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CERES storyline - oysters at the South Atlantic coast

What do we expect under climate change?

Until the 1970s, in Portugal and France the Portuguese oyster *C. angulata* was a relevant species for the shellfish industry. However, this species started to become affected by a viral disease in the late 1960s, and its exploitation collapsed. To overcome this situation, *C. gigas* was illegally introduced in the 90s, despite being considered as an exotic species, and currently is an important biological and economic resource. The conservation of *C. angulata* populations is important in the context of production diversification and biodiversity preservation, since in Europe, pure populations of C. angulata were observed only in the southern coasts of Portugal and Spain, namely in Rio Sado estuary, Rio Mira estuary and Rio Guadalquivir. Despite the effort made, climate changes may compromise the conservation of the genus Crassostrea populations in Portugal.

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. Both factors are major issue impacting estuarine organisms, especially in cases of abrupt changes. Therefore, the occurrence of extreme climate events, especially extreme rain 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 mortality episodes.

Our goal in CERES is to determine the potential impact of climate change, namely the combined effect of salinity and temperature changes, not only on oyster survival, but also on behavior, immunology and biochemistry.

How vulnerable are oysters?

Climate change processes potentially threaten the bivalve mollusc aquaculture sector, which is economically relevant in 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 such 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). Currently, France is the largest consumer of oysters reared in Portugal.

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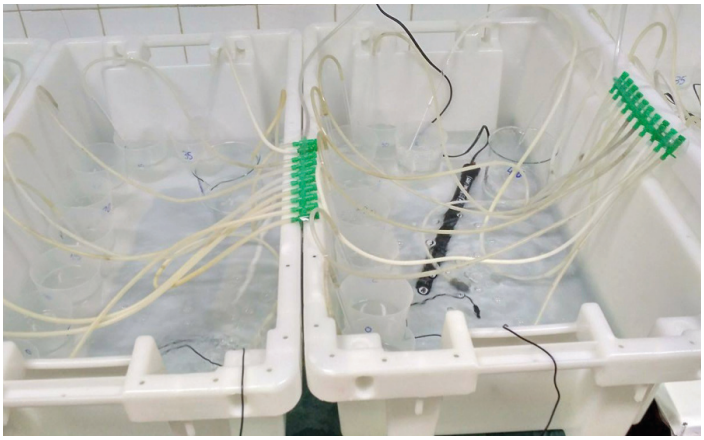

What are the challenges?

Several studies reported the effect of climate changes in bivalves. Most studies evaluated the effect of changes in an isolated environment factor and some evaluated the potential impact of the combined effects of changes in different environmental parameters in bivalves, such as temperature and pH. Other studies revealed that salinity by itself can affect significantly bivalves behavioral and physiological responses, and in extreme cases may lead to massive 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 oyster *C. angulata* will be distributed in different aquaria to test the combination of different levels of temperature (5 to 35ºC) 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. Daily animals will be checked for mortality and behavior. 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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