

Spatio-temporal variation of trematode parasites community in *Cerastoderma edule* cockles from Ria de Aveiro (Portugal)

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Cerastoderma edule (edible cockle) is among the most exploited bivalves in Europe playing an important socio-economic role. Cockles are keystone species living in estuaries and lagoons. They act as ecosystem engineers and occupy a crucial position within food webs. In fact, cockles contribute to biodiversity and ecosystem resilience, and therefore the identification of environmental factors that control their population dynamics, including parasitism, is of utmost importance. Trematodes are the most prevalent macroparasites of cockles being able to exert an impact both at the individual and population levels. Therefore, it is of prime relevance to recognize and understand the parasite-host system dynamics in order to better predict potential conservation threats to bivalve populations and to maximize the success of stock and disease episodes management.

Cockle monitoring was conducted in 2012 and 2016, in six and eight stations, respectively, distributed by two channels from the Ria de Aveiro coastal lagoon, northwest of Portugal. Cockles were sampled in one single occasion in 2012 and seasonally in 2016. The tested hypothesis is that the trematode community in cockles was spatially and seasonally heterogeneous but stable over time.

The main result showed that despite a relative homogeneity of the parasite community structure in cockles, the among-years heterogeneity of trematode communities was higher than among-sites and among-seasons heterogeneity rejecting the postulated hypothesis. It was demonstrated that (1) spatially, despite an overall channel difference and a slight downstream-upstream gradient, mean parasite species richness per cockle and mean metacercariae abundance per cockle displayed low values. This scarcity of trematode parasites in the Ria de Aveiro was linked to the success of infection processes, which appears to be related to the more or less sheltered status

of the habitat. In inner areas of coastal ecosystems with more continental influence (which is the case of the present study area), more pronounced seasonal variation of temperature and salinity, less hydrodynamics and lower water mass turnover, and sometimes seagrass occurrence and salt marsh proximity, trematode parasite abundance is often low. Conversely, more oceanic influenced habitats with more buffered temperature and salinity fluctuations, and higher hydrodynamics features are generally characterized by higher metacercariae abundance. (2) Seasonally, and conversely to what is generally expected, there was no evident modification in the sampled trematode community, a possible direct consequence of trematode scarcity found in the Ria de Aveiro. (3) Interannually, there was a worrisome loss of trematode diversity and prevalence which consequently indicates an important loss of overall diversity and/or environmental conditions reflecting the negative effects of global and local changes (mean temperature rise and overharvesting, among others).

This work most important outcome was the effective use of trematode communities as possible early warning indicators of changes (mean temperature rise and overharvesting, among others) and deteriorating conditions (e.g. increase of exposure to several anthropogenic-derived contaminants) occurring in an ecosystem, which might be helpful to assess ecosystem ecological status and to identify threatened areas.

