Factsheet No. 8, July 2017

CERES storyline - clams at the South Atlantic coast

What do we expect under climate change?

The European clam Ruditapes decussatus is widely distributed along the coastal and estuarine areas of Europe and Northern Africa and represents an important resource income due to its high commercial value. *R. decussatus* is extensively produced and harvested in Portugal, where clam farming represents an important economic sector. The main production areas of this species are Ria de Aveiro (40°42'N; 08°W) and Ria Formosa Lagoon (37°01'N; 07°49'W). In these production areas, clams are reared in plots in the intertidal zone. Clam farming involves seeding juveniles, collected from natural beds, into plots maintained in tidal flats and harvesting commercial size animals. During the last two decades, the European clam production has suffered an important decrease due to several constraints, namely recruitment failures and excessive pressure on the capture of juveniles on natural banks and severe clam mortalities.

Given their global importance, coastal marine environments are a major focus of concern regarding the potential impacts of climate change, namely due to alterations in seawater salinity and temperature. These two factors are major issues impacting estuarine organisms, especially in cases of abrupt changes.

Therefore, the occurrence of extreme climate events, especially extreme rainy events and drought periods, may severely impact bivalve's species, affecting immunological and physiological processes. The increased physiological stress frequently results in behavioral and physiological responses and in extreme cases may lead to massive mortality episodes. Our goal in CERES is to determine the potential impact of Climate Change, namely the combined effect of estuarine salinity and temperature changes, not only on clam survival, but also in behavior, immunology and biochemistry.

How vulnerable are clams?

Climate change processes potentially threaten the bivalve mollusc aquaculture sector, which is economically relevant to several regions and countries. Detrimental effects on bivalve mollusc species might arise from the associated increase in sea surface temperature, pH reduction, higher frequency of extreme climatic events, extreme alteration in salinity, and possible synergies with other non-climatic stressors, such as harmful algal blooms and mollusc diseases. Simultaneous exposure to multiple stressors may lead to even stronger impacts on organisms, but interacting effects remain poorly understood

What is the economic value of this species?

In Portugal, the production of bivalves is an important social and economic activity, with a great growing potential, due to the edaphic-climatic and geographic conditions. Bivalves accounted for 45% of the total Portuguese aquaculture production in 2014. Artisanal production of bivalve mollusks is mainly based on the culture of the European clam, *Ruditapes decussatus*, (2.251 tons) and oysters (*Crassostrea* sp.) (1.085 tons) (DGRM, 2016). The culture of R. decussatus in Ria Formosa Lagoon (Souths of Portugal) represents 90% of the national production and is central to the socioeconomic framework.

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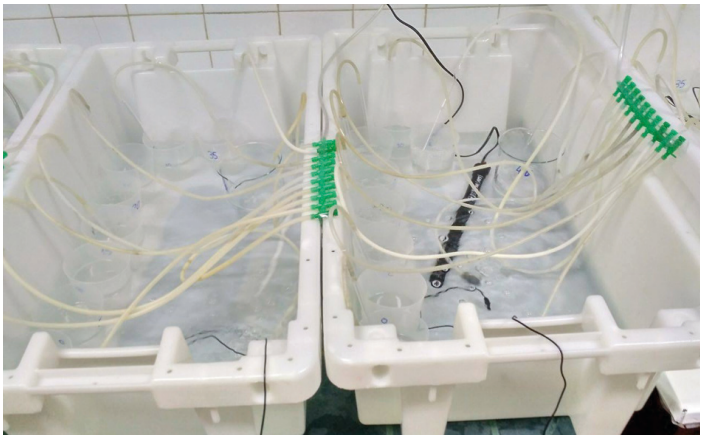
What are the challenges?

Several studies reported the effect of climate changes in bivalves. Most studies evaluated the effect of changes in an isolated environmental factor and some evaluated the potential impact of the combined effects of changes in different environmental parameters in bivalves, such as temperature/pH. Other studies revealed that salinity by itself can significantly affect bivalve behavioral and physiological responses and in extreme cases may lead to mortality episodes. However, no studies evaluated so far the combined effect of temperature and salinity in bivalves.



What is the working program in CERES?

Adults and juveniles of European clams *R. decussatus* will be distributed in different aquaria to test the combination of different levels of temperature (from 5 to 35°C) and salinities (0 to 40) exposures. For each condition, 3 replicates will be used, with 5 organisms per replicate (15 organisms per condition). Organisms will be exposed to each condition for 144 hours. During the experimental period animals will be checked for mortality and behavior factors, every day. Aquaria will be maintained at 12 light: 12 dark photoperiod and continuous aeration. Animals will be fed with the same diet, seawater will be renewed every day, and temperature and salinity levels re-established. Dead organisms will be removed when identified. After exposure, surviving organisms will be frozen for biochemical and physiological analysis.

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