

Monitoring Phytoplankton and Nutrients in Tagus Estuary, Portugal, for 20 years

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Tagus estuary (Portugal) is one of the largest estuaries in Europe, a good example for the need for achieving the sustainable use of ecosystems, as it is by Lisbon, the capital city, and it must provide a diversity of services, comprehending the Port of Lisbon, industrial, agricultural, fisheries and tourism activities, whilst comprising a natural park where waders are an iconic feature. A long-term survey has been occurring since 1999 to study the phytoplankton biomass and composition and environmental parameters, as part of a monitoring program of the Central de Tratamento de Resíduos Sólidos Urbanos - S. Joao da Talha (Valorsul) in Tagus Estuary. Several publications have been done (Gameiro & Brotas, 2010; Brito et al., 2014), identifying the driving forces which control phytoplankton biomass and productivity (Gameiro et al 2004; 2007; 2011) and characterizing seasonal and interannual patterns (Gameiro & Brotas, 2010; Brito et al, 2015).

The present work summarizes main results from the long-term series and focuses on the last three years, with the aim of evaluating patterns and ranges of chlorophyll a and turbidity related parameters, namely suspended particulate matter, in water light profiles, in order to monitor these parameters by satellite remote sensing, namely using the new ESA Sentinel 2 satellite constellation. Sampling was done monthly or bimonthly during ebb tide of neap tides, on 4 sites located in the mid and upper estuary. Temperature, salinity, in water light penetration profiles were determined. Surface water was sampled for the analysis of dissolve nutrients concentration (nitrates, nitrites, ammonia; as a DIN (Dissolve Inorganic Nitrogen); phosphates as DIP (Dissolve Inorganic Phosphate) and silicates), chlorophyll a by spectrophotometry, photosynthetic pigments by HPLC and suspended matter concentration.

From 1999 till early 2018, the average chlorophyll a is 3,8 µg L⁻¹ in these 4 sites. The maximum values are always during spring/summer (April to August) and the minimum in winter (November to January). The results obtained showed a consistent seasonal pattern with a unimodal peak occurring in spring or early summer, diatoms being the main bloom-formers (Gameiro & Brotas, 2010).

This works focuses on the results of last 3 years, from January 2015 until October 2017, in 2 stations (Site 1, upper estuary and Site 4, mid estuary). The chlorophyll a, ranged from 0.5 to 17 µg L⁻¹, with an average value of 4.0 µg L⁻¹, similar to the overall 20 years mean, indicating that the estuary does not show any recent eutrophication trend. Nutrients levels registered also were similar to the previous observed ones. Dissolved inorganic nitrogen (DIN) and silicates concentrations were higher in winter, evidencing a riverine origin. DIN varied from 73.8 µM in upper site 1, during winter, to 6.4 µM in mid station 4 in summer. Regarding phytoplankton composition, diatoms were the most abundant group, which is a sign of an healthy estuary.

Using Sentinel 2 products for suspended particulate matter is discussed as a complement to situ measurements, as satellite remote sensing monitoring potentially offers a cost-effective way of assessing water quality.

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