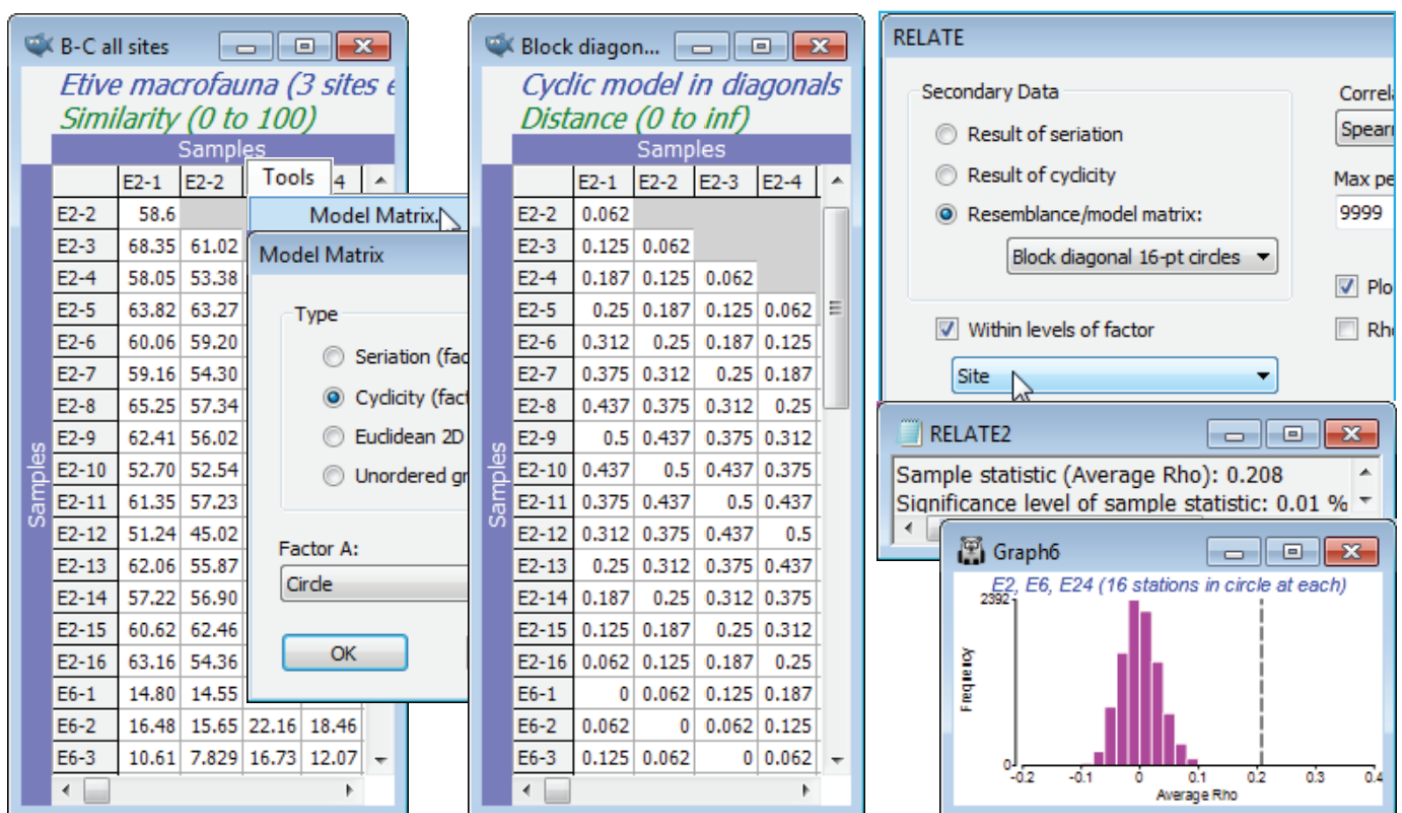


# 2-way RELATE for cyclicity

A 2-way RELATE version of the above test where there are no replicates, and the cyclic factor under test is actually nested within a 'nuisance' factor whose effect we want to remove, is given by reverting to the full data sheet for the Loch Etive macrofauna samples: **Select>All** and recompute the fourth-root transform and Bray-Curtis similarities, as **B-C all sites**, which now has 16 samples in a circle for each of the three sites E2, E6 and E24. Testing for a match with the circular spatial layout of stations, simultaneously at all three sites, whilst eliminating the inevitable differences in community composition for these three locations using 2-way RELATE, should give a still stronger test of the null hypothesis of no community differences within sites against this specific alternative.

As before, the model matrix is constructed by **Tools>Model Matrix>(Type•Cyclicity) & (Factor A: Circle)**, run on **B-C all sites**, giving a model distance matrix (rename it **Block diagonal 16-pt circles**) in which only the block diagonals of the stations within sites will be sensible in this nested case (and which is all that RELATE uses) because, for example, station 1 at E2 and station 1 at E6 have nothing in common. On **B-C all sites**, **Analyse>RELATE>(Secondary data•Resemblance/ model matrix: Block diagonal 16-pt circles) & (✓Within levels of factor Site)** gives an averaged  $\rho$  statistic across the three sites of 0.21, still strongly significant – note the tighter spread of the null histogram (c.f. **Graph1** above) because of the simultaneous testing. The lower value than for the E2 test alone suggests weaker effects at E6 and E24, which is seen in separate (1-way) cyclic tests.



More usually, the cyclic factor under test (often time) is crossed with a second factor (often space), whose effect we want to eliminate for our time test. The 2-way RELATE test structure is the same as for the above nested case however, and a more typical example is now given of a cyclic four-seasons series recorded for several regions, with the added complexity of replication within each of

the cells of this 2-way layout. Though the structure is that of a 2-way crossed ANOSIM, this case is not covered by running an ordered ANOSIM test because, of course, the time factor is cyclic and not serial – an appropriate model matrix therefore needs to be created as an input to RELATE.

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