

# The impact of decades of human-induced environmental change on phytoplankton communities in the Belgian part of the North Sea

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Long-term marine phytoplankton monitoring programs are essential for detecting trends and changes in biomass and species composition of marine communities in the context of climate change and other anthropogenic impacts (e.g. eutrophication and modified nutrient cycles). Even though the importance of marine phytoplankton as marine primary producers is known for a long time, a structural marine phytoplankton monitoring program of the Belgian part of the North Sea (BPNS) was only implemented in the 2000s in the framework of the European LifeWatch infrastructure. However, since the 1960s phytoplankton research has been conducted in the course of several smaller research projects. In the BRAIN project 4DEMON (4 decades of Belgian marine monitoring), an initiative to recover and integrate (historical) marine biodiversity and environmental data in the BPNS, we compiled, standardized and analyzed all available phytoplankton diversity and biomass data since the 1970s, with a focus on diatoms and dinoflagellates.

A comparison of diatom and dinoflagellate communities between the 1970s and the 2000s revealed significant changes, including a pronounced increase in both diatom and dinoflagellate abundance (especially during winter for diatoms) and shifts in spring bloom phenology (with an earlier start of the diatom spring bloom and the emergence of a pronounced dinoflagellate summer bloom). These changes are probably a result of complex bottom-up and top-down interactions. By looking into various environmental datasets, such as historical abiotic data measured in the BPNS (4DEMON), the LifeWatch measurements, the French (SRN - Regional Observation and Monitoring program for Phytoplankton and Hydrology in the eastern English Channel) and the Dutch long-term monitoring (conducted by the Rijkswaterstaat (RWS)), we hypothesize that the changes may be partly related to a combination of increasing (winter) water temperatures and changing nutrient ratios.

Keywords: phytoplankton time-series; diatoms; dinoflagellates; Belgian part of the North Sea; phytoplankton seasonality