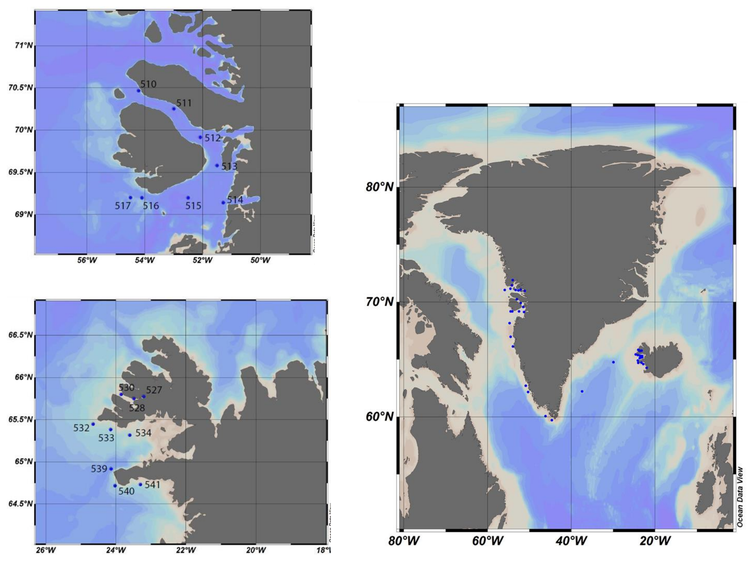
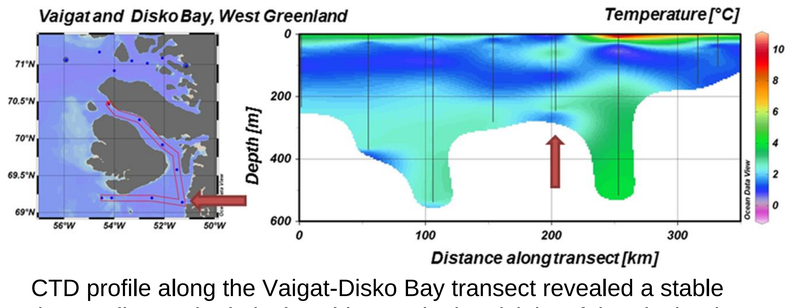
Allan Cembella[1], Uwe John[1], Bernd Krock[1], Urban Tillmann[1], Stephanie Westphal[1], Donald M. Anderson[2], Mindy Richlen[2], Rohan Henkel[3], Daniela Meier[3], Daniela Voss[3] and Oliver Zielinski[3]

Defining emerging patterns of Harmful Algal Bloom biogeography and biodiversity associated with global regime shifts in Arctic coastal systems

Global change mediated by sea temperature rise, enhanced ice melting and other anthropogenic influences is predicted to have a profound influence on Arctic coastal regions. Differential effects on biogeography and diversity of HABs and their associated toxins were addressed during an oceanographic expedition (ARCHEMHAB) to west Greenland with transects across the Irminger Sea to fjord systems in northwestern Iceland.



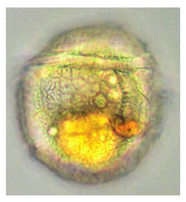


CTD profile along the Vaigat-Disko Bay transect revealed a stable thermocline and relatively cold water in the vicinity of the glacier, in contrast to unusually warmer water in the direction of the outer coast

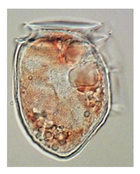
In west Greenland, longshore sampling was accompanied by fjord transects to the edge of the glacier ice shelf. Field observations included physical oceanographic parameters (CTD) and bio-optical profiles, vertical net tows and Niskin bottle sampling (plankton, nutrients, pigments, DOM), and benthic sediment grabs for dinoflagellate cysts (*Alexandrium* spp.) and bivalve molluscs.

Alexandrium cf. *tamarense*

Alexandrium ostenfeldii

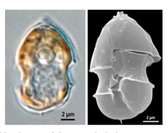


Protoceratium reticulatum



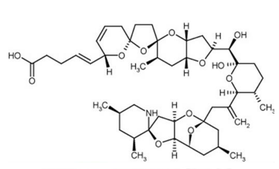
Dinophysis acuminata

Dinophysis acuta

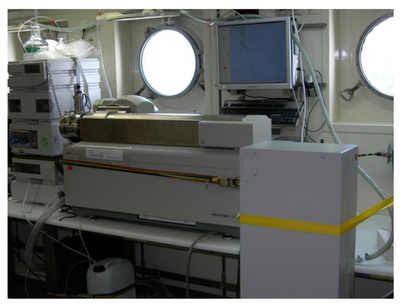


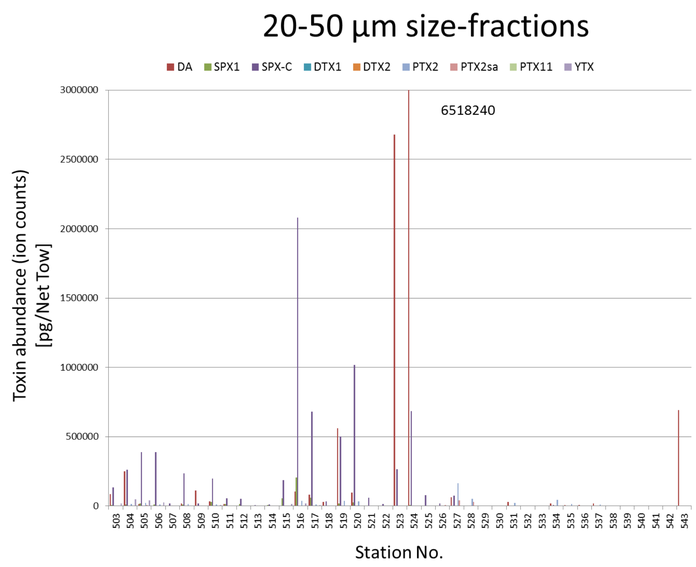
Azadinium/Amphidoma spp.

Pseudo-nitzschia sp.



Analysis of marine toxins by liquid chromatography with fluorescence (LC-FD) or tandem mass spectrometry (LC-MS/MS)

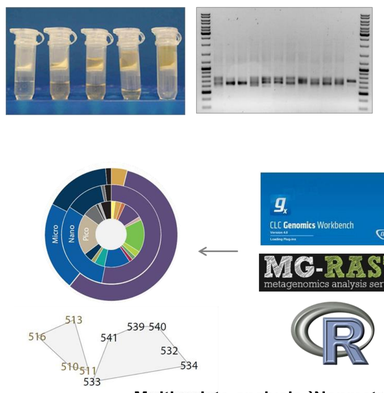




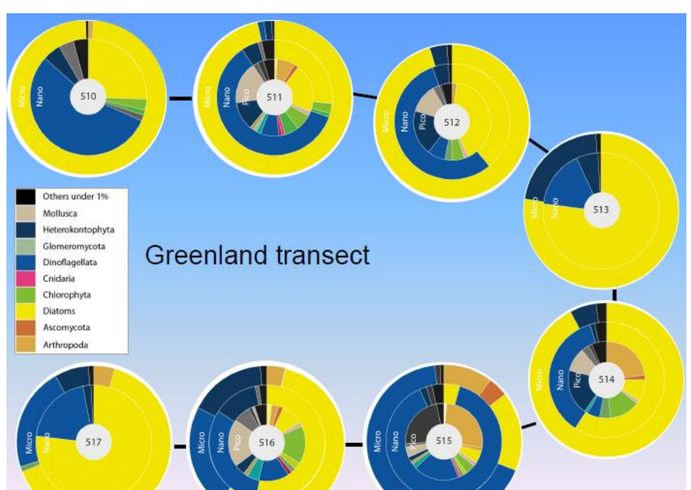
We found numerous HAB taxa and associated toxins, primarily gonyautoxins, spirolides C and des-methyl C, and domoic acid, with only trace levels of dinophysistoxins, pectenotoxins and yessotoxin, in the plankton from the water column.

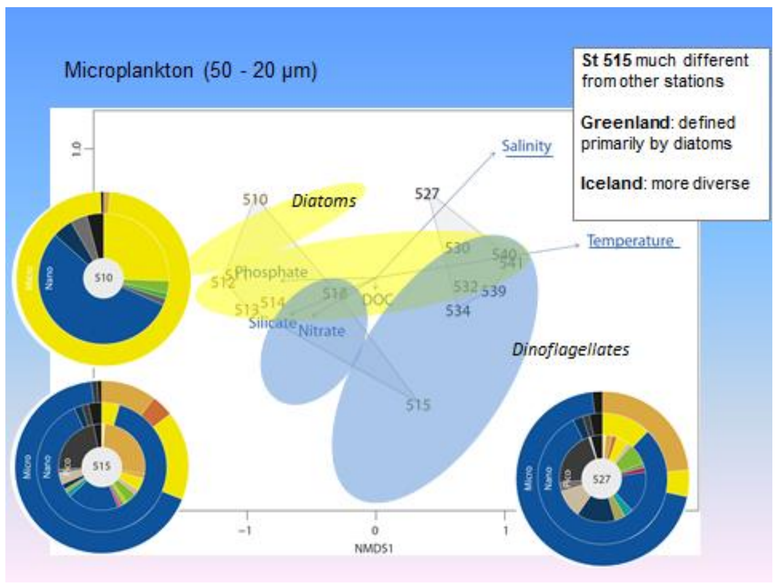
Ecogenomic Approach

Environmental rDNA libraries



Multivariate analysis `Nonmetric multidimensional scaling` (NMDS)





Community analysis of plankton size fractions by DNA bar-coding based upon sequencing the large sub-unit ribosomal DNA (LSU rDNA) D1/D2 region revealed comparative patterns of diversity for Disko Bay (Greenland) versus stations in an Icelandic fjord. The high species diversity in the microplankton, within which the known HAB taxa were embedded, showed a strikingly high representation of cryptic dinoflagellates on the Greenland coast.

Definitive linkages to HAB-relevant regime shifts could not be defined at this stage, but multi-faceted comparative ecosystem studies provide the basis for future scenarios and modelling global change processes of HAB biogeography in Arctic waters.

Financial support of the scientific work
Alfred-Wegener-Institut (AWI), Topic 1: The changing Arctic and Antarctic; Topic 2: Coastal Change, PACES Programme, Erde und Umwelt HGF
ICBM, Universität Oldenburg
Woods Hole Oceanographic Institution (WHOI) via National Science Foundation, USA

[1] Alfred Wegener Institut-Helmholtz Zentrum für Polar- und Meeresforschung Bremerhaven, Germany

[2] Woods Hole Oceanographic Institution, Woods Hole, MA, USA

[3] University of Oldenburg, Institute for Chemistry and Biology of the Marine Environment, Wilhelmshaven, Germany