Phytoplankton dynamics in the Belgian coastal zone monitored with a Cytosense flowcytometer

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Phytoplankton is a diverse group of photosynthesizing organisms which are accountable for roughly 50% of the primary production on earth. A subset of these phytoplankton species are capable of forming harmful algal blooms (HABs), for example the prymnesiophyte *Phaeocystis,* which occurs in the Belgian coastal zone (BCZ). During HABs phycotoxins can be produced that may result in massive fish kills and pose a risk for human health. Furthermore, HABs can cause depletion of oxygen and block available sunlight for other organisms through their rapid growth. Detailed monitoring data of phytoplankton collected in the BCZ provides the opportunity to study phytoplankton dynamics in this area and environmental parameters potentially involved in HABs. From 2016 onwards, the Cytosense flowcytometer (FCM) has been used to monitor phytoplankton in the BCZ. This device is present on the research vessel Simon Stevin and is capable of semi-continuous automatic sampling. Species size, shape and fluorescence characteristics of the phytoplankton were recorded along sailed transects (30-60 minutes between samples). These parameters were used to calculate biomass and cluster phytoplankton groups using specialized software (Easyclus, Thomas Rutten projects). Also at 17 fixed monitoring stations samples were collected and analysed for additional environmental parameters (e.g. nutrients, physical variables). Phytoplankton clusters within 250m of the fixed monitoring stations were linked to the data collected at the station, to enable comparison. Bayesian network models (BNM) were used to analyse the data and determine the relevance of different potential explanatory parameters. The 2016 monitoring data revealed an intense *Phaeocystis* bloom in the spring, but also a small bloom at the end of summer on the stations near the outflow of the Scheldt estuary. Both phytoplankton and environmental parameters showed a strong seasonal effect. The BNM showed a substantial correlation between nitrogen and bloom magnitude. There was also a strong link between nitrate/nitrite concentrations and the phytoplankton diversity. Phytoplankton diversity and salinity were related to biomass. Overall there was higher phytoplankton diversity and total zooplankton near the outflow of the Scheldt estuary. The outflow of nutrient rich water from the Scheldt estuary results in locally higher phytoplankton diversity and biomass. In this area, also a small *Phaeocystis* bloom was observed in autumn. The innovative monitoring in the BCZ with the Cytosense FCM results in large databases of phytoplankton composition with a high spatial and temporal resolution. BNM provide a promising tool to investigate potential associations between phytoplankton and environmental parameters in these complex databases. High resolution monitoring data is important to study short and long term trends in phytoplankton diversity and the effects of pollution, eutrophication or climate change, for example, on the marine ecosystem.

Keywords: Cytosense; flowcytometry; Belgian coastal zone; *Phaeocystis*; Bayesian network models