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### Temporal and spatial variability of physico-chemical and biological components of the Sado Estuary (Portugal)

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#### Abstract

Estuarine zones are very productive areas that receive great interest from local communities. While regional socio-economic development is a priority for most managers, estuaries are prone to conflicts that sometimes are hard to handle. Hence, sustainable development, that considers the implementation of sustainable aquaculture practices, has to be based on the preservation of the ecosystem, ensuring the maintenance of habitats, biological components as well as their function and interaction. For this, it is important to understand how environmental and biological conditions vary over time and space and how they interact with the use of the system. The objective of this study is to evaluate the environmental quality of the Sado Estuary, in an integrative perspective, at the ecosystem-scale, promoting the use of the natural element, estuarine microalgae, as a food source in the sustainable production of bivalves, namely the Portuguese oyster (*Crassostrea angulata*) and other species with potential for production. To meet this goal, the estuary was sampled monthly during 2018-2020, regarding physico-chemical (temperature, salinity, oxygen, nutrients) and biological parameters (phytoplankton biomass and species composition, microscopy and HPLC), as well as metals and contaminants. Historical data, from 1986 to 2010, were also gathered. A preliminary analysis revealed the existence of an upstream-downstream gradient for most parameters (temperature, salinity, dissolved oxygen, suspended solids, nutrients and chlorophylls). Nutrient levels were seen to be the highest during winter and the highest values of chlorophyll *a* concentrations were observed in spring/summer, with downstream (near river mouth) peaks in April and upstream peaks in June. Generally, the levels of nutrients and chlorophyll *a* concentrations are within the standard levels for the most Portuguese estuaries. However, in 2018, results revealed a 1-month delay in the phytoplankton bloom occurrence, which may have direct implications for the higher trophic levels.