Expanded RELATE test (Exe nematodes)

As an example of **Tools>Expand Samples** on a data matrix (or **Tools>Expand** on a resemblance matrix, since the expansion can be equally well achieved either before or after the computation of Euclidean distance in this situation) we shall use the Exe nematode study and the form of the data met in Section 9, in which the 19 sites from different environmental conditions around the Exe estuary were sampled 6 times through one year (with just 6 missing samples spread over several sites, i.e. 108 meiofaunal core samples in total). The biotic matrix is Exe nematodes bi-monthly in C:\Examples v7\Exe nematodes, comprising abundances of 182 species (its time-averaged form was used extensively in Section 8). Also open the abiotic data, Exe environment, which we have not encountered here but which is used as a motivating example for the BEST routine in Chapter 11 of CiMC. It consists of 6 sediment-based environmental variables, postulated to be structuring the communities of free-living nematodes, and recorded as relevant to each site over the full year of sampling: median particle diameter, depth of the water table, depth of the blackened H$_2$S (anoxic) layer, height up the shore (this was an intertidal study), % organics and the interstitial salinity. The environmental data therefore has only 19 samples, which are labelled with the site numbers (1-19). Importantly for the **Expand** routine, those labels need to be exactly the same as the levels for the site factor which is defined for the 108 samples of the Exe nematodes bi-monthly biotic matrix.

The biotic samples do have a time (i.e. seasonal) structure, in that they are all collected bi-monthly – factor time, with levels A, B, C, D, E, F in common for each site. The time factor will be ignored, however, for the purpose of this illustration and the (up to) 6 values used as replicates for each site. This is not unreasonable, since they will represent both the spatial and temporal variability at that site through the year (providing a conservative estimate of the true residual variability) and it was seen earlier – in Section 9 for sites 12-19 but true also for all sites – that 2-way crossed ANOSIM (without replication) fails to find significant evidence of a seasonal effect at all.

The Exe nematodes bi-monthly biotic matrix requires fourth-root transformation before the usual similarity calculation (resemblance B-C 4rt), and the *n*MDS plot for all 108 samples, with symbols as the site and labels removed (from **Graph>Sample Labels & Symbols**), shows clear differences among sites. The unordered RELATE test – equivalent to unordered 1-way ANOSIM but giving a ρ test statistic which we can compare with the expanded abiotic test – is obtained by running on the active B-C 4rt sheet: **Tools>Model Matrix**>(Type•Unordered groups) & (Factor A: site) to give the Unordered model. Then, again on B-C 4rt, **Analyse>RELATE**>(Secondary data•Resemblance/ model matrix: Unordered model) gives a Spearman rank statistic of ρ = 0.33 (p<0.01%) – though highly significantly different from zero (and thus confirming site differences), ρ is not large.

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