



Factsheet No. 6, July 2017

## CERES storyline - mussels at the South Atlantic coast

### What do we expect under climate change?

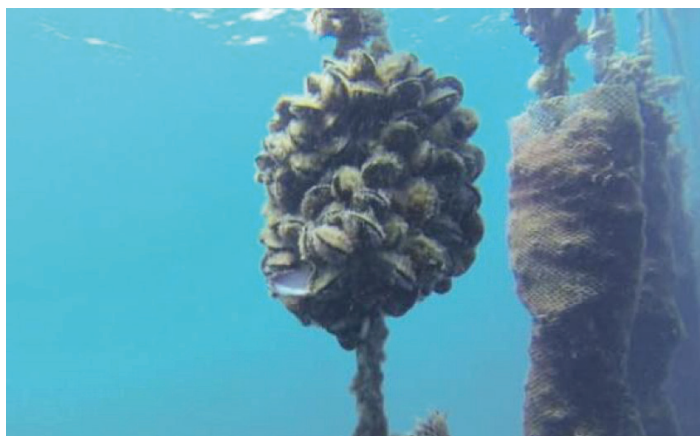
The Mediterranean mussel (*Mytilus galloprovincialis*) is a bivalve filter feeder that occurs naturally along the Portuguese coast. However in recent years, the development of aquaculture production areas on the coast has allowed the implementation of offshore companies for this species production, especially on the Algarve coast. The environmental background condition can define the production potential of a mussel offshore company, being determinant to scale the production according to environmental factors. In the SW coast of Algarve, the Mediterranean mussel is highly dependent on the natural occurrence of phytoplankton production as a result of upwelling events, as there is not significant runoff input from rivers into the coastal system. The spawning periods are also very dependent on the upwelling, where there is a typical spawning period from April to June during spring phytoplankton blooms, as well as a second smaller spawning period in mid to late autumn.

One main issue is the frequency of upwelling events that relates to food availability (phytoplankton) that affects mussel condition, reproduction and consequently settlement of mussel seed that naturally attaches to ropes. Other issue is the occurrence and intensity of Harmful Algal Blooms (HAB's). In the south Portuguese

coast, Mediterranean mussel exhibits recurrently elevated concentrations of Okadaic Acid (OA) group toxins between spring and autumn due to the proliferation of HAB's. Our goal in CERES is to examine in laboratory whether changes on water temperature influence the depuration rates of OA-group toxins in mussels, with or without food supply.

### How sensitive and vulnerable are mussels?

The Mediterranean mussel is well-adapted to shifts of temperature as demonstrated in CERES experimental testing effects of different temperatures and two chlorophyll-a concentrations. Their vulnerability/sensitivity as a species in the environment is not a major issue, but the capacity of being a suitable species to be farmed and of economic interest is highly sensitive to climate change, particularly warming. It is known that the occurrence of warm waters represents a reduction of phytoplankton abundances (reduced chlorophyll-a), followed by reduced mussel conditions, affecting the spawning performance and increased susceptibility to diseases. Another point is an indirect effect that is related with the intensification of the occurrence of Harmful Algal Blooms which conduce to large closure periods on harvesting. These vulnerabilities make the sustainability of offshore mussel aquaculture very difficult.



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### What is the economic value of this species?

The global production in 2014 of aquaculture in Portugal, reached 10,791 tons, with a total value of 50.3 million Euro. Bivalves represented 45 % of total production, where mussel's production reached 1,547 t. The average price of fresh mussels in Portugal decreased 17.6 %, from 0.70 €/kg in 2014 to 0.58 €/kg in 2015 (INE, 2016). Large volumes of mussels (20 tons) can be sold at 0.70 €/kg and direct sales to restaurants can reach 3.3 € to 4 €/kg, whereas at large supermarket chains the medium mussel size are regularly sold at 2.49 €/kg.

### What are the challenges?

The knowledge of the reproductive performance of the Mediterranean mussel in the Algarve coast, behind the simple biological characterization, will be an essential help to increase farm productions and to develop better aquaculture management, adjusting and maximizing the placement timings of larval recruitment according to the market needs. The gonad development depends on the synergic effect of both internal and external factors. Specific endogenous rhythm is synchronized by external factors, such temperature, food availability, regulate reproductive cycles. Indeed, mussel's quality is assessed by consumers as a result of gonad development, with the fuller gonad attaining higher commercial value. The only available information is from a recent study developed by IPMA. Nonetheless, it is well known that climate changes,

specially alteration on temperature and food availability can influence the reproductive cycle and condition of mussels with a great impact on mussel's recruitment, settlement and condition.

The high incidence of toxic phytoplankton blooms reported along the Algarve coast in the last years can affect mussel physiology, condition and reproductive cycle. As reported in previous studies, a reduction in soft body mass and gonad build-up was observed as a consequence of the reduction of filtering capacity in presence of toxic phytoplanktonic cells, apart of the longer closure periods of harvesting when mussels contain toxins above the regulatory limit. In general, closure periods vary from weeks to months, according to the intensity and duration of the toxic bloom and the ability of each bivalve species to eliminate the toxins.

### What is the working program in CERES?

The experiments planned with mussels will be performed at IPMA. After the gap analysis carried out within CERES it was decided to examine whether changes on water temperature influence the depuration rates of OA-group toxins in mussels. This depuration procedure would enable the possibility to commercialize Mediterranean mussel with a good nutritional status in a much shorter period than in natural conditions, as observed for other species.

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