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Long-term monitoring of phytoplankton in a changing estuary

Luz Amadei Martínez¹, Tom Maris², Patrick Meire², Koen Sabbe¹, Wim Vyverman¹

¹Ghent University, Belgium. ²University of Antwerp, Belgium

Abstract

Since 1996, phytoplankton biomass and composition has been monitored in the Zeescheldt estuary (Belgium) using microscopy and HPLC pigment analysis.

Time series analysis of Chlorophyll-a revealed a decreasing trend in phytoplankton biomass from 2002 onwards. The peak Chl-a concentration in the brackish and freshwater zone had an annual decrease of 10 % and 2 %, respectively, and occurred on average 3 days earlier every year. Pigment analysis showed that diatoms and green algae are the major contributors to phytoplankton biomass and that their relative importance remained fairly constant throughout the entire period. However, significant changes in phytoplankton species composition occurred, corresponding to three main periods. The first period (2002) had high concentrations of ammonium, nitrite and nitrate and was dominated by chlorophytes (*Tetrastrum*, *Crucigenia* and *Scenedesmaceae*) and diatoms (*Aulacoseira*) in the brackish zone, and *Tetrastrum* and pennate diatoms in the freshwater zone. The second period (2003 – 2011) was characterized by a gradual decrease of N compounds, due to the progressive improvement of wastewater treatment, and an increase in temperature, particulate organic carbon, dissolved organic carbon and total phosphorous, linked to the increase of *Actinocyclus*, cryptomonads and rhodomonads. In the third period (2012-2018), Thalassiosirales and pennate diatoms increased in both zones, which appeared to be related to a decrease in discharge in the freshwater zone and increased salinity in the brackish zone. Cyanobacteria increased throughout the year in the freshwater zone, but only in winter in the brackish zone. In both zones, dissolved oxygen concentration was higher compared to the two previous periods, while turbidity (~SPM) increased in the summer months and pH in the winter months.

Our results show that phytoplankton in the Scheldt estuary responded rapidly to the changes in nutrient inputs, and that changes in SPM levels, saltwater intrusion and discharge are important drivers of phytoplankton community assembly.

Keywords

Long-term, Phytoplankton, Scheldt estuary, Biodiversity