General Models of Ecological Diversification (Discussion)

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Outline

- Introduction
- Four Models
- Some Statsical Measures
- Redundancy Model
- Partitioning Model
- Expansion Model
- Neutral Model

Introduction

During Phanerozoic Diversity increased

- To explain the changes that happened due to increase in diversity during Phanerozoic, there are many hypothesis proposed for example, escalation, seafood through time, tiering etc.
- These hypothesis can be generalized into four models of ecological diversifiaction.

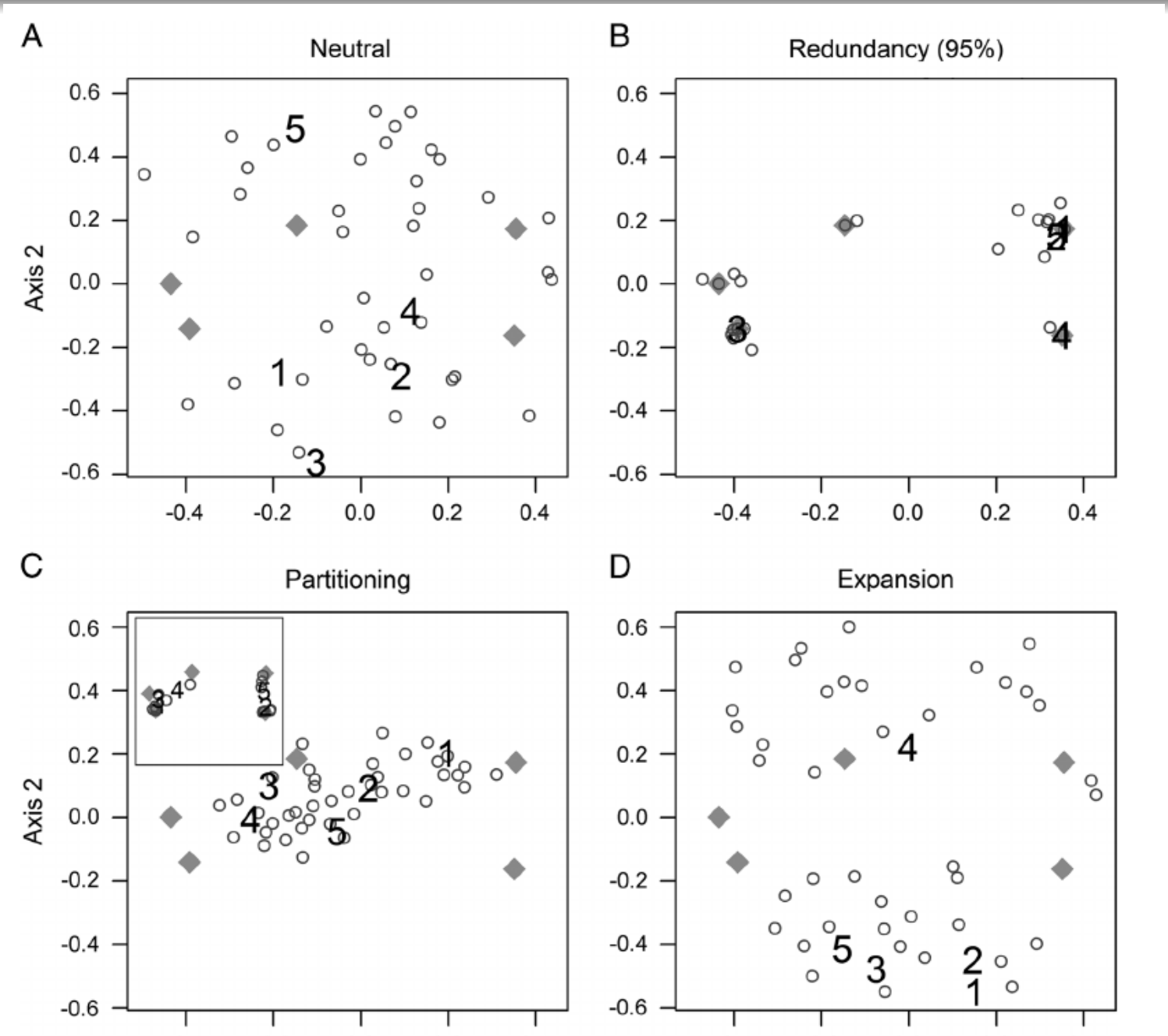
Statstical Measures used

- Functional Richness (FRic)-the amount of functional space filled by the community.
- Functional Eveness (FEve)- the eveness of the abundance distribution in a functional trait space.
- Mean Distance (D)- the average pairwise distance between two species in functional trait space.
- Funactional Divergence (FDiv)- the average pairwise distance from Principal coordinates analysis(PCoA) Centriod. {PCoA: It is dimensionality reduction analysis method.}
- Maximum Distance (M)- Maximum pairwise distance between two species in functional trait space.

Some terms that we need to know before we dive into it

- Tiering - Vertical distribution of organisms with benthic boundary layer.
- Seafood through time - Changes in biomass, energetics and productivity in the marine ecosystem.
- Adapative Radition- relatively fast evolution of many species from a single common ancestor.
- Ecological Release- population explosion that happens when a species freed from limiting factors in its environment.
- Enemy-driven escaltion- The role of prey is downplayed in the arms race between prey and predator.
- Coevolution - two or more species change reciprocally in response to one another; prey are thought to drive the evolution of their predator, and vice versa.

Four Models of Ecologocial Diversification



Dyanamics and Mechanism of Models

TABLE 1. Summary of the four models of ecological diversification. Model dynamics are based on simulations of community assembly, in which species' life habits (functional traits) were assigned according to the model rules. However, the models are generalizable to any scale or process in which taxonomic richness increases. Listed mechanisms are non-exclusive, and include representative hypotheses spanning ecological and evolutionary processes. Models are sorted according to typical ranking of ecological disparity/functional diversity statistics (i.e., the expansion model generally has greatest values, whereas redundancy has the smallest). Strict ("str.") and relaxed ("rel.") refer to alternative implementations of the partitioning model. Statistics listed are those frequently used in the morphological disparity and functional diversity literature, although the general dynamics ought to occur for other statistics. See Table 2 for description and abbreviations of each statistic. Dynamics are reported as a function of increasing species richness (S); most dynamics reach asymptotic values at sample sizes of 50–200 species. When model rules are enacted in weakened form, dynamics will be intermediate between those of the neutral model and the relevant model.

			Dynamics			
Model	Rule	Potential causal mechanisms	Richness (H)	Disparity/dispersion ($FDis$, V, $FRic$, M)	Internal structure ($FDiv$, D)	Spacing ($FEve$)
Expansion	Successive species occupy life habits divergent from those already inhabited.	Divergence, character displacement, adaptive radiation, ecological opportunity, ecological release, key innovation, habitat colonization, increased nutrient availability, (in part: ecosystem engineering, escalation, Red Queen, seafood through time)	$\approx S$	↑ (fastest)	↓ $FDiv$	Constant
Neutral	Successive species accumulate without regard to existing life habits.	Stochasticity, random colonization from species pool	$\approx S$	↑ (fast)	↓ $Fdiv$ D constant	Constant
Partitioning	Successive species occupy life habits intermediate to those already inhabited.	Niche partitioning, specialization, coevolution, ecological fitting	rel: $\leq S$ str: $< S$	↑ (slow) $FRic$, M, ↓ (slow) $FDis$, V	↓	↓
Redundancy	Successive species occupy life habits already inhabited.	Keystone species, intermediate disturbance, competition–colonization trade-off, emergent neutrality, habitat filtering, niche conservatism, adaptive peaks, systems stability	Constant and low	↓ $FDis/V$, low $FRic$, constant M	↑ $FDiv$, ↓ D	↓