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The DEB model as tool to predict ecological responses of *Brachidontes pharaonis*

There are numerous energetic models that explain the growth of molluscs according to environmental conditions, i.e. temperature and food supply; some of these models are based on the Dynamic Energy Budget model (DEB model). Hence, we decided to use this model to get information about mechanisms of energy utilisation and ecological responses at species level. We focus on a particular aspect of energy budget of *Brachidontes pharaonis*, one of the most common intertidal bivalve colonising hard substrates in Southern Mediterranean shallow waters.

In this context, energy assumes a central role as energy from food is allocated at a certain rate to the basal metabolic maintenance, growth, development and reproduction and that depends upon metabolism (Brown et al., 2004). Metabolism depends upon temperature which controls and regulates biochemical kinetics (Brown et al., 2003; 2004; Clarke and Gaston 2006). For animals with indeterminate growth (animals growing rapidly when young for quickly reaching mature gonads, *sensu* Charnov 1993) like most of marine invertebrates, is well known that the more the energy available for the organism, the more the somatic growth and the gonadal output. High quality and abundant gonadal tissue warrant abundant gametes, which represent the *condicio sine qua non* to insure viable populations over time (Sebens 2002).

Consequently, we need a model linking the energy utilised for growth, reproduction and respiration of individual organisms to energy from available food may. The DEB model could satisfy the most of these needs.

During a mesocosmal experiment lasting 17 weeks, specifically set up, we weekly measured growth, respiration rates and feeding rates of *B. pharaonis* in order to estimate basal parameters of the DEB model. In particular, starvation experiments were made simultaneously with feeding conditions experiments on a sample of 624 mussels. Starvation experiment started after 8 weeks of *ad libitum* feeding condition. Preliminary data showed that starvation experiments

are a good tool to understand how energy reserves are allocated by the organism. Although, estimation of DEB parameters is complicated and can often be done in an indirect way, combining measurement such as feeding rates and respiration rates it would be useful to asses the energy balance of an individual, i.e. the energy potentially available for growth.

References

Brown, J.H., Gillooly, J.F., 2003. Ecological food webs: high-quality data facilitate theoretical unification. P. Natil. Acad. Sci. USA 100, 1467-1468.
Brown, J.H., Gillooly, J.F., Allen, A.P., Savage, V.M., West, G.B., 2004. Toward a metabolic theory of ecology. Ecology 85, 1771-1789.
Charnov, E.L., 1993. Life history invariants. Oxford University Press, Oxford.
Clarke, A., Gaston, K.J., 2006. Climate, energy and diversity. P. Roy. Soc. B 273, 2257–2266.
Sebens, K. P., 2002. Energetic constraints, size gradients and size limits in benthic marine invertebrates. Integrated and Computational Biology PloS. Comput. Biol. 42, 853-861.