Principal component and discriminant analyses revealed that shape differences in all small rough periwinkles are very subtle. The situation is further confused in *L. neglecta*, as the identification features used by other authors do not stand up to rigorous analysis. However, when four categories, equivalent to *L. nigrolineata, L. arcana, L. neglecta* and *L. saxatilis*, are defined using the combination of colour plus sculpture, morphological analysis confirms the differences shown.

The 'ecotype' label cannot be applied to *L. neglecta*, since micro-sympatric specimens of *L. neglecta* and *L. saxatilis* firom the British east coast were shown to be morphometrically distinct, with few intermediate shell forms. *L. neglecta* was found to occur well within the range of *L. saxatilis*, while small, reproductively mature *L. saxatilis* occurred in the same barnacle habitat as *L. neglecta*. Moreover, size effects do not account for the differences between the two categories. Thus large *L. neglecta* are distinct from both large and small *L. saxatilis*, and small, mid-shore *L. saxatilis* classify with large high-shore *L. saxatilis* in the analysis, rather than with *L. neglecta*.

Based on the apparent shell homogeneity of *L. neglecta* over its range, and its distinctiveness from *L. saxatilis*, it is proposed that *L. neglecta* is at a more advanced evolutionary stage than is possible with an 'ecotype'. However, this character set on its own cannot be used to infer specific status as defined by the Biological Species Concept.

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# Morphological changes in the digestive epithelium of *Littorina littorea* in relation to the reproductive cycle.

G. Calvo-Ugarteburu[1], V. Saez[2], C.D. McQuaid[1] & E. Angulo[2].
1) Department of Zoology and Entomology. Rhodes University. Grahamstown 6140. South Africa.
2) Zitologi eta Histologi Laborategia. Biologia Zelularra eta Zientzia Morfologikoen Saila. Zientzi Fakultatea. Euskal Herriko Unibertsitatea. 644 P.K. 48080 Bilbo. Spain.

The use of molluscs as indicators of pollution in the marine ecosystem has become world-wide. Special attention has been paid to cellular responses as they take place before the effects of contaminants become evident at other levels, and therefore they can be used to provide an early indication of environmental stress.

This study forms part of a larger project in which five planimetric parameters have been used to study changes in the digestive epithelium of *Littorina littorea* under different environmental and physiological conditions.

The visceral hump of *L. littorea* is formed mainly by digestive gland, gonad and connective tissue, and it is well known that the relative proportions of these tissues vary greatly during the reproductive cycle. The aim of this study was to examine the effect of the reproductive cycle on the planimetric parameters in order to assess the value of their changes as indicators of environmental stress.

The five parameters were : mean epithelial thickness (MET), mean diverticulum radius (MDR), mean luminar radius (MLR) and the ratios MET/MDR and MLR/MET. They were calculated by the method of geometrical transformation (Marigomez *et al*, 1990).

The reproductive state of the animals was calculated as the percentage of the total area of a tranverse section of the digestive gland occupied by digestive tissue, gonad and connective tissue.

A correlation analysis showed that both MET and MDR were highly correlated with the percentage of digestive tissue, and therefore they are not good indicators of pollution. On the other hand, the ratios MET/MDR and MLR/MET proved to be better indicators of stress as they are independient of intrinsec variables such as the reproductive cycle.

## The *Littorina saxatilis* species complex - interpretation using random amplified polymorphic DNAs.

S. Crossland, D. Coates, J. Grahame & P.J. Mill
Department of Pure and Applied Biology, The University of Leeds, Leeds, LS2 9JT, UK

The *Littorina saxatilis* species complex is generally thought to comprise four recognised species. *L. saxatilis* (Olivi), *L. arcana* Hannaford Ellis and *L. nigrolineata* (Gray) are generally regarded as "good" species by most workers. The status of *L. neglecta* Bean has recently been called into question (B. Johannesson & K. Johannesson, 1990 ; K. Johannesson & B. Johannesson, 1990 ; Reid, 1993). The four species are known to be very similar, with no consistent genetic differences reported between them (Crossland *et al.*, 1993).

We have used Random Amplified Polymorphic DNAs (RAPDs) to detect differences between the taxa. RAPDs has already been shown to separate sympatric populations of *Littorina saxatilis* and *L. arcana* from Cornwall (Crossland *et al.*, 1993). The study has now been extended to include all four taxa from two shores in Pembrokeshire, Wales ; one shore is sheltered, the other exposed.

Analysis of data was carried out using the methods outlined in Crossland *et al.*, 1993. This involved calculating Nei and Li's- F-percent similarity index and clustering the resulting matrix using the UPGMA algorithm (Sokal & Sneath, 1969).

The data reported here show clear differences between the species *Littorina nigrolineata, L. arcana* and *L. saxatilis*. "*Littorina neglecta*" remains unresolved from *L. saxatilis*, and on the basis of this investigation cannot be elevated from the status of ecotype. This study has shown that RAPDs can provide molecular information about population structure even when little is known of the organisms' genetics.

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