species = a reproductively isolated group

> *Species are groups of actually or potentially interbreeding natural populations, which are reproductively isolated from other such groups. (Mayr 1942, p. 120)*

Problems

- Unapplicable to asexual species
- Gene flow is not the only force to keep phenotypic coherence within a species

Many Definitions, No Agreement

There are many different species definitions. Each definition has some virtues, but problems too.

- No universal agreement on the right definition has been reached.

Thus one can see that definitions have long been at the centre of the species controversy. But is it the whole story?

- When biologists talk about species they usually do not say which definition they are assuming.

Many Definitions, No Agreement

There are many different species definitions. Each definition has some virtues, but problems too.

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Thus one can see that definitions have long been at the centre of the species controversy. But is it the whole story?

- When biologists talk about species they usually do not say which definition they are assuming.

Doing Without Definitions?

Biologists acknowledge different species definitions, but when they talk about species they usually do not say which definition they are assuming. They seem to be reasoning about species in a non-definitional way.

> *No one definition [of species] has as yet satisfied all naturalists; yet every naturalist knows vaguely what he means when he speaks of a species.* (Origin, *p. 44*)

"'Species' should have one common meaning"

Jody Hey: A biologist believes the term 'species' has one common meaning, although she should be fully aware of the fact that different definitions are proposed and there is no universally accepted definition of 'species.'

"'Species' should have one common meaning"

... when talking with biologists, one hears [the term 'species'] tossed about regularly in a manner that supposes there is one single common meaning. If pressed on that common meaning, biologists are stuck . . . , but they persist in using the word in a casual way much as laypersons do, as if it has a well-known meaning. (Hey 2001, p. 11, emphasis added)

Puzzling situation

Besides, there is a puzzling situation around the concept of species and the species problem:

1. Biologists have no “solution” to the species problem.
2. The species category is important in biology.

However,

3. Biologists have made progress even in areas where the species category is important (such as speciation and biodiversity), and/or
4. Biologists behave as if the species problem is already solved, when being aware of the fact that it is not. (Hey)

A take-home message: Non-definitional reasoning of species

One of the main messages of this presentation is that reasoning about species is not limited to reasoning about individual definitions.

- In particular, biologists reason about species by employing prototype resaoning processes vs. rule-oriented, definitional processes.

And we need to focus on the general concept of species, rather than individual definitions of species.

Contents

Prototype Reasoning on Species: Good species

How do biologists employ prototype reasoning on species?

Thesis: Biologists often reason about species as "good species."

Biologists often speak of particular species as "good species."

⟨Non-definitional R - Prototype R - Good Species⟩

Then, what **is** *good species*?

Prototype Reasoning on Species: Good species

How do biologists employ prototype reasoning on species?

Thesis: Biologists often reason about species as "good species."

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⟨Non-definitional R - Prototype R - Good Species⟩

Then, what **is** *good species*?

Good Species

‘Good Species’

When biologists explain what they mean, they say that a good species is:

(1) A group of organisms which satisfy many or most criteria of species proposed.

(2) Or a group generally recognized as a species by naturalists.

Two Meanings of 'Good species'

(1) Good species is a group of organisms which satisfy many or most criteria of species proposed.

Chromosomal, morphological and ecological evidence indicates that S. maroniense ... is a good species. (Hamada & Adler 1999)

(2) Good species is a group generally recognized as a species by naturalists.

I used the term "good" species several times meaning that people generally agree that "the blue whale" and "the fin whale," for example, are species,. . . (Mallet 1996, p. 174)

Good Species

But when biologists use ‘good species’ they do not always explain or justify their use of the term.

- When they simply refer to a species as a “good species,” I argue that they are employing prototype reasoning.
- In this sense, prototype reasoning involves non-definitional reasoning on species.

Good Species is a Prototype of Species

(1) Good species is a prototype of species

Prototype: a highly exemplary instance of a concept in virtue of possessing a sufficient number of properties that are exemplary of the concept.

- Robins are more prototypical member of birds than penguins.
- Apples are more prototypical member of fruits than olives.

Good Species is a Prototype of Species

Good species is a prototype of species

- Prototype: the most representative exemplar of a concept in virtue of possessing a sufficient number of properties that are exemplary of the concept.
- *Good species* possesses many features of prototypes.
  - **"Good *X*":** "Good ***X***" is used by psychologists to refer to prototypical instances of a concept. E.g., in an experiment, psychologists ask subjects to pick 'good' instances of a concept in the instruction.
  - **Hedges:** "A robin is technically a bird" (False) and "A penguin is technically a bird" (True). "*Xus Zus* is a good species and technically a species"→ False.

Good species: This is How Biologists Reason about Species in a Non-Definitional Way

Recap of the argument:

(1) *Good species* is a prototype of species.

(2) Psychologists believe that the prototype reasoning is a non-definitional reasoning.

(3) Hence, when biologists reason about good species, they reason about species in a non-definitional way.

Good species: This is How Biologists Reason about Species in a Non-Definitional Way

Recap of the argument:

(1) *Good species* is a prototype of species.

(2) Psychologists believe that the prototype reasoning is a non-definitional reasoning.

(3) Hence, when biologists reason about good species, they reason about species in a non-definitional way.

Talking about Species in a Loose Way

When biologists talk of species with having *good species* in mind, they do not have any definition in mind.
→ They may leave what 'species' exactly refers to for further specification.

There are some costs and benefits in this kind of indecision:

- Cost: Makes unclear what biologists really refer to.
- Benefit: It takes time and energy to precisify what you mean. Leaving what we really mean open saves our time and energy and helps quick but sufficiently effective communication.

Attribute Substitution (1)

I have argued: "*Good species* is a prototype of *species*. Biologists often represent the species category by its prototypes (not definitions) in their minds."

So what? Can we explain biologists' attitude described by Hey, for example?

Yes, if we think that this is an instance of attribute substitution as proposed by Daniel Kahneman.

Attribute Substitution (2)

Attribute substitution: A subject replaces the real question (the "target" question) with a different question (the "heuristic" question), and takes as the answer to the real question the answer to the replacement question.

Example

- The real question: How happy are you with your life in general?
- Heuristic question: How many dates did you have last month?

Subjects take the answer to the heuristic Q as that to the real Q.

Attribute Substitution (3)

The same thing may well happen to *species*.

Attribute Substitution of *Species* with *Good Species*:

- Biologists, often implicitly, represent the species category by its prototype, *good species*, in their minds.
- Biologists replace the real question concerning *species* with a heuristic question concerning *good species* and take an answer to the heuristic question as one to the real question.

Attribute Substitution (4): Hey's Observation

Recap: Jody Hey: A biologist believes the term 'species' has one common meaning, although she should be fully aware of the fact that there is no universally accepted definition of 'species.'

Biologists replace the real question with a heuristic question:

- The real question: Is species a homogeneous category such that biologists can easily grasp the nature of it?
- Heuristic question: Is good species a homogeneous category such that biologists can grasp the nature of it?

Attribute Substitution (4): Hey's Observation

Biologists replace the real Q with a heuristic Q:

- The real Q: Is species a homogeneous category?
- Heuristic Q: Is good species a homogeneous category?

Biologists can answer "yes" to the heuristic Q even if their answer to the real Q would be no.

- General agreement on the specieshood of a good species.
- A good species satisfies multiple criteria of species.

Contents

Implications to the Species Problem

We have argued ...

- Biologists often reason about species without any particular definition in mind.
- In particular biologists often reason about species by employing prototype resaoning processes
- This explains some of their puzzling attitudes about “species.”

Those insights do have some implications for philosophers and biologists when engaged in the species controversy.

There is More to the Species Problem than Definitions

Definitions have long been at the centre of the species controversy, and this is for a good reason.

But some authors may have taken this too seriously. Take David Hull's attempt (Hull 1997, 1999):

- He assesses various species definitions in terms of three criteria: universality, applicability and theoretical significance.
- If any definition scores better on these criteria than others, then it will be the best definition.
- (Most of the major definitions score roughly the same.)

There is More to the Species Problem than Definitions (2)

What Hull seems to assume is that

- Biologists only represent the notion of species through definitions (or they should)
- Reconciling conflicting definitions in one way or another is a necessary step for the resolution of the problem

There is More to the Species Problem than Definitions (3)

Hull assumes

- Reconciling conflicting definitions is a necessary step for the resolution of the problem

However,

- Biologists are more likely to represent the concept of species with its prototype, i.e., *good species*.
- Biologists may have some reason to keep using the general notion of species even when one particular definition scores better.

Summary and Conclusions

- Reasoning about species may not be limited to reasoning about particular definitions.
- Biologists often reason about species by employing prototype reasoning process.
- This explains some of their puzzling attitudes observed in the species controversy and suggests that some of the attempts to resolve the species problem have problems.
- Some extant solutions for the species problem assume that reconciling different definitions in one way or another is an important step for the resolution of the problem, but this assumption may well not be correct.

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Thanks!

And for YOUR attention!