

In the present work we do not address the question of gene flow, nor do we seek to examine material from a range of sites. We concentrate on one site, the densely barnacle populated platform at 'Peak Steel', on the Yorkshire coast at Ravenscar (Grid Reference NZ/979026). On this shore, small and large individuals of *L. saxatilis* and *L. arcana* occur with large animals living on the boulders and cliff habitats and small ones in the barnacles. We have not found any reproductively active small *L. arcana* in the barnacles, judging by the absence of females with turgid, opalescent pallial oviducts in this habitat and size category. We have found what appear to be reproductively active *L. saxatilis* at shell sizes of < 5 mm. These animals are judged to be *L. saxatilis* on the basis of similarity of shell to nearby boulder populations where the animals are of the larger, 'usual' size, and also on the basis of metabolic studies. We have investigated the activity of the enzymes Aat and Alat in these animals, and find that *L. saxatilis* fall into two metabolic types : high shore animals with higher thermal tolerance of the enzymes, and low shore animals with lower thermal tolerance identical to that of the barnacle-dwelling form. The relative activity levels of the two enzymes is shown to be the same between barnacle-dwelling (small) *L. saxatilis* and low shore (boulder) *L. saxatilis* (ANCOVA, $P = 0.9458$). Distinct from these is another small, barnacle-dwelling brooding periwinkle. This is distinguished by having a slightly more 'patulous' shell with a thinner posterior lip. In a sample of 10 breeding females, the mean size of six shells (*L. saxatilis*) was 3.376 mm (range 2.627 - 3.983 mm), and of the remaining four was 2.687 mm (range 2.505 - 2.972 mm). We suggest that this smaller and differently shaped form represents *L. neglecta*. As well as being distinct in terms of shape, it is metabolically distinct : the enzyme thermal tolerance is lower than that of low shore or small barnacle-dwelling *L. saxatilis*, and the relative enzyme activity levels is different (ANCOVA, $P = 0.0015$, for the difference between small *L. saxatilis* and *L. neglecta*).

We conclude that either *L. saxatilis* produces two distinctly different barnacle-dwelling ecotypes on this shore, differing both in shape and in metabolic characteristics, or that *L. neglecta* does exist as a separate and distinct species. The differences between the two forms would strongly suggest the latter to be the case, clearly more work is needed on this system as the potential for understanding evolutionary processes is considerable.

REFERENCES

- JOHANNESSEN, B. & K. JOHANNESSEN, 1990. *Hydrobiologia*, 193 : 71-87.
 JOHANNESSEN, K & B. JOHANNESSEN, 1990. *Hydrobiologia*, 193 : 89-97.
 REID, D.G. 1993. *J. Moll. Stud.*, 59 : 51-62.

Comparison of imposex response in three prosobranch species

M. Huet

Laboratoire de Biologie Marine, URA CNRS 1513, 6, avenue Le Gorgeu, BP 452, F-29275 Brest Cedex

Two methods have been used to analyse imposex phenomenon in gastropods. One uses narcotization and the other does not. In order to compare calculated indices (RPSI = Relative Penis Size Index and VDSI = Vas Deferens Sequence Index) obtained with the two methods, samples were analysed using the two methods. Narcotization leads to an underestimation of RPSI in relation to the method non using narcotization. Furthermore narcotiza-

tion points out a seasonal variation of male penis length which is not visible when animals are not narcotized. This seasonal variation in penis length leads to a seasonal variation of RPSI ($RPSI = [\text{mean female penis length}/\text{mean male penis length}]^3 \times 100$) what has for consequence to obtain no good correlation between RPS indices of the three species *Nucella lapillus*, *Ocenebra erinacea* and *Hinia reticulata*. Nevertheless VDSI is not different with the two methods and we obtain a good correlation between these indices in the three species. *Nucella lapillus* is the most sensible with TBT while *Hinia reticulata* is the less one. Two sterilized females of the mud-snail *Hinia reticulata* have been discovered but it seems this sterilization is not due to the overgrowth of vas deferens tissues in the vaginal opening. A more complete research will be necessary to observe intermediary stages between stage 4⁺ (see Stroben *et al.*, 1992) and sterilized females in this species. An abnormality in *Nucella lapillus* in Brest region (West Brittany) has conducted us to discard some animals from the calculation of the indices : aphallic males and females in polluted areas. This last point was first discovered by Gibbs (1993) in England and a research on this phenomenon is in preparation.

REFERENCES

- GIBBS, P.E., 1993. *J. Mar. Biol. Ass. UK*, 73 : 667-678.
STROBEN, E., J. OEHLMANN & P. FIORONI, 1992. *Mar. Biol.*, 113 : 625-636.

An experimental analysis of resource allocation in relation to the radiation of life histories within the *Littorina saxatilis* group

R.N. Hughes

School of Biological Sciences, University of Wales, Bangor, Gwynedd, LL57 2UW, Wales, UK

Responses in flesh growth, shell growth and reproductive output to limited food ration were measured in *Littorina arcana*, *L. neglecta* and in *L. saxatilis*. Flesh growth in fertilized *L. saxatilis* was significantly less than in unfertilized snails taken from the same population sample, indicating a trade off in resource allocation to somatic and reproductive functions. Decreasing food ration significantly depressed flesh growth in all species, but had no significant effect on reproductive output. Priority in resource allocation therefore was given to reproduction. The degree of this priority was similar among species, since their responses to food ration were not significantly different. The principle of allocation therefore appears to have been irrelevant in the radiation of life histories in the *L. saxatilis* group. *

Aminotransferases in *Littorina* : is there a functional story ?

S.L. Hull, P.J. Mill and J. Grahame

Department of Pure and Applied Biology, The University of Leeds, Leeds LS2 9JT, UK

The Aat-1 locus of the enzyme aspartate aminotransferase (Aat, E.C. 2.6.1.1) appears to be under some form of differential selection in both *Littorina saxatilis* (Johannesson & Johannesson 1990) and *L. arcana* (Grahame, Mill, Double & Hull 1992). In both species, Aat-1 120 predominates in high shore populations, whereas the Aat-1 100 allele occurs in high frequencies in low shore populations. The aim of this study was to determine if there was any physiological basis for the reported pattern of allozyme variation.