

## Density-dependent growth of bivalves dominating the intertidal zone of Banc d'Arguin, Mauritania: importance of feeding mode, habitat and season

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### Text S1 Justification of the experimental set-up used to in situ manipulate clam densities.

To our knowledge density-dependent growth (and survivorship) in bivalves has only been studied in infaunal filter-feeding species using enclosures to maintain treatment densities of the focal species in the field (e.g. Peterson 1982, Peterson & Black 1987, Black & Peterson 1988, Peterson & Beal 1989, Peterson & Black 1993). Generally, in these studies, enclosures are placed after which all living infaunal organisms are removed from the enclosed plot, to which variable densities of the focal bivalve species, all being individually measured and marked, are added. Subsequently, bivalve growth and/or survivorship over time are measured per treatment. Although such enclosure experiments provide a wealth of quantitative data on density-specific processes in soft-sediment filter-feeding bivalves, there is also widespread concern about enclosure (and exclosure) experiments, because enclosure walls baffle currents, potentially altering sedimentation rates and the supply of suspended particulate organic matter, which often result in unnatural growth rates in the target species (Peterson & Beal 1989, Wilson 1991, Peterson & Black 1993). Furthermore, excavation of all macrofauna from the experimental plot, before relocation of known densities of marked individuals of the target species to the enclosed plot, destroys the surface structure of the sediments (especially in seagrass-covered sediments), which may also have significant effects on growth rate and/or other individual, population and community parameters. This effect may be even stronger in benthic soft-sediment organisms belonging to feeding guilds that, in contrast to suspension feeders, obtain their food from the surrounding sediment and/or pore-water (e.g. deposit-feeders and chemosymbiotic organisms). Given the artefacts that may be imposed by the use of enclosures in a high energy environment like the intertidal Banc d'Arguin that is dominated by seagrass beds, and the knowledge that one of our three focal species has a chemosynthetically-fueled diet (i.e., *Loripes orbiculatus*), we used an alternative experimental set-up to *in situ* manipulate clam densities while keeping growing conditions as natural as possible, as described in the section *Materials and Methods–Experimental design*

### Literature cited

Black R, Peterson CH (1988) Absence of preemption and interference competition for space between large suspension-feeding bivalves and smaller infaunal macroinvertebrates. *J Exp Mar Biol Ecol* 120:183-198

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**Text S2** *Explanation of the method used to determine the minimum value for the maximum shell height  $H_{\infty}$  for our focal bivalve species.*

We assessed whether the variance in the residuals was described as a function of initial size ( $H_1$ ), as this would indicate that the assumed  $H_{\infty}$  is inappropriate; because the Von Bertalanffy growth model that we used in this study assumes that growth rates decrease linearly with clam size until growth becomes 0 at  $H_{\infty}$ , any large clams that approached  $H_{\infty}$  and grew relatively fast would have a disproportionately large estimated  $k$ . When this is the case, a model where the variance is described as a positive (e.g. power or exponential) function of  $H_1$  would be supported over a model where the variance is not a function of  $H_1$ , which would indicate that  $H_{\infty}$  was chosen too small. Similarly, when  $H_{\infty}$  was chosen too large, any small clams that grew relatively fast would have a disproportionately large estimated growth constant  $k$ . Therefore, having increased the value of  $H_{\infty}$  until the variance in the residuals of the most parsimonious model was no longer described as a positive function of  $H_1$  provided a method to determine the appropriate minimum value for  $H_{\infty}$ , which turned out to be at 76.3, 17.1 and 11.4 mm for *Senilia senilis*, *Pelecypora isocardia* and *Loripes orbiculatus*, respectively.

**Text S3** *Results of the sensitivity analysis with respect to the maximum value of  $H_{\infty}$  for our focal species.*

As there is some individual variation around  $H_{\infty}$  we performed a sensitivity analysis with respect to the selected value of  $H_{\infty}$ . Note that this sensitivity analysis was only performed for  $H_{\infty}$  values larger than those determined for each species, as for smaller values we would have to incorporate a variance structure described as a function of initial size, which would result in erroneous predictions of  $k$  (for details see supplementary Text S2). Our results for *Pelecypora isocardia* and *Loripes orbiculatus* did not change when increasing  $H_{\infty}$  (and the corresponding variance structure) across a range of values for  $H_{\infty}$  (*P. isocardia*, 17.1–23 mm; *L. orbiculatus* 11.4–14 mm), reaching much beyond the natural range of  $H_{\infty}$  in these two species (respectively 17–20 and 10–12 mm; M. van der Geest and J. A. van Gils, unpublished data). For *Senilia senilis* the result did not change when varying  $H_{\infty}$  (and the corresponding variance structure) between 76.3–81.7 mm. However, when setting  $H_{\infty}$  to values higher than 81.7 mm, the effect of density on shell growth in *S. senilis* becomes significant. Given that 99.9% of the *S. senilis* population has a shell height smaller than 81.7 mm ( $N = 2234$ ; M. van der Geest and J. A. van Gils, unpublished data) and that the height of the largest marked *S. senilis* specimen that we recaptured measured  $H_2 = 68$  mm, we believe that using our estimated value of  $H_{\infty} = 76.3$  mm in our statistical models for *S. senilis* is justified.