

The POLDIV cruise (Heincke HE533) was conducted to deliver samples and data for six research projects within the section of Chemical Ecology, AWI and the HIFMB (Oldenburg). These projects include (1) the DFG-funded project 'Taxonomics: Single-cell transcriptomics of marine microeukaryotes', (2) the EU Horizon 2020 funded project 'MixITiN', (3) the ERA-MBT funded project 'Promise', (4) the ERA4CS / ERA-NET funded project 'CoCLiME' (5) the HIFMB funded project on metatranscriptome analysis, and the (6) RCN-funded project 'TaxMArc'. The focus of the cruise was the comparison of functional plankton biodiversity, species interactions, presence and extend of Harmful Algal Blooms (HABs), and the chemical-physical oceanography among Polar and Arctic fjord systems, subjected to different climate forcing mechanisms along the coast of Norway.

The primary transects originated from the Norwegian coast, at Trondheim to the Lofoten archipelago (research area A), over the fjord system around Tromsø (research area B) and finally to the Porsangerfjorden, Laksfjorden, and Tanafjorden (research area C), where more comprehensive studies were conducted. The sampling targets for all projects were the oceanographic parameters, chemical components of the water column (inorganic and organic compounds) and the respective microeukaryotes and prokaryotes. A detailed investigation of temporal, spatial and functional relationships among members of plankton communities within polar fjords was coordinated and compared with prevailing oceanographic regimes defined by temperature and salinity gradients, and the profile of dissolved organic carbon (DOC), solid-phase extracted organic matter (SPE-DOM), dissolved macronutrients and chlorophyll content from various depths. Plankton samples were collected by net-tows (40 m vertically integrated), and in Niskin bottles or via high volume pumping from fixed depths, followed by size-fractionation.

Dilution experiments were performed on board in order to investigate the impact of mixotrophy in micrograzing as well as to determine the potential effect of different climate change scenarios on such processes. For this purpose, we used a temperature-controlled chamber and applied different combinations of temperature and light regimes.. Selected cells from species of interest were directly isolated from the field and used for single-cell (SC) PCRs and / or treated for next generation sequencing in terms of SC transcriptome analysis.

In general, microscopic analysis of the micro- and nano-plankton revealed a late spring to summer-bloom plankton community, with moderate but in some fjords high chlorophyll concentrations, moderate plankton biomass and a relatively high abundance of copepods and micrograzers (heterotrophic dinoflagellates, tintinnids and other ciliates, in particular).

During the cruise period, massive blooms of *Chrysochromulina leadbeateri* have been reported in the Lofoten area, and this was confirmed with our cruise. In the Tromsø area (Balsfjorden) we found the highest *Chrysochromulina* concentration ever measured in Norwegian waters with > 25 mio c/L (about 10 times over the fish-toxicity threshold). We have also detected this species in more northern areas where it was not identified before.

Expected genera of centric diatoms such as *Thalassiosira* and *Chaetoceros* were present but never at bloom concentrations (except at the station 28 outside of Tanafjorden); pennate diatoms were typically less common, but at a few stations they contributed substantially to the composition (e.g., *Pseudo-nitzschia cf. delicatissima*). The haptophyte species *Phaeocystis*

*pouchetii*, a nuisance HAB representative, was locally blooming, particularly in the Tromsø area and in the inner Porsanger fjord. Large thecate phototrophic dinoflagellates, the typical toxic HAB targets, were never dominant nor abundant in the water column, and except for *Dinophysis norvegica*, were seldom found (e.g., *Alexandrium* spp., *Protoceratium* spp.). Attempts were made to isolate and successfully bring into a culture many of these taxa, for further morphological and molecular diversity studies. The POLDIV cruise yielded so far an abundance of new knowledge on the association of plankton biodiversity with various environmental parameters at the Norwegian coastal and fjord systems. Further sample and data analysis are currently underway. These efforts are directed towards providing the linkage of biodiversity patterns to environmental variables and potential driving forces resulting from climate-driven regime shifts in the Polar region.