Modeling the physiological performance of intertidal and subtidal populations of the brown mussel, Perna perna

C.J. Monaco, & C.D. McQaud
Rhodes University, South Africa
christianmonaco@gmail.com

Perna perna is an ecologically and commercially important marine mussel species, distributed widely throughout subtropical rocky shores in the Indian Ocean. It represents an important protein source for rural communities and a growing aquaculture industry in the region. It is critical to gain a better understanding of how this and other sensitive species will respond to environmental drivers, especially in an era of ongoing climate change. One of the most prominent approaches currently being used by ecologists to characterize the physiological condition of organisms under different environmental contexts is the Dynamic Energy Budget (DEB) model. Once parameterized, DEB models allow quantifying the flows of energy/mass amongst the different components of an individual’s energy budget (maintenance, growth, reproduction), which ultimately determine fitness and ecological success. A first version of a DEB model was recently developed for P. perna, which accurately predicts the species’ performance throughout the coast of South Africa. This early version, however, does not discriminate between subtidal and intertidal populations, which predictably experience radically different conditions of feeding and aerial (anaerobic) stress. Here we build on this initial effort to produce a model that explicitly accounts for increased energetic costs incurred during periods of aerial exposure on the energy budget of P. perna. We validated the model using shell length and reproductive output data collected from the intertidal and subtidal zones. The new model presented here is able to quantify reductions in energy invested into growth and reproduction, thus capturing the influence of tide dynamics on this species' physiological condition. Furthermore, the model can provide predictions of performance under expected scenarios of food and temperature. This model should prove useful to resource managers and conservationists interested in predicting population dynamics of P. perna.