

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, quasispecies

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), phylopecies (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 phylopecies, 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), phylopecies (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), phylopecies

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), phylopecies

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: Phylopecies

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: Compilospecies, horizontal or lateral transfer

Principal author: Wagner 1983

Specifications: Species formed from the hybridisation of two distinct parental species, often by polyploidy.

Phylopecies

Synonyms: Autapomorphic phylopecies, monophyletic phylopecies, 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-dimensional 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, phylopecies

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.

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