Picophytoplankton off Helgoland

B. Knefelkamp, K.H. Wiltshire

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International Max Planck Research School for Marine Microbiology

Introduction

The aim of my PhD work is to obtain expertise allowing me to investigate the role of picophytoplankton in the pelagic trophodynamic processes ("Helgoland Foodweb Project"). Picophytoplankton are the smallest (< 3 μm), single celled plants and cyanobacteria, living in worldwide waters. They occur at all trophic states and form the dominating biomass. The autotrophs play an important role in the production of oxygen and hence are a basis of life in, for example marine, water habitats. However, until now they are poorly identified and only small investigations on their physiology and interactions are carried out. This may occur from the lack of a suitable method to describe the range of picophytoplankton organisms in a whole.

In my project, the eukaryotic picophytoplankton organisms off Helgoland shall be identified, examined genetically, structurally and physiologically (with methods like FISH, DGGE, flow cytometry, EM, HPLC and a fluorometer), and their recognised basic role in trophodynamic processes shall be deliberated. Furthermore, the same species (e.g. *Micromonas* sp., Prasinophyceae) from different habitats will be compared (culturing and grazing tests) and the international cooperation in this field of marine research will be extended.

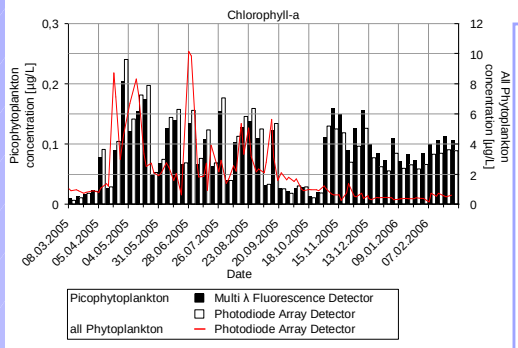

Figure 1 Chlorophyll-a concentration

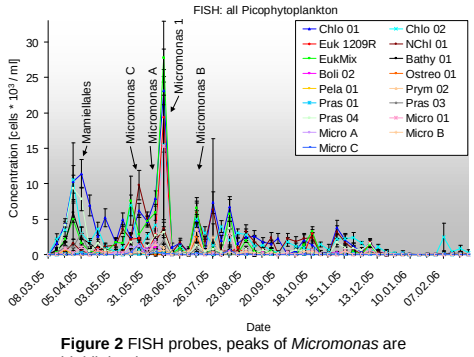

Figure 2 FISH probes, peaks of *Micromonas* are highlighted

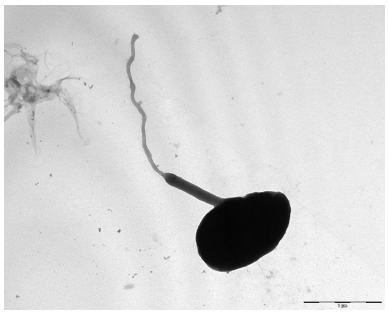

Figure 3 *Micromonas sp.* (07.06.2005)

Results

A new developed HPLC method calculates pigment concentrations in picophytoplankton samples within a very short runtime. Chlorophyll-a (Figure 1) is generally used as a biomass parameter and other pigments (like Fucoxanthin, Diadinoxanthin, Neoxanthin, Peridinin etc) serve as identifiers of different algae classes. Comparison with the long-term series data of phytoplankton from the Helgoland roads (54°11.18' N , 07°54' E) shows, that peaks in the picophytoplankton abundance during springtime (end of April and mid of May) come shortly after the larger phytoplankton organisms disappeared and nutrients (nitrate, silicate, phosphate) decreased. This is also supported by the fluorometric data.

The genetic results (FISH, figure 2) give contradictory information. They show a high picophytoplankton abundance around mid of June. Hence this peak cannot be found in the Chlorophyll-a data, the difference between these two methods is conspicuous. High Chlorophyll-a concentrations in the water can represent a higher quantity of cells but also an increased per cell amount of this pigment. This would for instance be the case when the cells adjust to different light intensities or in 'preparation' for cell division.

That the number of picophytoplankton organisms decreases somewhere during the preparation method for electron microscopy investigations, is already known (in consultation with Dr W. Eikrem). However, pictures that were taken, can be combined with the results from the FISH method. For example the picture of *Micromonas sp.* (figure 3), taken from the sample of 7th June 2005, seems to be a species from *Micromonas* clade A. This clade was genetically most abundant at this date (figure 2).

Conclusions

This study brings light into a new field of marine phytoplankton research. The samples of this annual cycle, processed with different methods in parallel, give a clear and detailed picture about the picophytoplankton community structure in the North Sea off Helgoland. The recording of its succession and its connection with other biological processes leads to a better understanding of the complex marine ecosystem and its foodweb which provides commodities for people as well. Furthermore, greater knowledge about our marine environment can help us recognize or even predict natural changes (like climatic change). My work hopefully helps to show how important even the smallest organisms are and which currently available method is best suited to study them.

References

Wiltshire & Manly Helgol Mar Res 58 (2004) and Franke H-D, Buchholz F, Wiltshire KH (2004) Ecological long-term research at Helgoland (German Bight, North Sea): retrospect and prospect - an introduction. Helgol Mar Res 58, PANGAEA 2004 and http://www.pangaea.de.

Name: Britta Knefelkamp
Nationality: German
Date of Birth: 05 Aug. 1979
Start of PhD Thesis: Jan. 2005
Funding: AWI / MarMic
Thesis Committee: Prof. Dr. KH Wiltshire, AWI
Prof. Dr. GO Kirst, Uni HB, rtd
Prof. Dr. R Amann, MPI
Prof. Dr. J Throndsen, UIO, rtd
Dr. G Gerdts, AWI
Dr. W Eikrem, UIO
Dr. D Vaulot, SBR