Universiteit Utrecht
Faculty of Geosciences
Future Deltas

koeman en bijkerk bv
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Exploring long-term phytoplankton monitoring data to develop tools for understanding the drivers of spatio-temporal species distribution in the Dutch Delta area

Farilde Steur[1], René van Wezel[2], Aleksandra Cvetkoska[1], Francesca Sangiorgi[3], Friederike Wagner-Cremer[1] *(f.wagner@uu.nl)

[1]Paleoecology, Physical Geography, UU; [2]Koeman en Bijkerk bv, Haren; [3]Marine Palynology and Paleoceanography, Earth Sciences, UU

The “Monitoring Waterstaatkundige Toestand des Lands (MWTL)” campaign is performed since 2000 within the regulations of the Water framework directive. Analyzed at sub-annual, and high taxonomic resolution over the entire Dutch Waddenzee area (Fig.1), to-date more than 200.000 diatom and dinoflagellate data entries are available, accompanied by measured physical and chemical water properties such as temperature, salinity, pH and light conditions in the water column. In general, all 46 stations are sampled 1–4 times each month over the monitoring period. Phytoplankton is counted and identified at species level, providing exceptional taxonomical details.

The data sets, however, were not currently linked to each other, and available in data formats that make statistical analysis of species abundances, spatial and temporal distribution and the relation to physio-chemical properties difficult. Through a **UU - Future Deltas** seedmoney project, kick-off studies in the context of ‘understanding drivers’ of salinization, subsidence and loss of ecosystem services in the Dutch Delta are supported.

Through this Future Delta project we are now able to synergistically combine and structure large data-sets from long-term monitoring campaigns available from different sources. Our main aim is thereby to produce a fully searchable data base from which any kind of information can be retrieved and analyzed in any relevant combination and resolution.

Examples of potential application: time-series plots and sensitivity tests

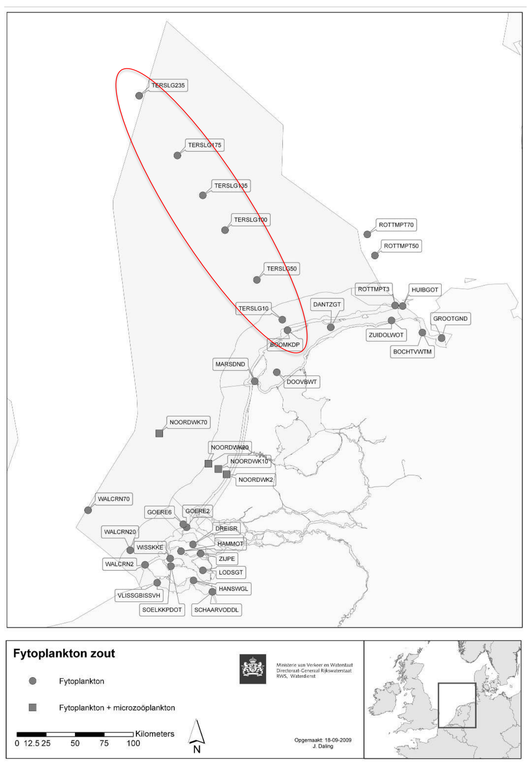

Fig.1: sampling sites MWTL, red: ‘Terschelling transect’

For a simple test of the applied data format, we plotted from 3 sites within the longest monitoring transect (Fig.1) abundance data of three common species (Fig. 2).

The multiple species time-series plots show changing abundances over the time period from 2000 to 2015 as well as spatial variability from 4 km to 100 km off the coast.

We further perfomed a simple DCA analysis of the species in the transect (Fig. 3) with measured salinity, P, N, pH and temperature data.

Chaetoceros socialis is well represented in all three sites. The DCA analysis places *C. socialis* in the N and salinity sectors, with a negative correlation on the DCA 1 and DCA 2 axes.

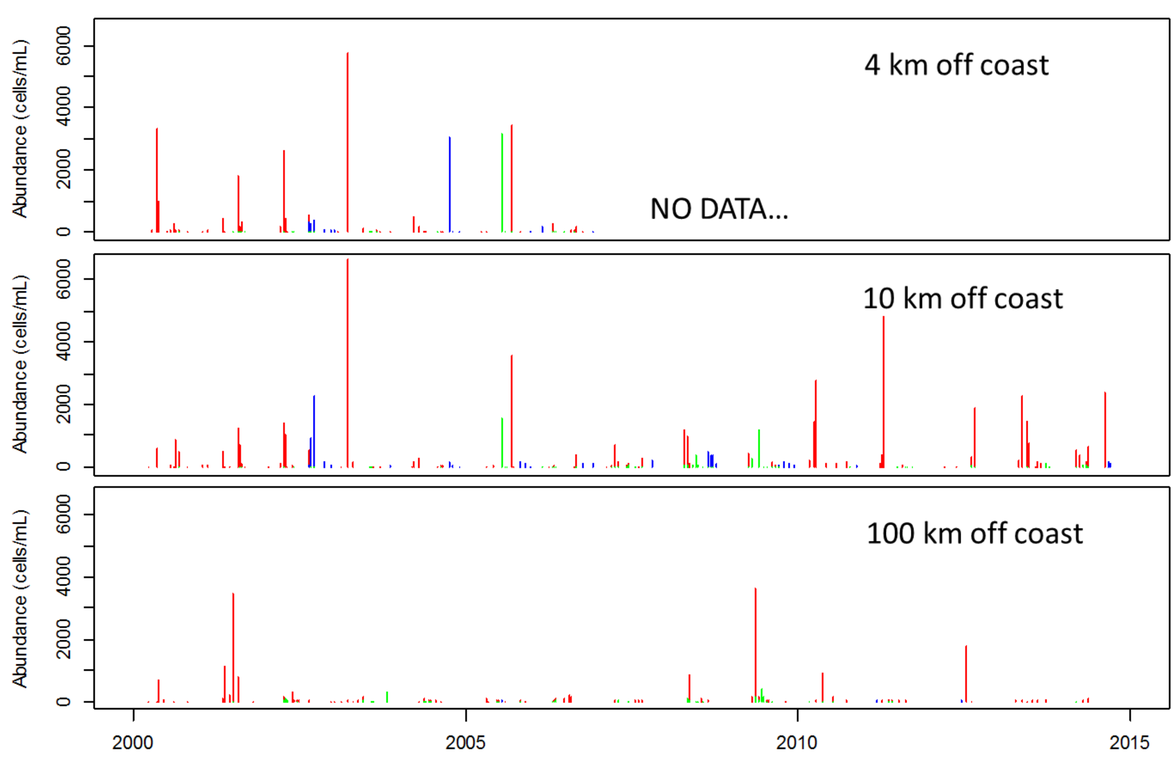

Fig.2: abundance time-series plot of the three most abundant species in the Terschelling transect. *Minutocellus scriptus*, *Pseudo-nitzschia fraudulenta*, *Chaetoceros socialis*

Using these two variables as background for a time-series plot of *C. socialis* (Fig.4), extreme blooms appear to be most pronounced under high N conditions in combination with extremely low salinity.

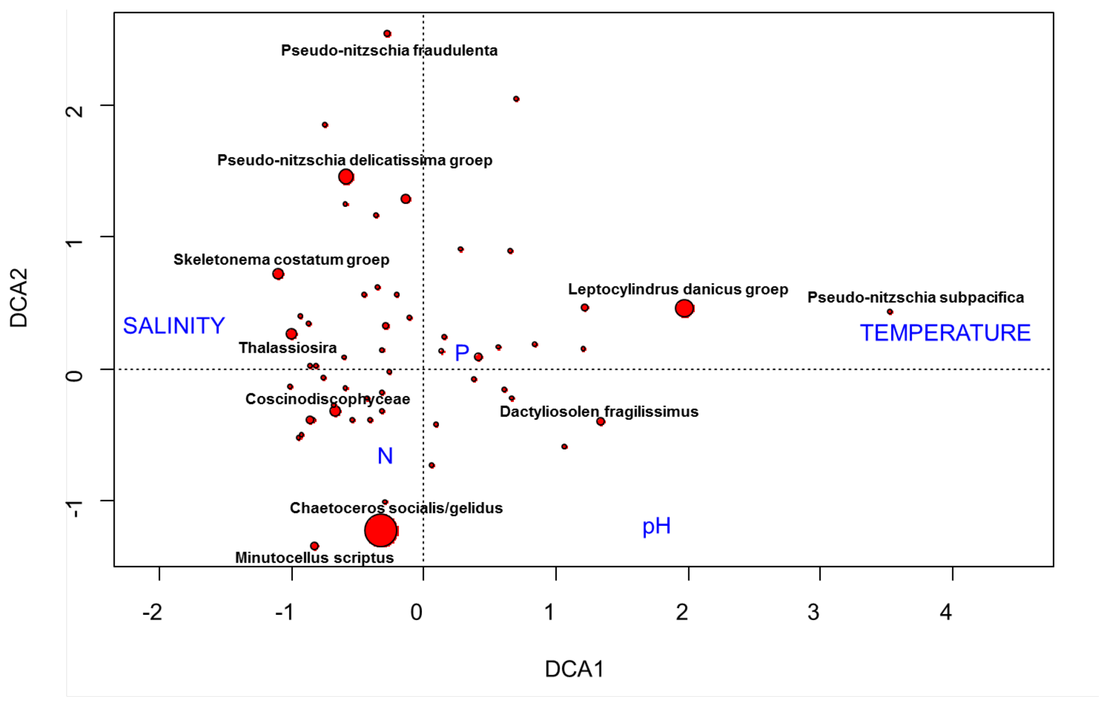

Fig.3: DCA of diatom assemblages and fitted environmental variables of the ‘Terschelling transect’. Red dots indicate relative abundances of diatoms present with >50 cells/mL

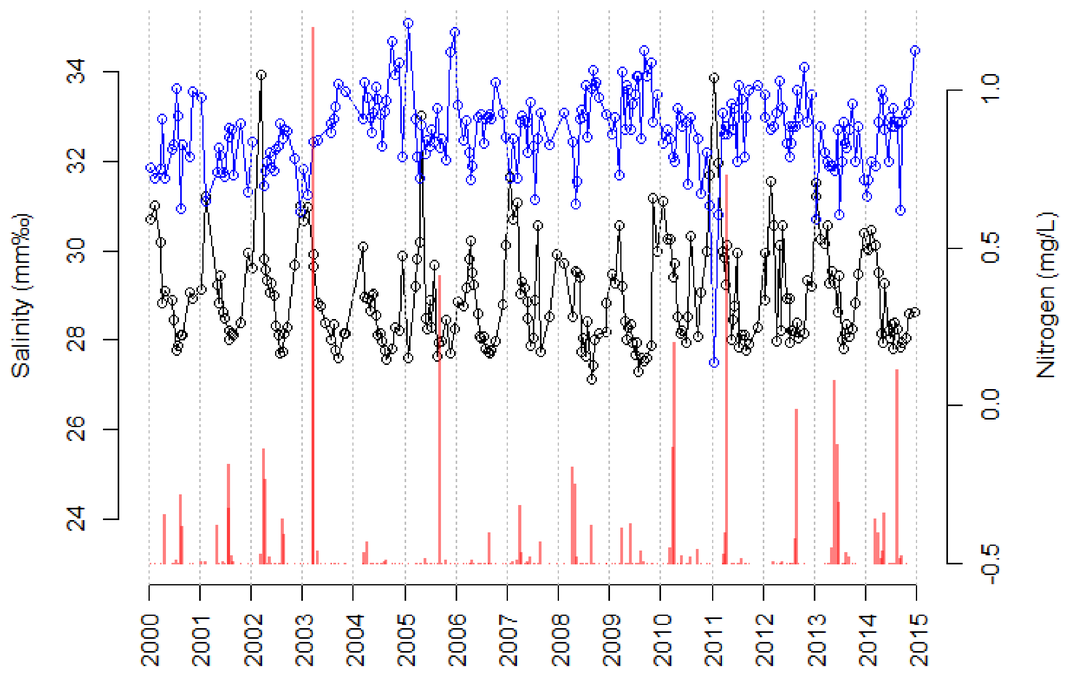

Fig.4: Time-series plot of **salinity**, **nitrogen** and ***C. socialis*** abundance showing the distinct pattern of blooms under high N paralleled by very low salinity phases.

The shown analysis is only a ‘randomly chosen’ example of the potential applications of the newly structured MWTL data-set and the accompanying physio-chemical measurements from the Dutch Waddensea. This data-set may in the future be fully explored to better understand drivers of spatio-temporal species occurrence and abundance. Such long-term modern ecological data are an extremely valuable tool to evaluate and predict e.g. extreme ecosystem states or harmful phytoplankton blooms.
Once fully accessible, these monitoring data provide an unique opportunity to develop modern training sets for diatom and dinoflagellate assemblages with which we can study the sedimentary archive and reconstruct past sea-level change, flooding events, the long-term spatial and temporal effects of salinization and biodiversity shifts in the Dutch Delta system.

Source diatom abundance data: Koeman & Bijkerk BV

Source physical and chemical water properties data: Rijkswaterstaat