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Large-Scale Microzooplankton Abundance and Biomass in the North Sea in Mid-Winter

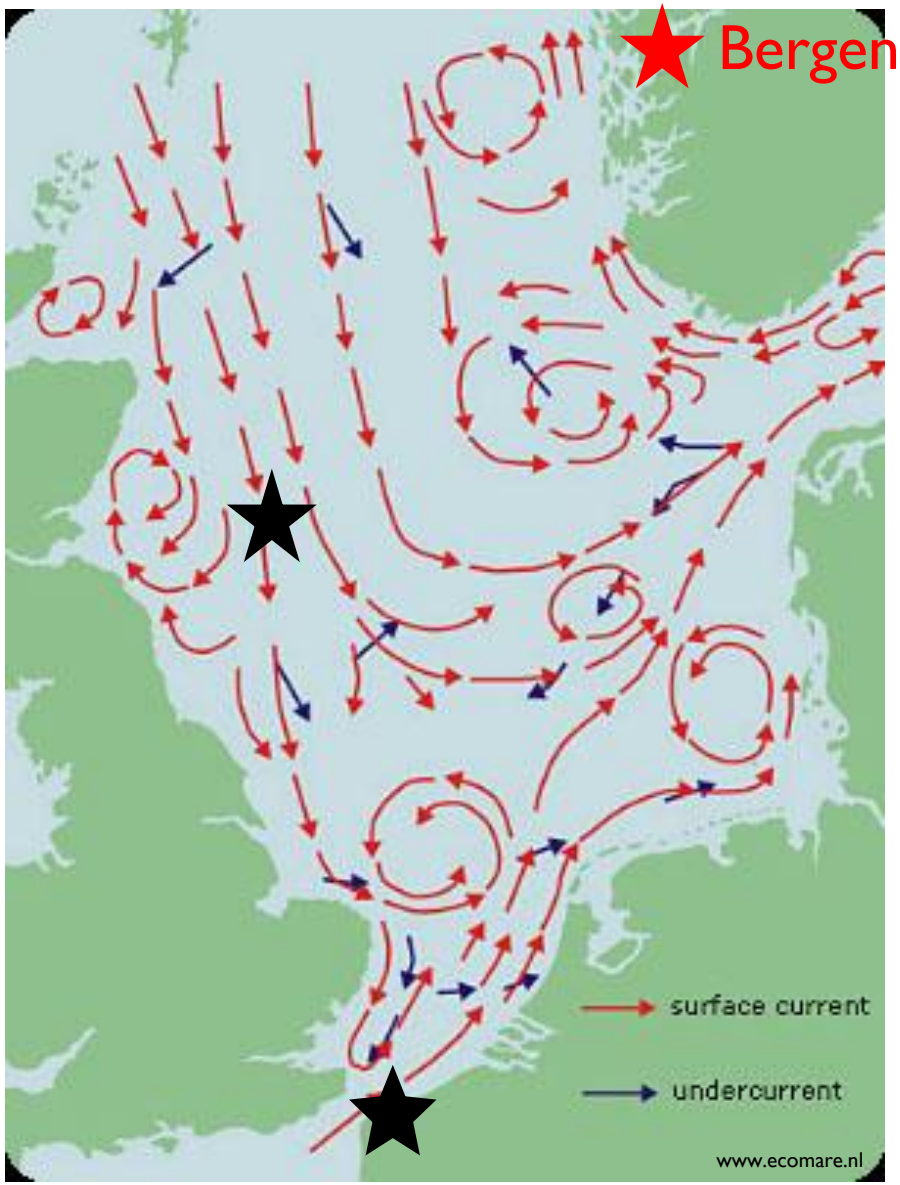
Franziska Bils[1]; Marta Moyano[1]; Nicole Aberle[2] & Myron A. Peck[1]

[1]University of Hamburg, Institute for Hydrobiology and Fisheries Science

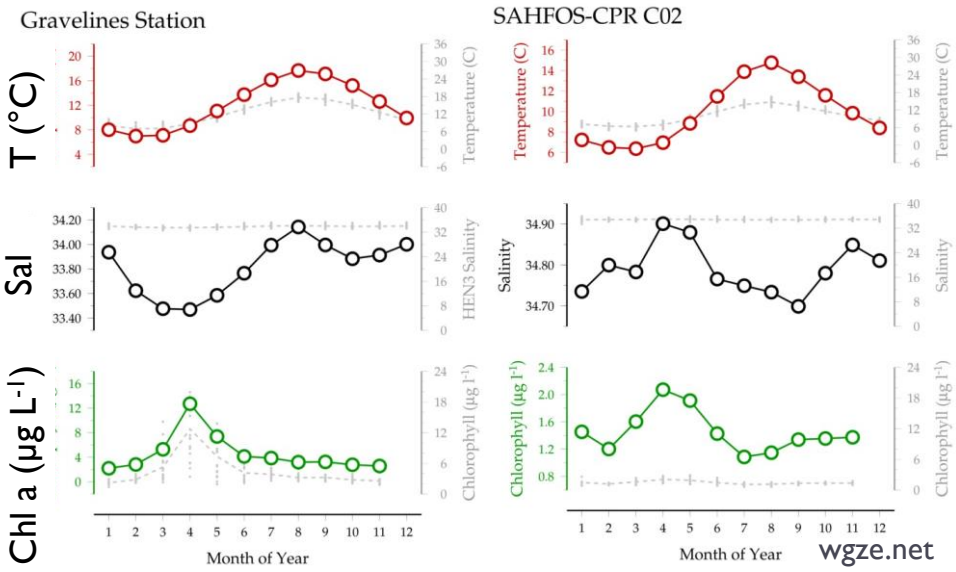
[2]Norwegian University of Science and Technology, Trondhjem Biological Station

ICES/PICES 6th Zooplankton Production Symposium, 9 – 13 May 2016, Bergen, Norway

The North Sea



- Southern North Sea
  - Shallow (< 90 m)
  - Atlantic inflow through the English Channel
- Northern North Sea
  - Up to > 300 m (Norwegian trench)
  - Atlantic Inflow through Norwegian Sea and along Shetlands
- Strong seasonality



The North Sea Plankton

- Existing data

  Time series for mesozooplankton and phytoplankton abundance and distribution from different locations and seasons (e.g. ICES WGZE)

  Sparse data on microzoo- and protozoan plankton abundance and composition

Estuaries Vol. 21, No. 4A, p. 585–596 December 1998

On the Quantitative Importance of Heterotrophic Microplankton in the Northern German Wadden Sea

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Helgol Mar Res (2012) 66:11–23
DOI 10.1007/s10152-010-0242-z

ORIGINAL ARTICLE

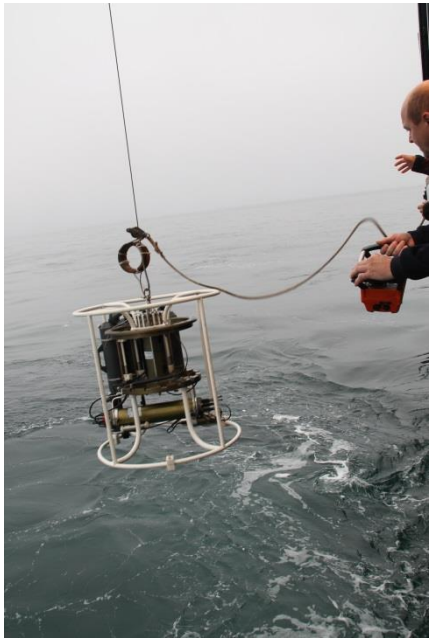
Dinoflagellates and ciliates at Helgoland Roads, North Sea

Martin Günther Joachim Löder · Alexandra Claudia Kraberg · Nicole Aberle · Silvia Peters · Karen Helen Wiltshire

Microplankton community structure and the impact of microzooplankton grazing during an *Emiliania huxleyi* bloom, off the Devon coast

E.S. Fileman*, D.G. Cummings and C.A. Llewellyn

Plymouth Marine Laboratory, Prospect Place, West Hoe, Plymouth, PL1 3DH. *Corresponding author, e-mail:ese@pml.ac.uk



- Most frequently, sampling one protist group or on community composition at one location

The North Sea Plankton

- Missing data

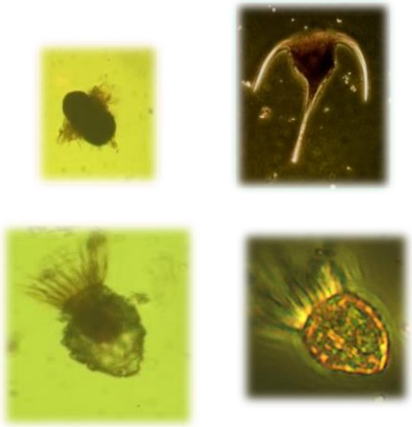
  Broad-scale distribution, abundance and composition of protist plankton

  Community composition in winter

  Classification
  - Protozoans often mixotrophs
  - Inconsistent classification

  Preservation
  - Routine zooplankton surveys use formalin
  - Fragile protists (without shell or lorica) dissolve

  Analysis
  - Time consuming
  - Samples preserved for max. 1 year in Lugol's solution




By Karsten Petersen

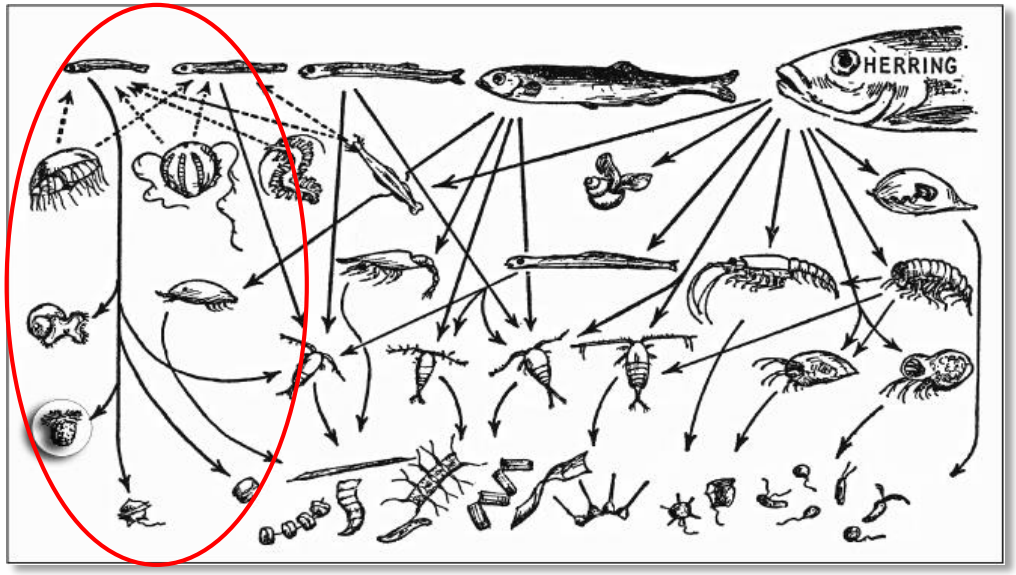
The North Sea Plankton

Why should we care about Protozoans (in winter)?

Carbon cycling

- Key players in the microbial loop
- Grazers of phytoplankton

Food source for higher trophic levels (e.g. larval fish)

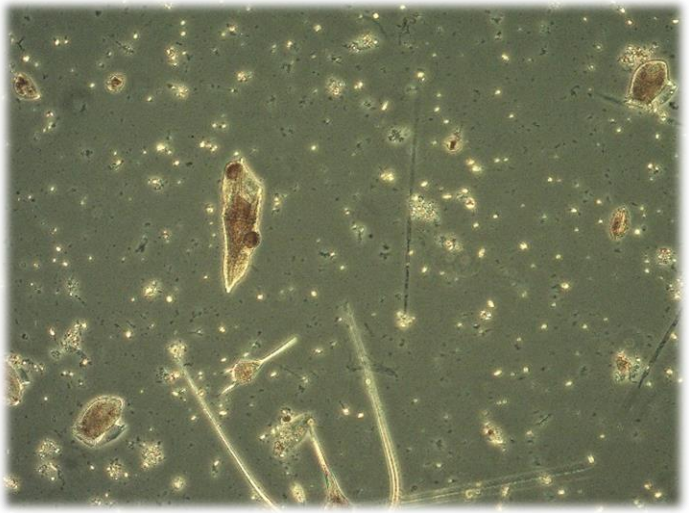


Hardy (1924) modified by Dolan et al. (2013)

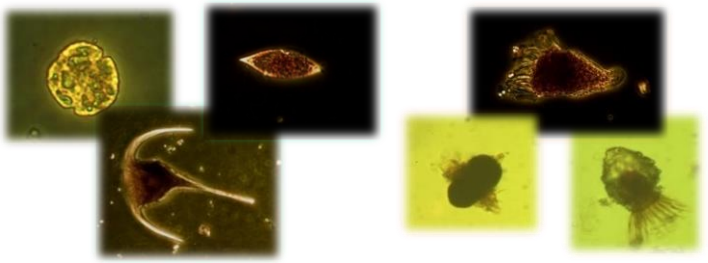
Winter prey fields urgently needed for modelling trophodynamics

Main questions

- What and how much is out there?
  - Biomass
  - Abundance
  - Community composition

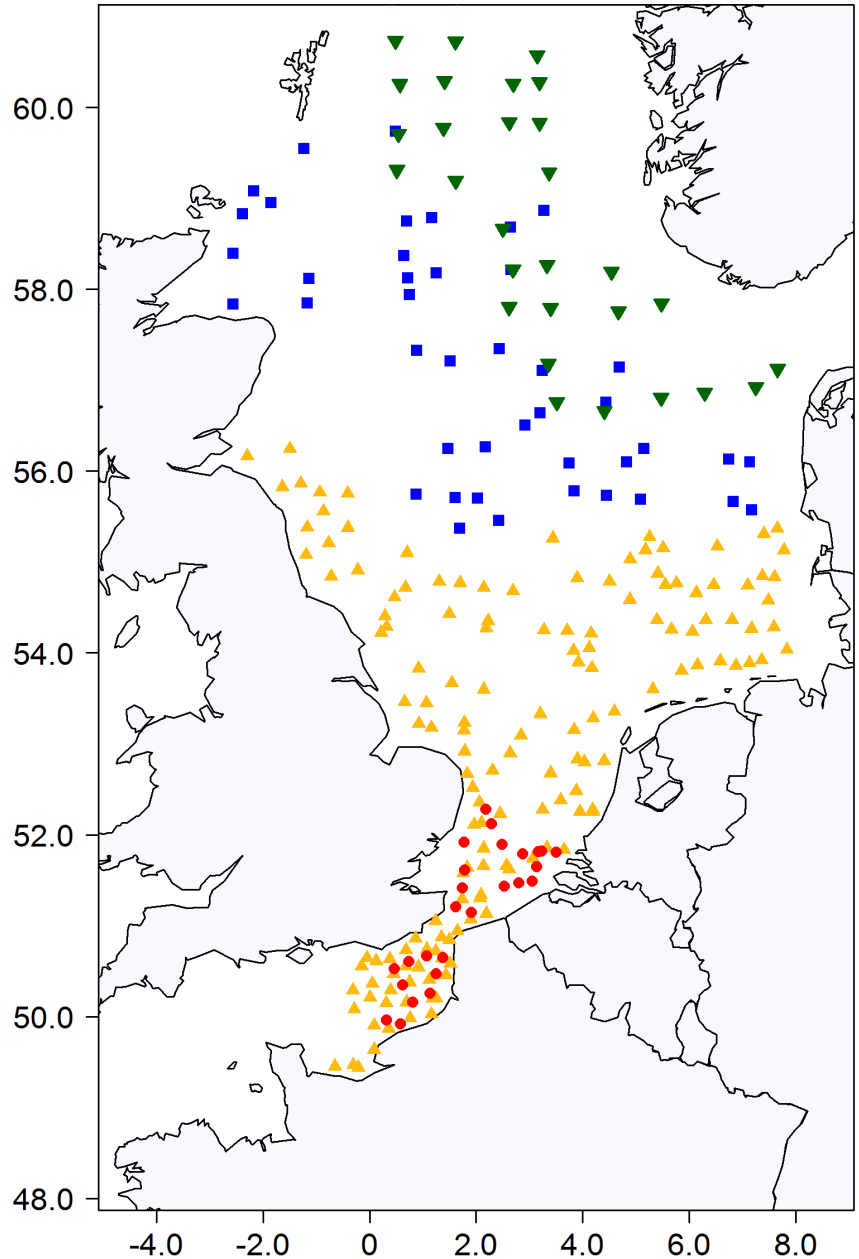


- Are there any patterns related to hydrography?



How to most effectively collect / analyze samples for broad-scale patterns in protozoans in winter?

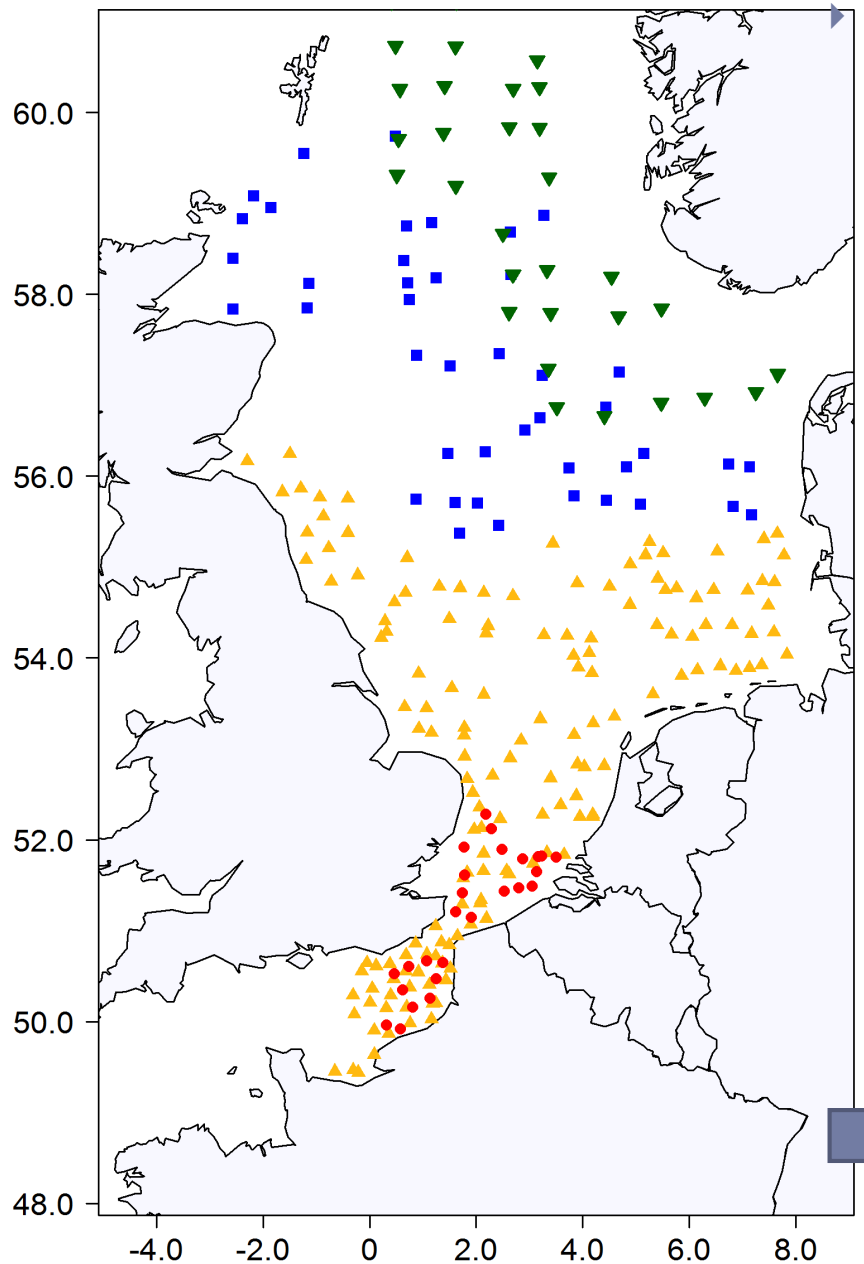
North Sea IBTS Q1 2014



International Bottom Trawl Survey

- ICES coordinated annual survey for fish stock assesment
- Quarter 1: Mid Jan – Mid Feb
- Covering the entire North Sea
- Conducted by various EU members, among others Norway, Germany, France & the Netherlands

North Sea IBTS Q1 2014



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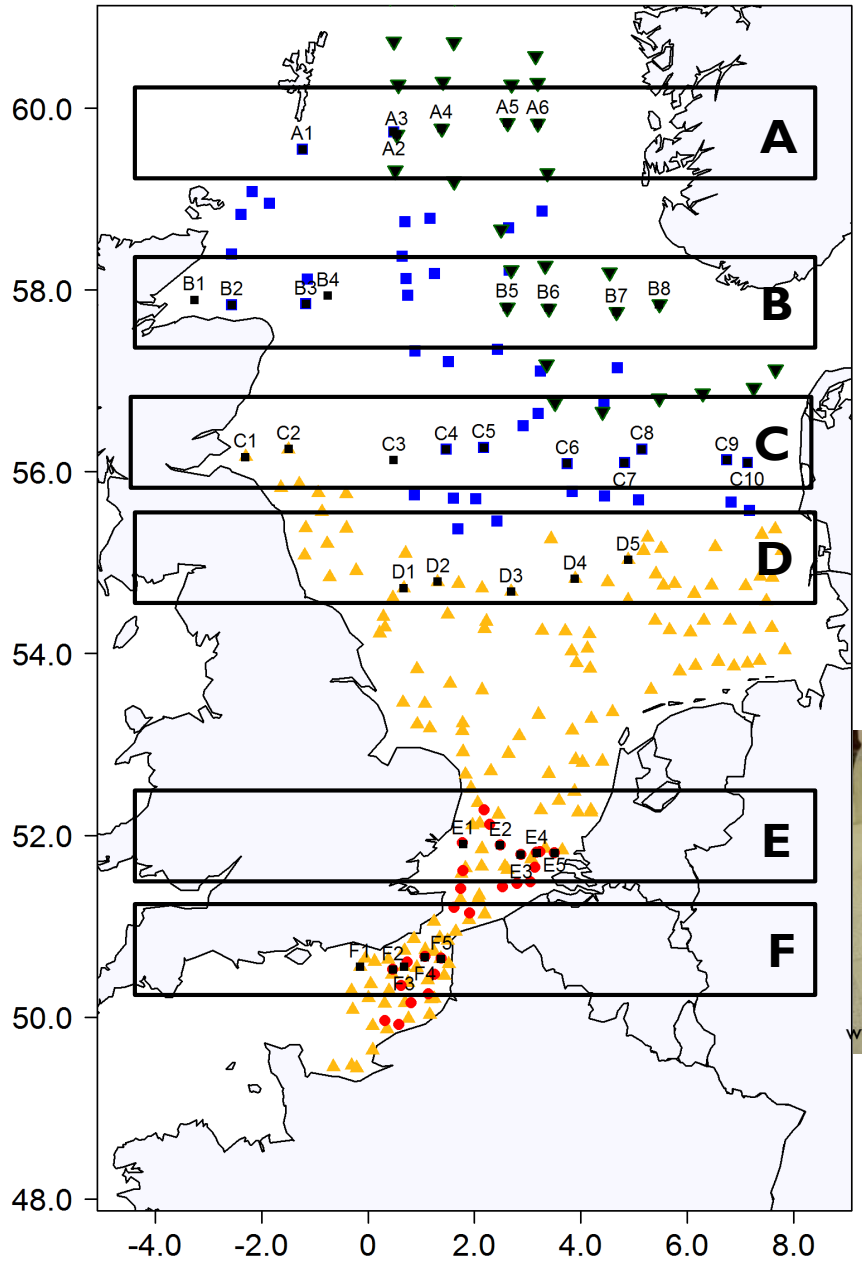
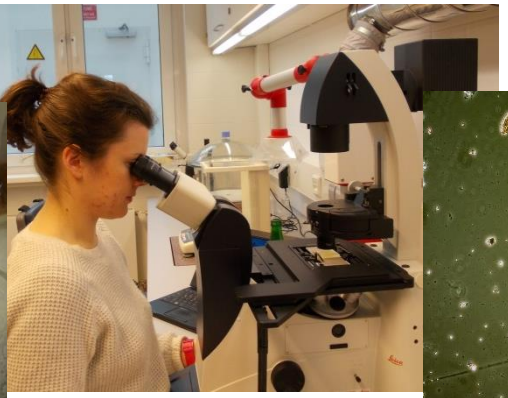
IBTS 2014

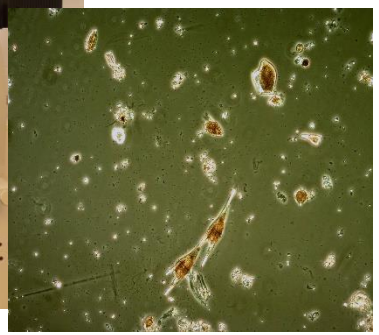
- Additional sampling in collaboration with IMR Bergen, TI Hamburg, IFREMER Boulogne-sur-mer & IMARES Ijmuiden
- ~140 water samples taken with CTD rosette at 10 m depth
- CTD is a standard gear
- Sampling did not alter the survey

North Sea IBTS Q1 2014

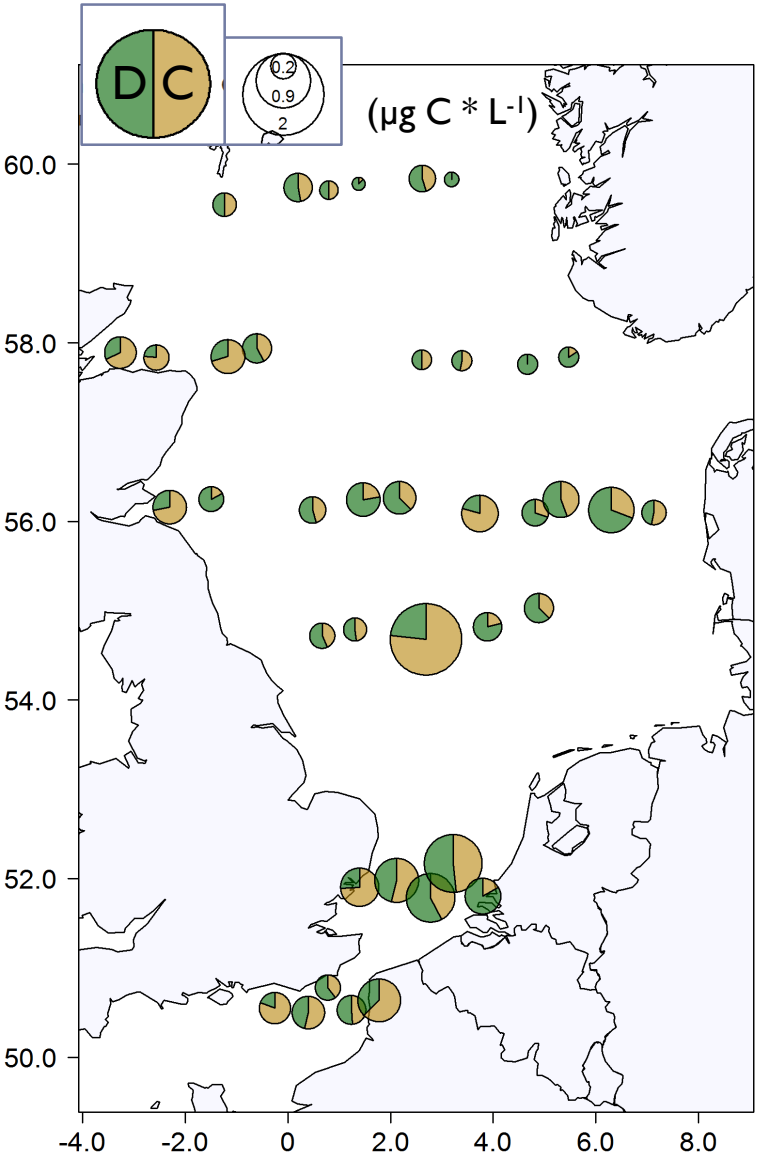


- 39 water samples of 6 latitudinal areas were analyzed
- Utermöhl method
- Identification of HT & MT Dinoflagellates and Ciliates to the lowest taxonomic level possible



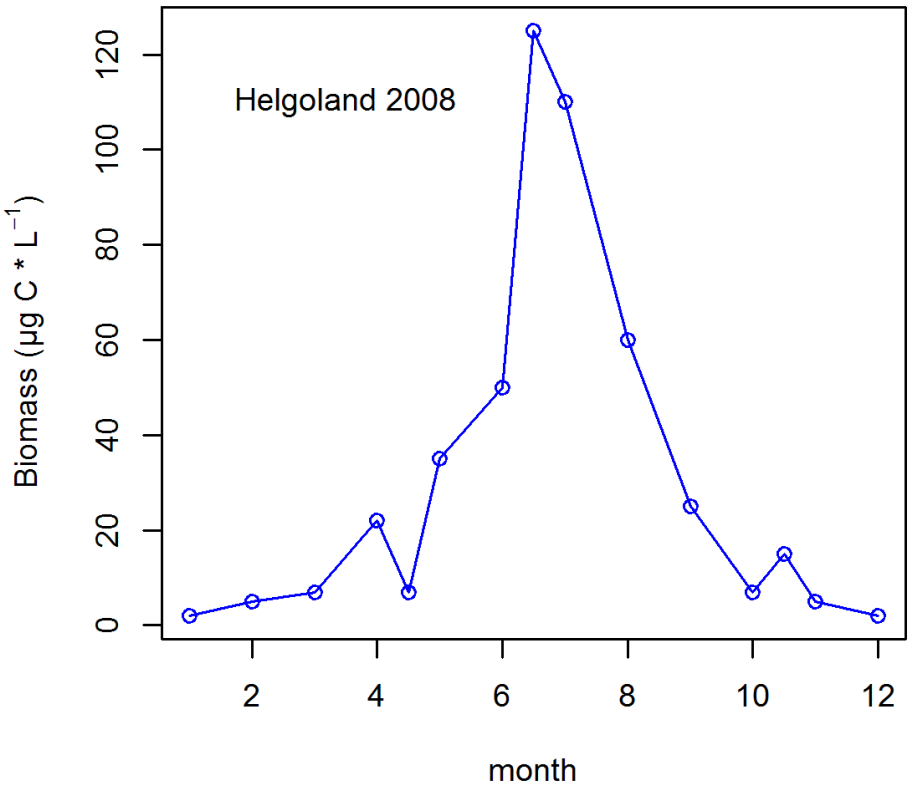


Protist biomass (µg C * L^{-1})



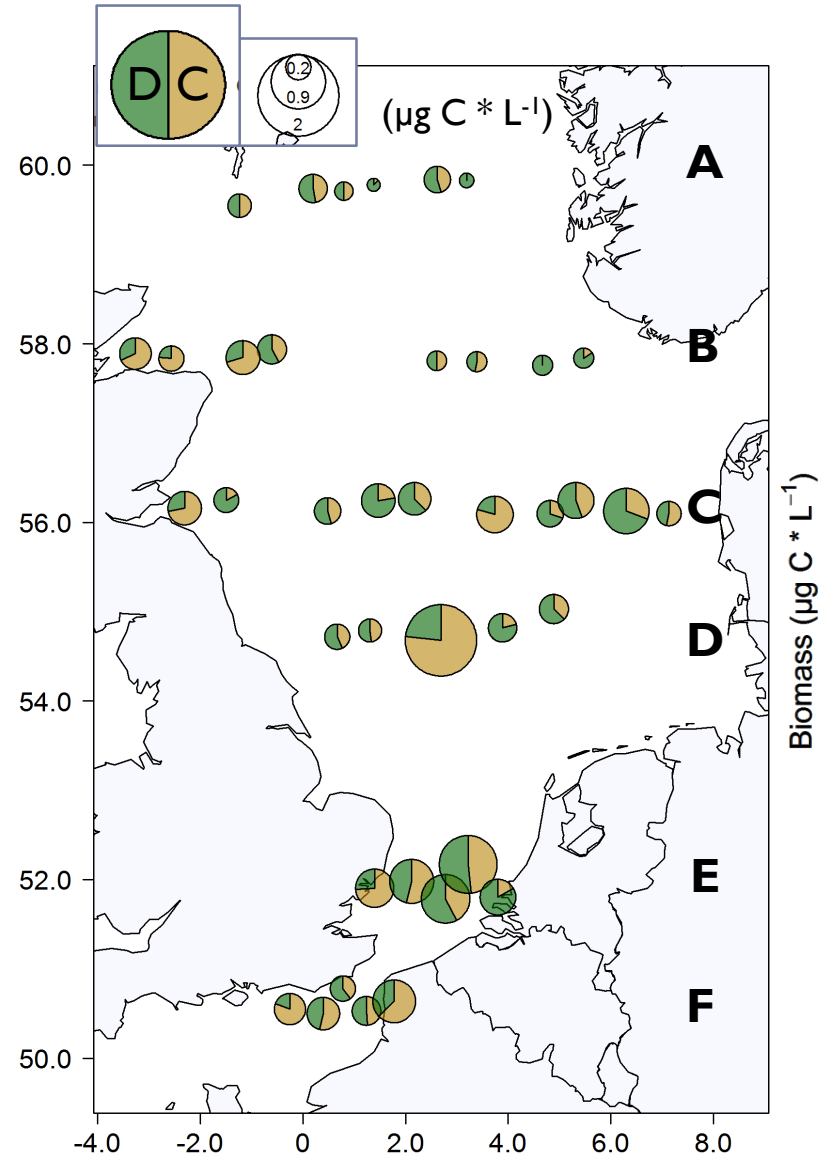
Maximum biomass of 2.4 µg C * L^{-1}

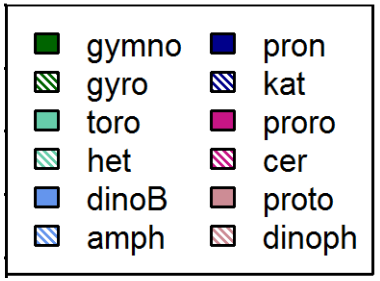
Minimum biomass of 0.08 µg C * L^{-1}

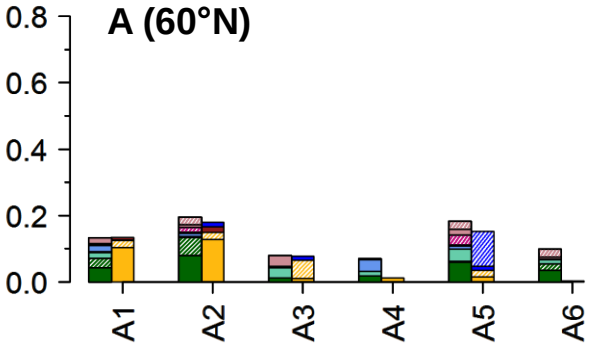


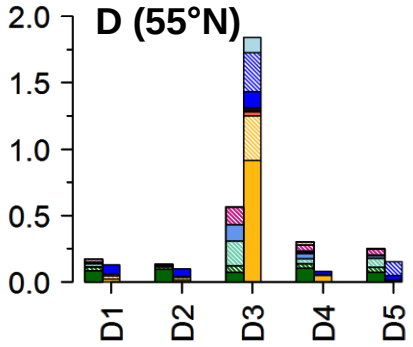
Modified after Löder et al. 2011

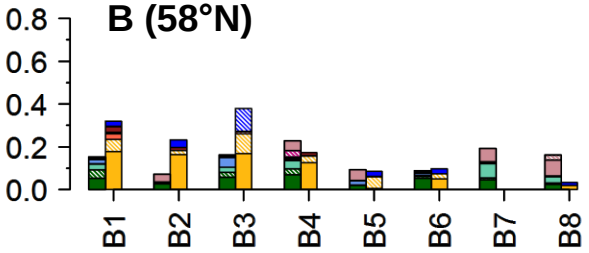
Community composition

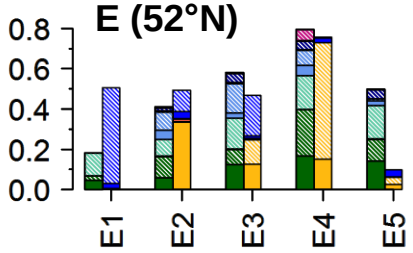


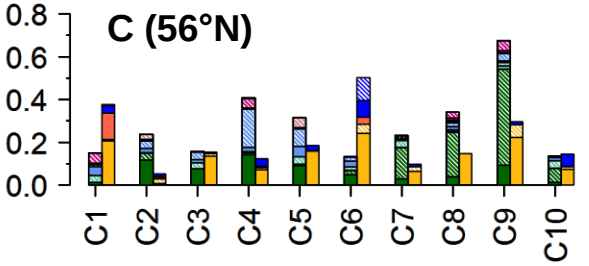


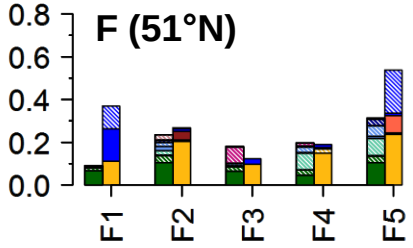






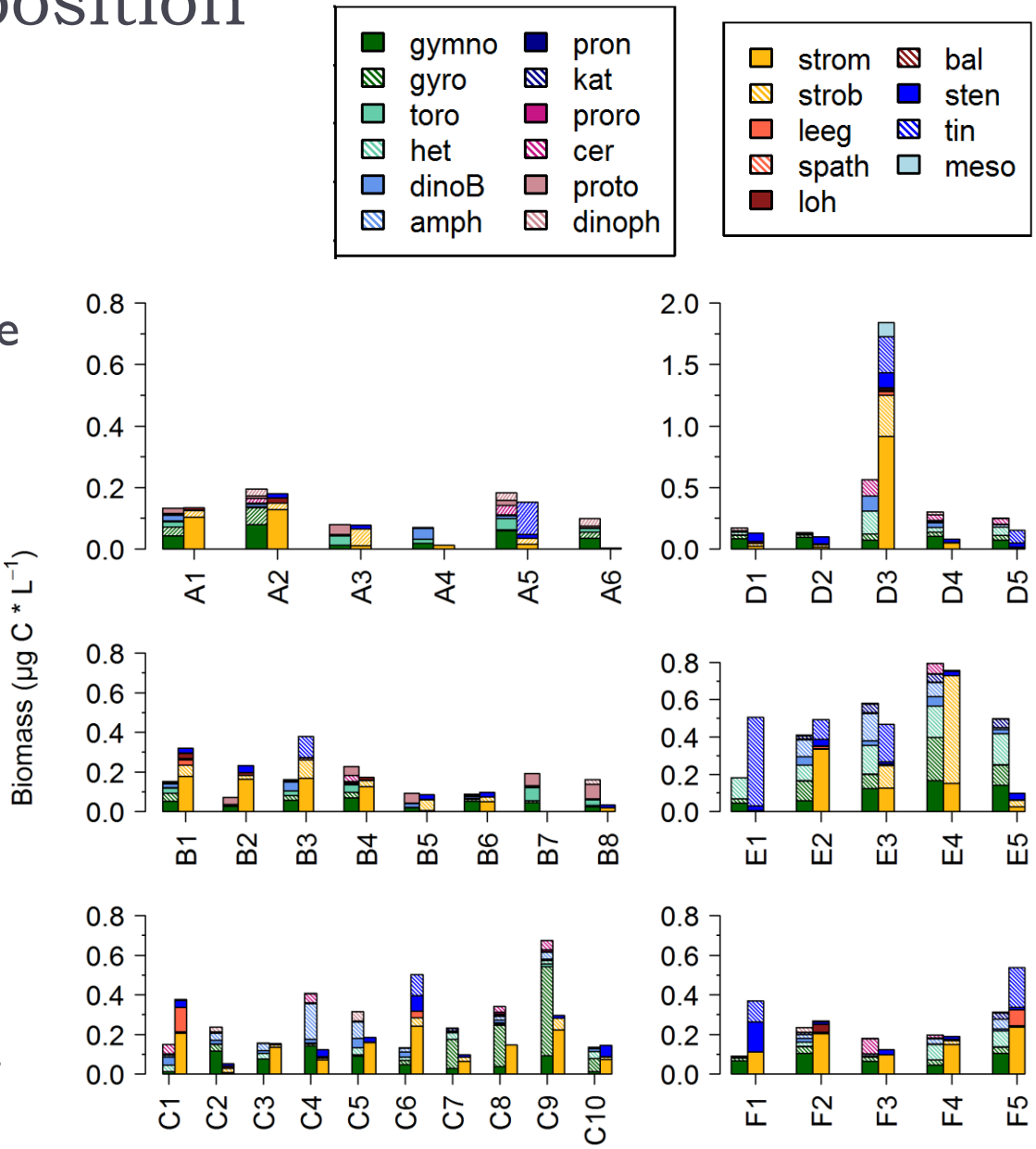




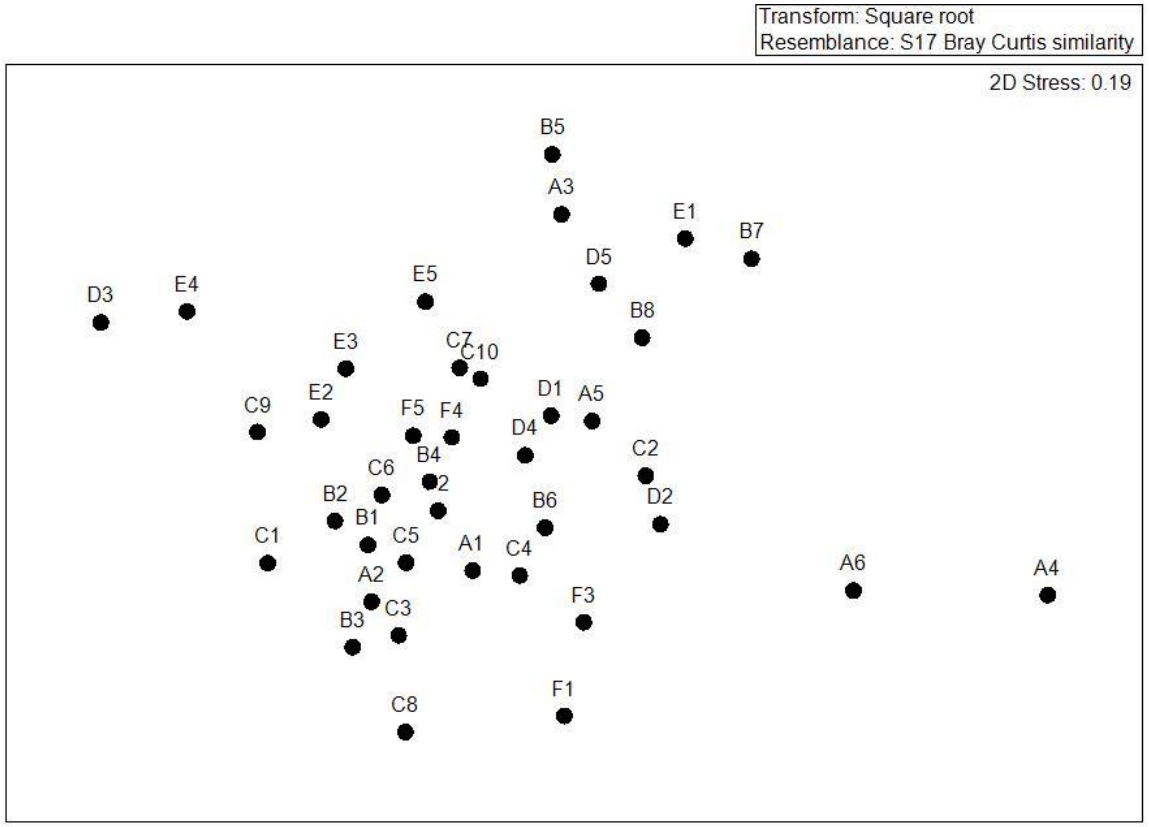


Community composition

- 27 taxa were identified
  - 16 Dinoflagellate & 11 Ciliate taxa
  - *Gymnodinium* spp and *Strombidium* spp dominated the system
  - Cells < 50 µm 43 % of the biomass and 75 % of total abundance
  - High portion of small cells may indicate conditions favouring bacterivorous taxa → strong microbial loop

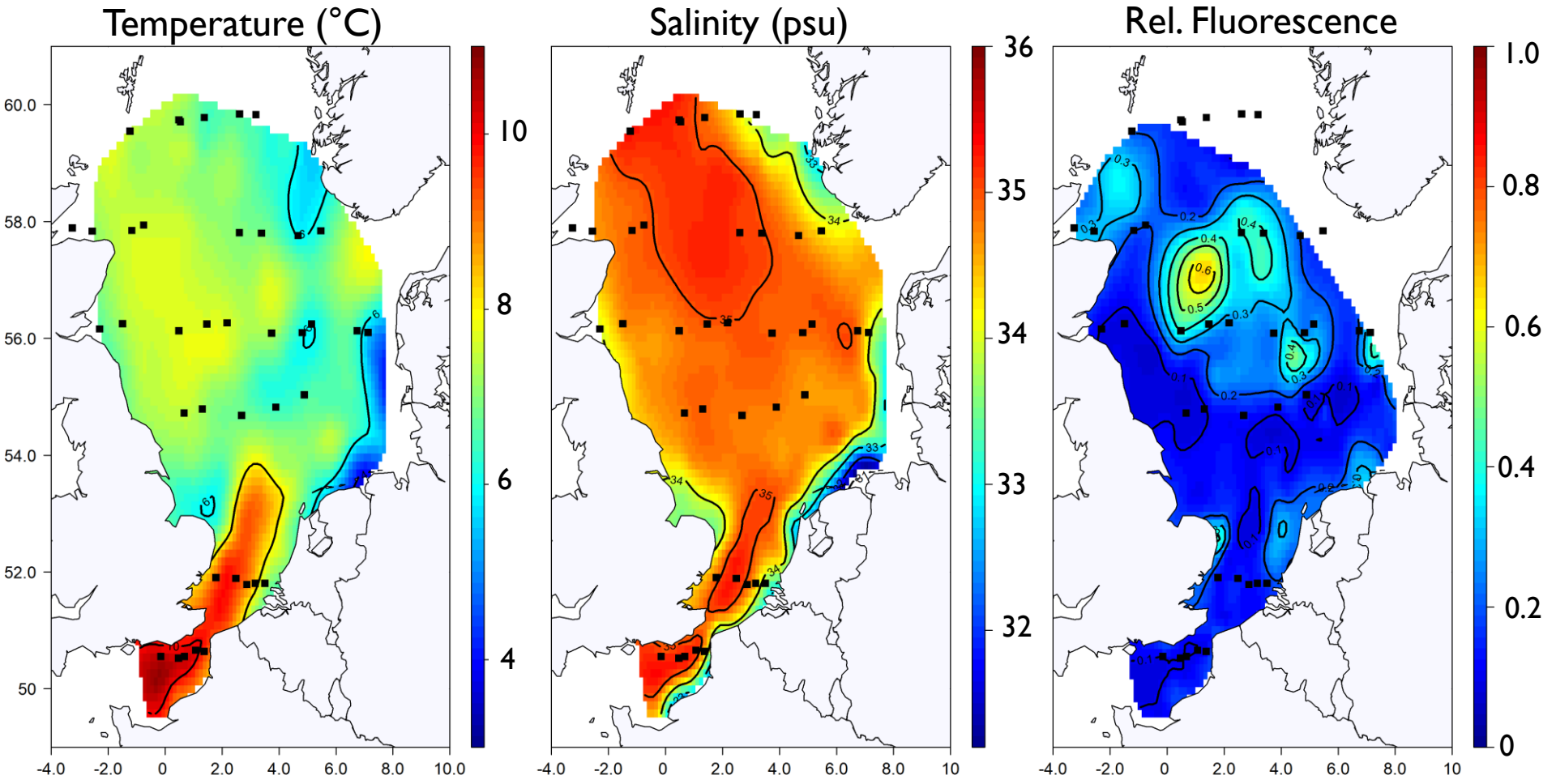


Community composition

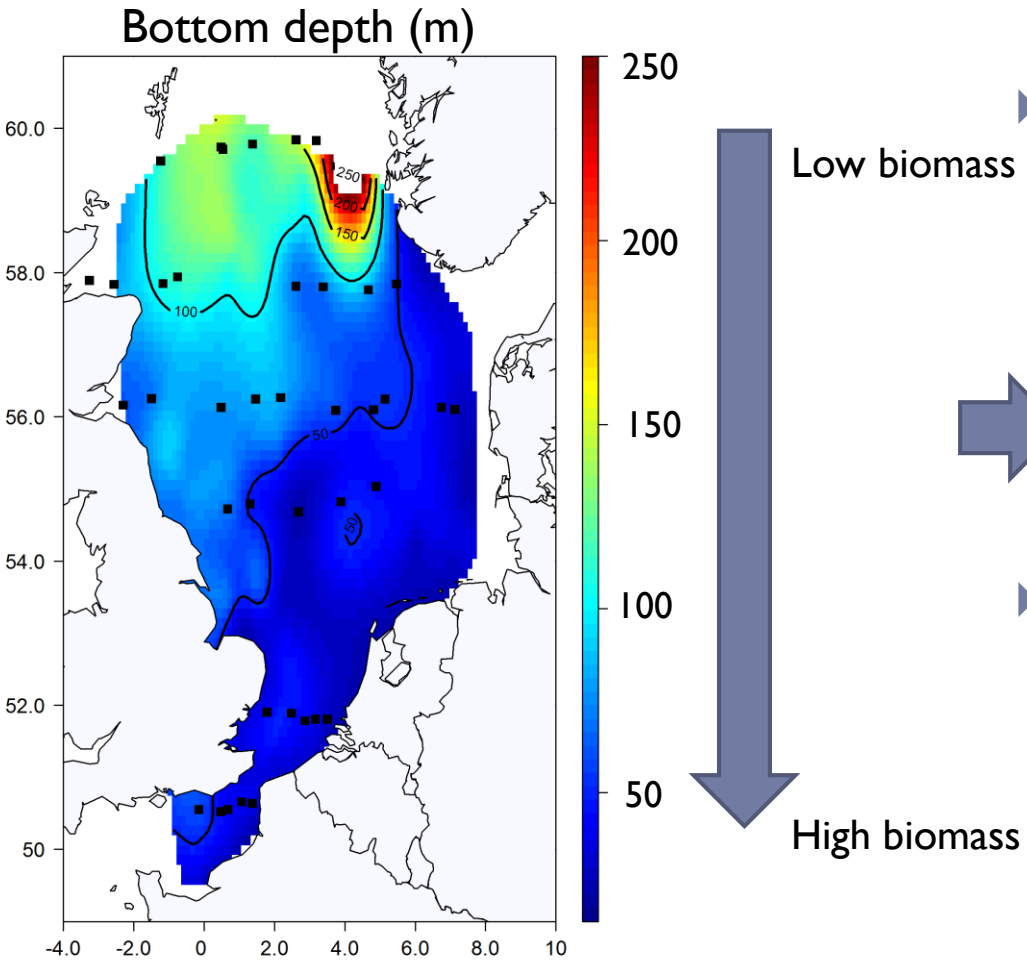


- 7 taxa used to create MDS
- No spatial patterns within the Protist community
- Homogenous community composition across broad sampling area

North Sea winter conditions 2014



Protist distribution



- Significant ($p < 0.05$) negative correlation of Dinoflagellates and Ciliates with latitude and depth
- Higher biomass in the shallow southern areas
- Important winter spawning grounds (e.g. herring and plaice)

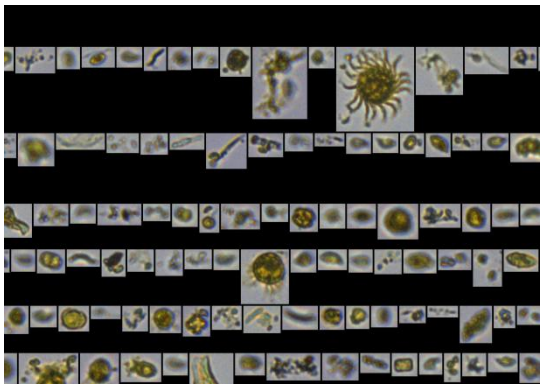
This study provides a snapshot of the North Sea protist community in winter

Outlook 1

This study describes the broad-scale distribution, abundance and biomass of the protozooplankton in the North Sea during wintertime

How to best continue this routine sampling?

- Lack of spatial patterns in community composition identified
  - Streamline the type of data that can/should be collected on broad scale surveys
- Adapting the method
  - FlowCam being trained and compared to manual counts
  - Process larger number of samples - lower taxonomic resolution - gain information on size spectrum → important for models!



Outlook 2

- Collaboration with the institutes in France, Norway, the Netherlands & Germany continued in 2015 and 2016

Cindy van Damme
IMARES, Ijmuiden

Matthias Kloppmann
Thünen Intitute, Hamburg

Christophe Loots
IFREMER, Boulogne-sur-mer

Richard Nash
IMR, Bergen

→ Base is set for starting a longer-term time series for the North Sea winter community.

→ Importance of implementing routine surveys for modelling and ecosystem- based management

Thanks to

- Matthias Kloppmann & the crew of the RV Walther Herwig
- Cindy van Damme & the crew of the RV Tridens
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