Monitoring phytoplankton dynamics in the Belgian continental zone using a Cytosense flowcytometer

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Phytoplankton are responsible for roughly 50% of global primary production. Some species are capable of forming harmful algal blooms (HABs), with important ecological and human health impacts. Flow cytometry (FCM) allows studying phytoplankton dynamics at high spatial and temporal resolution and can be an important tool for the early detection of harmful species. Since 2016, a Cytosense FCM is used onboard RV Simon Stevin to measure phytoplankton size, shape and fluorescence characteristics in the Belgian Continental Zone (BCZ), in an automated and semi-continuous way (30-60 minutes between samples). Here, we report on data generated in 2016 within LifeWatch, a European infrastructure for biodiversity and ecosystem research. FCM phytoplankton size, shape and fluorescence characteristics were recorded at multiple stations along a west-east and onshore-offshore gradient. Based on a total of 55 FCM parameters, phytoplankton functional groups were defined using Easyclus software (Thomas Rutten projects) and their biomass was calculated. Bayesian network models (BNM) were used to analyse *Phaeocystis* bloom intensity, phytoplankton size class distribution, biomass and diversity data, and examine the relationship with different abiotic and biotic environmental parameters. We found that nanophytoplankton was highest throughout the year in both number and biomass for all stations. Picophytoplankton were more abundant in western stations and stations associated with low turbidity. The time series data, also revealed an intense *Phaeocystis* bloom in spring (March) and a second small bloom at the end of summer (September) near the outflow of the Scheldt estuary, a feature not yet reported from the BCZ. BNM revealed an inverse correlation between total dissolved nitrogen and bloom magnitude. There was a negative association between the sum of nitrate and nitrite and phytoplankton diversity. Overall, phytoplankton diversity, biomass and total zooplankton were higher near the outflow of the Scheldt estuary. This FCM dataset of the BCZ provides the opportunity to study short and long term trends in phytoplankton community structure and abundance, with high spatial and temporal resolution, which enables the detection of small, local changes in the phytoplankton community (e.g. a second *Phaeocystis* bloom). This data will be valuable for studying the effects of pollution, eutrophication and climate change over time.

Keywords: Cytosense; phytoplankton; time series; Bayesian network models; Belgian continental zone