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Limits to randomness in paleobiologic models: the case of Phanerozoic species diversity

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The question of how random, or unconstrained, paleobiologic models should be is examined with a case study: Signor's (1982, 1985) inverse calculation of levels of marine species diversity through the Phanerozoic. His calculation involved an ingenious model that estimated species numbers and species abundances in the world oceans of the past by correcting known numbers of fossil species for variations in sedimentary rocks available for sampling and in effort paleontologists might devote to sampling. The model proves robust to changes in possible shapes of species-abundance distributions, but it is sensitive to alterations in the assumption that paleontologists collect fossils at random. If it is assumed that ease of collecting varies with age of sediment (with the Cenozoic offering easy sampling) or that paleontologists tend to seek out rarer fossils, results of the inverse calculation change. In particular, the magnitude of the calculated Cenozoic diversity increase always declines from the factor of about seven as originally reported to something considerably smaller. This leaves open the problem of the magnitude of Cenozoic increase in marine species diversity, awaiting better empirical data and, perhaps, more exacting models, random or otherwise.

Key words: random models, inverse calculation, Phanerozoic species diversity, macroevolution.