17.5 ‘Expected distinctness’ tests

Species master list

The construction of taxonomic distinctness indices from simple species lists makes it possible to address another of the ‘desirable features’ listed at the beginning of the chapter: there *is* a potential framework within which TD measures can be tested for departure from ‘expectation’. This envisages a *master list* or *inventory* of species, within defined taxonomic boundaries and encompassing the appropriate region/biogeographic area, from which the species found at one locality can be thought of as drawn. For example, the next illustration uses the full British faunal list of 395 free-living marine nematodes, updated from the keys of Platt & Warwick (1983) and Platt & Warwick (1988) . The species complement at any specific locality and/or historic period (e.g. putatively impacted areas such as Liverpool Bay or the Firth of Clyde) can be compared with this master list, to ask whether the observed subset of species represents the biodiversity expressed in the full species inventory. Clearly, such a comparison is impossible for species richness *S*, or *total* TD or PD, since the list at one location is automatically shorter than the master list. Also, comparison of *S* between different localities (or historic periods) is invalidated by the inevitable differences in sampling effort in constructing the lists for different places (or times). However, the key observation here (Clarke & Warwick (1998b)) is that average taxonomic distinctness ($\Delta ^ +$) of a randomly selected sublist does not differ, in mean value, from AvTD for the master list. So, localities that have attracted differing degrees of sampling effort are potentially directly comparable, with each other and with $\Delta ^ +$ for the full inventory. The latter is the ‘expected value’ for average distinctness from a defined faunal group, and reductions from this level, at one place or time, *can* potentially be interpreted as loss of biodiversity.

Testing framework

Furthermore, there is a natural testing framework for how large a decrease (or increase) from expectation needs to be, in order to be deemed statistically ‘significant’. For an observed set of *m* species at one location, sublists of size *m* are drawn at random from the master inventory, and their AvTD values computed. From, say, 999 such simulated sublists, a *histogram* can be constructed of the expected range of $\Delta ^ +$ values, for sublists of that size, against which the true $\Delta ^ +$ for that locality can be compared. If the observed $\Delta ^ +$ falls outside the central 95% of the simulated $\Delta ^ +$ values, it is considered to have departed significantly from expectation: a two-sided test is probably appropriate since departure could theoretically be in the direction of enhanced as well as reduced distinctness.

The next stage is to repeat the construction of these 95% probability intervals for a range of sublist sizes (*m* = 10, 15, 20, ...) and plot the resulting upper and lower limits on a graph of $\Delta ^ +$ against *m*. When these limit points are connected across the range of *m* values, the effect is to produce a *funnel plot* (such as seen in Fig. 17.8). The real $\Delta ^ +$ values for a range of observational studies are now added to this plot, allowing simultaneous comparison to be made of distinctness values with each other and with the ‘expected’ limits.¶

¶ *Histogram and funnel plots of the ‘expected’ spread of $\Delta ^ +$ values for a given subsample size (or size range), drawn from a master species list, are plotted in the PRIMER TAXDTEST routine, accessible when the active sheet is the aggregation file for the master list. An option is given to superimpose a real data value on the simulated histogram, or a set of real values on the funnel plot.*

Revision #7
Created 15 March 2022 11:07:21 by Arden
Updated 13 November 2024 04:19:17 by Abby Miller