Summary of 26 species concepts

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There are numerous species concepts at the object-level in the literature. (Mayden 1997) has listed 22 distinct species concepts along with synonyms, and his metataxonomy provides a useful starting point for a review. I have added authors where I can locate them in addition to Mayden’s references, and instead of his abbreviations I have tried to give the concepts names, such as biospecies for Biological Species, etc. (following George 1956) except where nothing natural suggests itself. There have also been several additional concepts since Mayden's review, which I have added (the views of Pleijel, Wu, and Hey), and several new revisions presented in (Wheeler and Meier 2000). In addition, I add some "partial" species concepts - the compilospecies concept and the nothospecies concept. I have made a distinction between two phylospecies concepts that go by various names, mostly the names of the authors presenting at the time (as in the Wheeler and Meier volume). To remedy this, I have christened them the Autapomorphic species concept and the Monophyletic species concept.

1. Agamospecies

Synonyms: Microspecies, paraspecies, pseudospecies, semispecies, quasipecies
Principal authors: Cain 1954, Eigen 1993 (quasispecies)
Specifications: Asexual lineages, uniparental organisms. May be secondarily uniparental from biparental ancestors

2. Autapomorphic species

See: Phylospecies
Principal authors: Nelson and Platnick 1981; Rosen 1979

3. Biospecies

Synonyms: Syngen, speciationist species concept
Related concepts: Biological species concept, Genetic species, isolation species
Principal authors: Ray, Buffon, Dobzhansky 1935, Mayr 1942
Specifications: Inclusive Mendelian population of sexually reproducing organisms (Dobzhansky 1935; Dobzhansky 1937; Dobzhansky 1970), interbreeding natural population isolated from other such groups (Mayr 1942; Mayr 1963; Mayr 1970; Mayr and Ashlock 1991). Depends upon endogenous reproductive isolating mechanisms (RIMs).

4. Cladospecies

Synonyms: Internodal species concept, Hennigian species concept, Hennigian convention
Principal authors: Hennig 1950; Hennig 1966; Kornet 1993
Specifications: Set of organisms between speciation events or between speciation event and extinction (Ridley 1989), a segment of a phylogenetic lineage between nodes. Upon speciation the ancestral species is extinguished and two new species are named.

5. Cohesion species

Synonyms: Cohesive individual (in part) (Ghiselin and Hull)
Principal authors: Templeton 1989
Specifications: Most inclusive population with potential for phenotypic cohesion through intrinsic cohesion mechanisms ... having the potential for genetic and/or demographic exchangeability (Templeton 1989).

6. Compilospecies

Synonyms: None
Related concepts: Introgressive taxa
Principal authors: Aguilar et al. 1999; Harlan and De Wet 1963
Specifications: A species pair where one species “plunders” the genetic resources of another via introgressive interbreeding.

7. Composite Species

Synonyms: Phylospecies (in part), Internodal species (in part), cladospecies (in part)
Principal authors: Kornet and McAllister 1993

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Specifications: All organisms belonging to an internodon and its descendents until any subsequent internodon. An internodon is defined as a set of organisms whose parent-child relations are not split (have the INT relation).

8. Ecospecies
Synonyms: Ecotypes
Related concepts: Evolutionary species sensu Simpson, Ecological mosaics
Principal authors: Simpson 1961; Sterelny 1999; Turesson 1922; Van Valen 1976
Specifications: A lineage (or closely related set of lineages) which occupies an adaptive zone minimally different from that of any other lineage in its range and which evolves separately from all lineages outside its range.

9. Evolutionary species
Synonyms: Unit of evolution, evolutionary group
Related concepts: Evolutionary significant unit
Principal authors: Simpson 1961; Wiley 1978; Wiley 1981
Specifications: A lineage (an ancestral-descendent sequence of populations) evolving separately from others and with its own unitary evolutionary role and tendencies (Simpson).

10. Evolutionary significant unit
Synonyms: Biospecies (in part) and evolutionary species (in part)
Principal authors: Waples 1991
Specifications: A population (or group of populations) that 1) is substantially reproductively isolated from other conspecific population units, and 2) represents an important component in the evolutionary legacy of the species.

11. Genealogical concordance species
Synonyms: Biospecies (in part), cladospecies (in part), phylospecies (in part)
Principal authors: Avise and Ball 1990
Specifications: Population subdivisions concordantly identified by multiple independent genetic traits constitute the population units worthy of recognition as phylogenetic taxa

12. Genic species
Synonyms: none
Related concepts: Genealogical concordance species, genetic species (in part), biospecies (in part), autapomorphic species (in part)
Principal author: Wu 2001a; 2001b
Specifications: A species formed by the fixation of all isolating genetic traits in the common genome of the entire population.

13. Genetic species
Synonyms: Gentes (sing. Gens)
Related concepts: Biospecies, phenospecies, morphospecies
Principal authors: Dobzhansky 1950; Mayr 1969; Simpson 1943
Specifications: Group of organisms that may inherited characters from each other, common gene pool, reproductive community that forms a genetic unit

14. Genotypic cluster
Synonyms: Polythetic species
Related concepts: Agamospecies, biospecies, genetic species, Hennigian species, morphospecies, non-dimensional species, phenospecies, autapomorphic phylospecies, successional species, taxonomic species
Principal author: Mallet 1995
Specifications: Clusters of monotypic or polytypic biological entities, identified using morphology or genetics, forming groups that have few or no intermediates when in contact.

15. Hennigian species
Synonyms: Biospecies (in part), cladospecies (in part), phylospecies (in part)
Principal authors: Hennig 1950; Hennig 1966; Meier and Willman 1997

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Specifications: A tokogenetic community that arises when a stem species is dissolved into two new species and ends when it goes extinct or speciates.

16. Internodal species
Synonyms: Cladospecies and Hennigian species (in part), phylospecies
Principal author: Kornet 1993
Specifications: Organisms are conspecific in virtue of their common membership of a part of a genealogical network between two permanent splitting events or a splitting event and extinction.

17. Least Inclusive Taxonomic Unit (LITUs)
Synonyms: evolutionary group (in part), phylospecies
Principal authors: Pleijel 1999; Pleijel and Rouse 2000
Specifications: A taxonomic group that is diagnosable in terms of its autapomorphies, but has no fixed rank or binomial.

18. Monophyletic species
See: Phylospecies
Principal authors: Cracraft 1983; Eldredge and Cracraft 1980; Nixon and Wheeler 1990

19. Morphospecies
Synonyms: Classical species
Related concepts: Linnean species, binoms, phenospecies, monothetic species, monotypes, types, Taxonomic species
Principal authors: Aristotle and Linnaeus, and too many others to name, but including Owen, Agassiz, and recently, Cronquist 1978
Specifications: Species are the smallest groups that are consistently and persistently distinct, and distinguishable by ordinary means (Cronquist 1978).

20. Non-dimensional species
Synonyms: Folk taxonomical kinds (Atran 1990)
Related concepts: Biospecies, genetic species, morphospecies, paleospecies, successional species, taxonomic species
Principal authors: Mayr 1942; Mayr 1963
Specifications: Species delimitation in a non-dimensional system (a system without the dimensions of space and time, Mayr 1963)

21. Nothospecies
Synonyms: hybrid species, reticulate species
Related concepts: Compillospecies, horizontal or lateral transfer
Principal author: Wagner 1983
Specifications: Species formed from the hybridisation of two distinct parental species, often by polyploidy.
Phylospecies
Synonyms: Autapomorphic phylospecies, monophyletic phylospecies, minimal monophyletic units, monophyletic species, lineages
Related concepts: Similar to internodal species cladospecies, composite species, least inclusive taxonomic units.
Principal authors: Cracraft 1983; Eldredge and Cracraft 1980; Nelson and Platnick 1981; Rosen 1979
Specifications: The smallest unit appropriate for phylogenetic analysis, the smallest biological entities that are diagnosable and monophyletic, unit product of natural selection and descent. A geographically constrained group with one or more unique apomorphies (autapomorphies). There are two versions of this and they are not identical. One derives from Rosen and is what I call the autapomorphic species concept. It is primarily a concept of diagnosis and tends to be favoured by the tradition known as pattern cladism. The other is what I call the monophyletic species concept, and tends to be favoured by process cladists.

22. Phenospecies
Synonyms: Phena (sing. phenon) (Smith 1994)
Related concepts: Biospecies, genetic concordance species, morphospecies, non-diensional species, phylospecies (in part), phenospecies, successional species, taxonomic species, quasispecies, viral species
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**Principal authors**: Beckner 1959; Eigen 1993; Sokal and Sneath 1963

**Specifications**: A cluster of characters that statistically covary, a family resemblance concept in which possession of most characters is required for inclusion in a species, but not all. A class of organisms that share most of a set of characters.

### 23. Recognition species

**Synonyms**: Specific mate recognition system (SMRS)

**Related concepts**: Biospecies

**Principal author**: Paterson 1985

**Specifications**: A species is that most inclusive population of individual, biparental organisms which share a common fertilization system

### 24. Reproductive competition species

**Synonyms**: Hypermodern species concept, Biospecies (in part)

**Principal author**: Ghiselin 1974

**Specifications**: The most extensive units in the natural economy such that reproductive competition occurs among their parts.

### 25. Successional species

**Synonyms**: Paleospecies, evolutionary species (in part), chronospecies

**Principal authors**: George 1956; Simpson 1961

**Specifications**: Arbitrary anagenetic stages in morphological forms, mainly in the paleontological record.

### 26. Taxonomic species

**Synonyms**: Cynical species concept (Kitcher 1984)

**Related concepts**: Agamospecies, genealogical concordance species, morphospecies, phenospecies, phyllospecies

**Principal author**: Blackwelder 1967, but see (Regan 1926)

**Specifications**: Specimens considered by a taxonomist to be members of a kind on the evidence or on the assumption they are as alike as their offspring of hereditary relatives within a few generations. Whatever a competent taxonomist chooses to call a species.

**References**


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