Appendix 3.6

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1 Alternative terms for the processes of selective extinction and speciation

Over time, a variety of terms have been used to represent the concept of selective extinction and speciation as well as its components and realms of relevance. Various aspects of the processes are emphasized in each case. As is the case for the literature on the general issue of natural selection at the species level, there is inconsistent use of these terms and there is considerable debate about differences. This appendix is a brief presentation of some of the terms related to processes within selective extinction and speciation, in many cases dynamics nearly equivalent to selective extinction and speciation. It is included in the interest of adding material relevant to the history (and is confined mostly to historical developments) and documentation of the concept. Some of the debate surrounding details of the concept is found in the literature cited below; further, and more recent, information is available in sources such as Okasha (2006).

For the early emphasis on extinction the term "differential extinction" was used (e.g., Guilday 1967). The term "selective extinction" was used by Brooks (1972), who also used "differential extinction") and Vermeij (1987). Whittaker and Woodwell (1972) used the term "edited". The community is a record of many successful species additions accumulated through evolutionary time, edited by extinctions. The process makes the community a system of interacting, niche-differentiated species.

De Vries (1905), Stanley (1975a) and others used the term "species selection". Alexander and Borgia (1978) used the term "differential species extinction" in comparing selective extinction to group selection.

The verbs "sort", "winnow" (Davis 1990, editor's term), "prune" (Roughgarden 1983),[1] and "edit" (Whittaker and Woodwell 1972) have been used to represent the nonrandom culling process of selection in selective extinction and speciation, primarily extinction. These terms combine the concepts of nonrandomness with the extinction process. When separate terms for selectivity and extinction are used together, common adjectives and adverbs implying selectivity include: "nonrandom", "differential", and "preferential".

Chapter 3 and Appendix 3.2 deal with understanding macroecological or species-level patterns (and species frequency distributions in particular) as influenced by the combination of selective extinction, selective speciation and microevolutionary processes. The combined processes of selective extinction and speciation are variously named in the scientific literature. "Macroevolution" is one of the more common terms, with its emphasis on consequences for changes in groups of species with taxonomic or genealogical affinity. As a term, macroevolution originated before 1945. In 1945 Wright (1945), in one of the early uses of the term "macroevolution", attributes the term to Dobzhansky (1937). Eldredge (1985) indicates that the term was used by Mayr (1942). The term has been developed by Stanley (1979) and many others. A sampling includes: Benton (1987), Brown and Maurer (1989), Cracraft (1985b), Damuth (1985), Dobzhansky (1937), Eldredge (1985), Eldredge and Cracraft (1980), Givnish (1989), Gould (1990), Gould and Eldredge (1977), Greenwood (1979), Hoffman (1983), Hoffman and Hecht (1986), Hull (1976),

Kitchell (1985), Levinton (1983), Maynard Smith (1983), Mayr (1942, 1982), Salthe (1985), Simpson (1953), Stanley (1975a 1979), Stanley *et al.* (1983), Vrba (1980), Wright (1945).

Scattered among the many works related to the combined processes of extinction and speciation in relation to species characteristics are a variety of other terms. The most common is "species selection", as used by a variety of authors such as Arnold and Fristrup (1982), Cracraft (1985b), Futuyma (1986a, 1987), Gould (1982b), Gould and Eldredge (1977), Grant (1989), Grantham (1995), Hoffman (1984), Hoffman and Hecht (1986), Maynard Smith (1988, 1989), Slatkin (1981, 1983), Stanley (1975a, 1979, 1989), and Vrba (1980, 1984). "Species selection" may become the most commonly used term in the long run, partly because it helps draw the analogy with selection at the individual level so firmly entrenched in the minds of modern day biologists.

Other equivalent or related expressions found in the literature include "natural selection at the level of the species" (Margalef 1975), "sorting among species" (Arnold and Fristrup 1982, Grant 1989, and Stanley 1989), "transpecific evolution" (Stanley 1975a), "interspecific selection" (Arnold and Fristrup 1982, Grant 1989, Simpson and Beck 1965, Wynne-Edwards 1962), "selection among species" (Arnold and Fristrup 1982, Grant 1989, Vermeij 1987, Vrba 1984, and Wright 1956), "differential sorting" (Cracraft 1985b), "differential speciation and extinction (rates)" (Futuyma 1987, Hoffman 1984), "selective biotic extinction" (Flessa *et al.* 1975), "differential (rates of, frequency of) speciation and extinction" (Gould 1982b, Marzluff and Dial 1991), "nonrandom speciation and extinction" (Marzluff and Dial 1991), "species sorting" (Maynard Smith 1989), "sorting process among species", and "preferential extinction" (Stanley 1989). "Species dynamics" is used in some of the literature (e.g., Gaston 1988) and is equally inclusive of extinction and speciation just as "population dynamics" is usually taken to include both birth and death processes.

In this book, as in Fowler and MacMahon (1982), the expression "selective extinction and speciation" is used to represent the overall concept as defined by the postulates laid out in Chapter 3. Microevolution is internal to, and an integral part of, selective extinction and speciation. Selective extinction and speciation can apply to any species group but the emphasis in this book is on the implications for management that is sufficiently holistic to embrace larger biotic systems such as ecosystems and the bioshpere in an evolutionarily enlightened (Brown and Parman 1993) way. "Species selection" and "macroevolution" are avoided because of their historical ties (constraint) to taxonomic or genealogical consideration (Gilinsky 1986, Mayr 1982, Stanley 1975a) both of which are part of selective extinction and speciation. One of the primary objectives of Chapter 3 is to dwell on the breadth of species sets to which selective extinction and speciation apply, including ecosystems and the determinants of their structure and function. This entails expanding the emphasis from taxonomic groups to all species whether represented in ecosystems, communities, or the biosphere. Specific ties of evolution to ecosystems are to be avoided because natural selection as it applies to all levels of biological organization may be among the most promising unifying principles for all of the biological sciences (Arnold and Fristrup 1982, Bateson 1979, Dell and Goolishian 1981, Eldridge 1985, Lewontin 1970, Williams 1992).

Natural selection in biotic systems, whether among genes, individuals, genomes, species, or other biotic units, fits within the general concept of selective systems failure. Self-replication distinguishes biotic systems from most others, but death, extinction, or failure are common to all. The selectivity of failure is also common to all as noted for the general notion of emergence (Morowitz 2002), and the failure among human, generated systems (e.g., Ormerod 2006 where it is also noted that failures of parts are often to the benefit to the whole, parallel to Carse's concept of infinite games; Carse 1986). The universal or ubiquitous aspect of selective systems failure applies to systems from atoms to galaxies to include biotic systems—all of which count among the collection of elements of reality accounted for in the reality of patterns (Fig. 1.4).

Note

1. See also Morowitz (2002) for use of the term "prune" in the more general sense of selective systems failure as

part of the process of emergence in and among systems at all hierarchical levels and domains of reality.

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