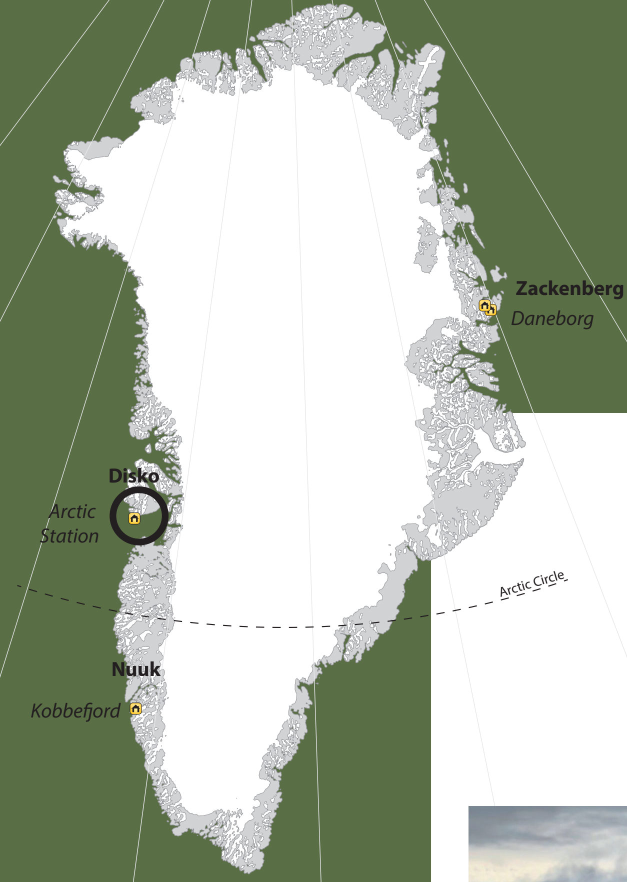

Annual Report Card 2024

TRANSITION FROM A PROTIST COMMUNITY DURING THE DARK COMMUNITY IN SURFACE WATERS OF

The GEM Marine monitoring programme at Disko Bay explores the seasonal changes in biodiversity of phototrophic and heterotrophic plankton organisms using e-DNA, allowing for documentation of climate driven changes in the food web structure.

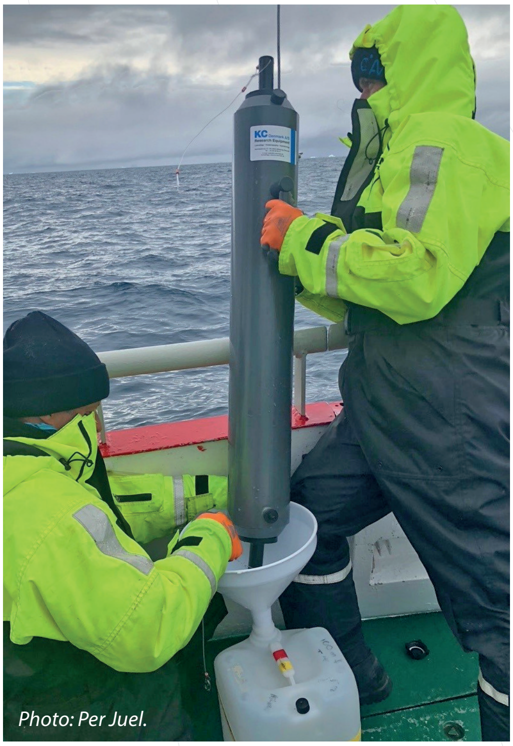

Photo: Per Juel.

Due to climate change, the Arctic is one of the fastest changing environments in the world. This has already affected the Arctic biosphere and will lead to further changes in the future. The base of the complex marine pelagic food web consists of unicellular organisms, such as bacteria and eukaryotic unicellular plankton (protists) occupying different ecological niches and providing food for higher trophic levels. Unicellular eukaryotic plankton communities (protists) are the major basis of the marine food web.

Plankton communities have traditionally been described and quantified using microscopical techniques in monitoring programmes. These techniques allow for quantification in terms of carbon biomass in functional groups in most cases. However, such an approach does not give enough resolution for several reasons. Typically, small water volumes are used for the description of the plankton communities, and especially for the smaller size fraction of organisms (< 15 µm), the organisms cannot be identified to genus and species level, in some cases not even to class level.

Photo: Per Juel.

Photo: Per Juel.

Authors:

Claudia Sabine Bruhn[1,2], Nina Lundholm[3], Per Juel Hansen[4], Sylke Wohlrab[1] & Uwe John[1]

[1]Alfred Wegener Institute, Germany

[2]GFZ Helmholtz Centre for Geosciences

3Natural History Museum of Denmark, University of Copenhagen, DK

[4]Department of Biology, University of Copenhagen, DK

Data source:

MarinBasis Disko, DOI: https://doi.org/10.17897/KGV0-N239

Data can be accessed on GEM database: https://data.g-e-m.dk

MIXOTROPHIC/HETEROTROPHIC

WINTER TO A PHOTOAUTOTROPHIC SPRING
DISKO BAY, GREENLAND

GEM
Greenland Ecosystem Monitoring

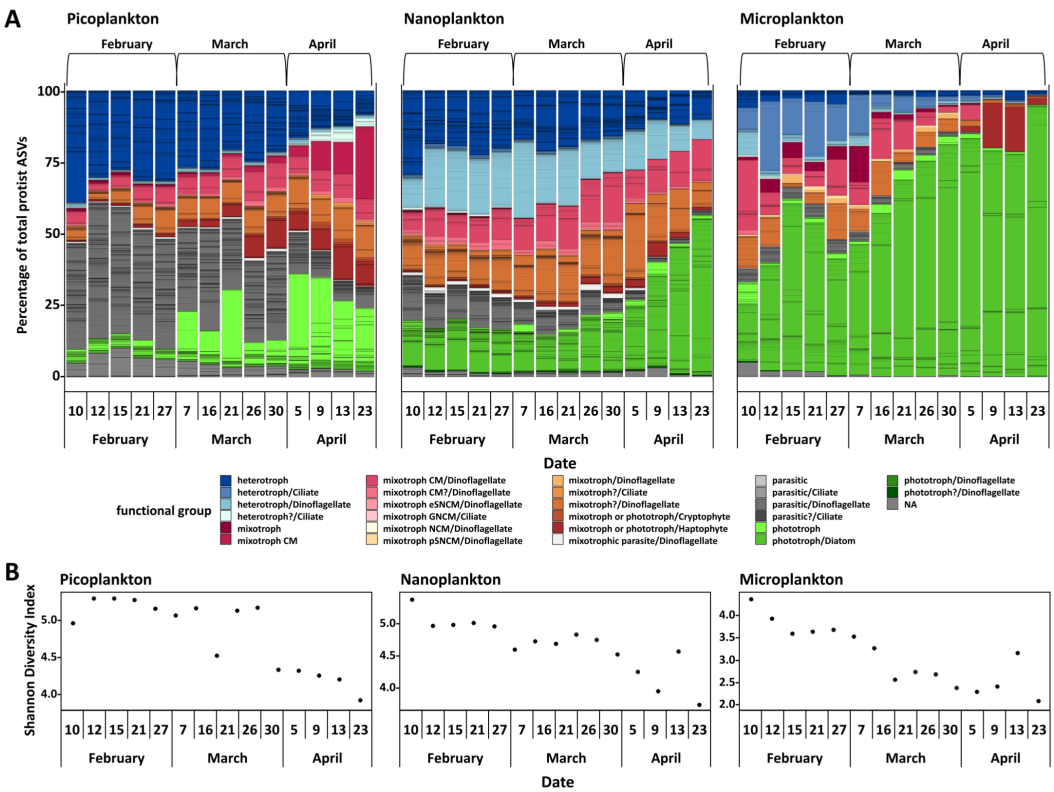

Figure 1. Protist community analyses. Water samples have been size-fractionated (picoplankton 0.2-3 µm, nanoplankton 3-20 µm and >20 µm). Normalized protist ASVs, divided by functional group and size fraction and additionally divided into three calendar months (A). CM, constitutive mixotroph; eSNCM, endo-symbiotic specialist non-constitutive mixotrophs; GNCM, generalist non-constitutive mixotrophs; NCM, non-constitutive mixotroph; pSNCM, plastidic specialist non-constitutive mixotrophs. It was not possible to assign the definite trophic mode to each ASV, hence a putative trophic mode (indicated with a question mark or NA) is displayed. The Shannon Diversity Index (B) is also displayed.

As part of the GEM marine monitoring programme at the Arctic Station in Qeqertarsuaq, we have therefore included e-DNA sampling to improve description of species diversity that also allows for a better resolution of the different functional groups. Here, we report on the use of e-DNA to describe the winter - spring transition in the protist community (Fig. 1; Bruhn et al 2024).

The spring bloom is especially important, because of its high biomass. However, it is poorly described how the protist community composition in Arctic surface waters develops from winter to spring. We show that mixotrophic and parasitic organisms are prominent in the dark winter period (Figure 1). Especially, the distribution of parasitic organisms is largely unstudied in Arctic waters, because they cannot be quantified using traditional techniques. The transition period toward the spring bloom event was characterized by a high relative abundance of mixotrophic dinoflagellates, while centric diatoms and the haptophyte *Phaeocystis pouchetii* dominated the successive phototrophic spring bloom event during the study. The data shows a continuous community shift from winter to spring, and not just a dormant spring community waiting for the right environmental conditions.

The spring bloom initiation commenced while sea ice was still scattering and absorbing the sunlight, inhibiting its penetration into the water column. The initial increase in fluorescence was detected relatively deep in the water column at ~55 m depth at the halocline, at which the photosynthetic cells accumulated, while a thick layer of snow and sea ice was still obstructing sunlight penetration of the surface water. This suggests that water column stratification and a complex interplay of abiotic factors eventually promote the spring bloom initiation.

References

Bruhn, C.S., Lundholm, N., Hansen, P.J., Wohlrab, S. & John, U. (2024). Transition from a mixotrophic/heterotrophic protist community during the dark winter to a photoautotrophic spring community in surface waters of Disko Bay, Greenland. Frontiers in Microbiology. 15. doi: 10.3389/fmicb.2024.1407888

Photo: Per Juel.