
STRONG COMPOSITIONAL CHANGES IN THE CENTRIC DIATOM COMMUNITIES OF THE SCHELDT-ESTUARY: A RESULT OF IMPROVING WATER QUALITY?

Jeroen Van Wichelen¹, Els Van Burm^{1,2}, Pieter Vanormelingen¹, Benoit Mialet³, Micky Tackx³, Tom Maris⁴, Patrick Meire⁴, Koen Sabbe¹ & Wim Vyverman¹

¹Laboratory of Protistology and Aquatic Ecology, Department of Biology, Ghent University

²Quantitative and Applied Ecology, School of Botany, University of Melbourne

³Laboratoire Ecologie Fonctionnelle et Environnement, Université de Toulouse

⁴Ecosystem Management Research Group, Department of Biology, University of Antwerp

The river Scheldt has a macrotidal estuarine zone (tidal amplitude up to 6m) that stretches 160 km inland. The estuary covers the complete salinity gradient, including a freshwater tidal area (FTA) of 60 kilometers. During the second half of the twentieth century, water quality was extremely poor due to the discharge of large volumes of wastewater, leading to periods of severe hypoxia and high ammonium concentrations. Since the late 1990's, increasing wastewater treatment caused a gradual recovery of the water quality. As part of a multidisciplinary study on the Belgian part of the Scheldt estuary (OMES/MONEOS projects), the estuarine phytoplankton has been monitored on a monthly basis since 1996. Here we report the main changes in the phytoplankton communities during this period of improving water quality.

The estuarine phytoplankton was always dominated by centric diatoms that mainly bloomed during summer, with bloom intensity depending on the flushing rate. The phytoplankton bloom biomass was considerably higher in the FTA from 2003 onwards and this independent of the flushing rate. This biomass increase was mainly attributable to *Actinocyclus normanii*, which replaced *Cyclotella scaldensis* as the dominant diatom species in the FTA. Field observations and laboratory experiments indicated reduced ammonium concentrations as an important driver for this shift given the low tolerance of *Actinocyclus* for ammonium. In 2011 however, phytoplankton biomass was considerably lower with *C. scaldensis* again dominating the summer phytoplankton. In the brackish part of the estuary, the biomass of *Thalassiosira nodulolineata* increased spectacularly since 2008, coinciding with the start-up of the wastewater purification plant of the city of Brussels, and nowadays forming an extensive recurring spring bloom. This diatom species also extended its range towards the FTA where it now sporadically dominates spring phytoplankton. Simultaneously, the calanoid copepod *Eurytemora affinis*, a predator of both *A. normanii* and *T. nodulolineata*, has colonized the FTA too. Future compositional changes in the estuarine phytoplankton may be anticipated as a result of further increases in water quality, ongoing tidal marsh restoration and downstream deepening of the main water channel.