Plankton seasonal cycles in the Norwegian and North Seas

Josie South [(1)], Martina Maric [(2)], Renata Khouri [(3)]
(1) Queen's University of Belfast, (2) Klaipeda University, (3) University of Southampton

Plankton are the base of the ocean food web and fundamental for the marine environment. The phyto and zooplankton cycles in the Norwegian and North Sea support many fish populations (including commercial stock) and are key for ocean nutrient cycles and primary production.

DIATOMS
- dominant phytoplankton in Spring, forming large blooms
- main source of food for copepods
- main primary producers in the ocean

CALANUS sp.
- dominant zooplankton in the region
- predominantly herbivorous
- main source of food for several fish

SPRING
- increased light
- decreased mixing
- decreasing nutrient concentration

COCCOLITHOPHORES
- occur after spring bloom, when diatoms decrease due to silica limitation
- can form large blooms

PHAEOCYSTIS
- similar to coccolitho-phores, can occur after the diatom bloom
- can form large colonies

SUMMER
- high light
- low mixing
- low nutrient concentration

DINOFLAGELLATES
- dominant phyto-plankton in Summer
- may cause Harmful Algal Blooms

AUTUMN
- decreased light
- increased mixing
- increasing nutrient concentration

WINTER
- low light
- high mixing
- high nutrient concentration

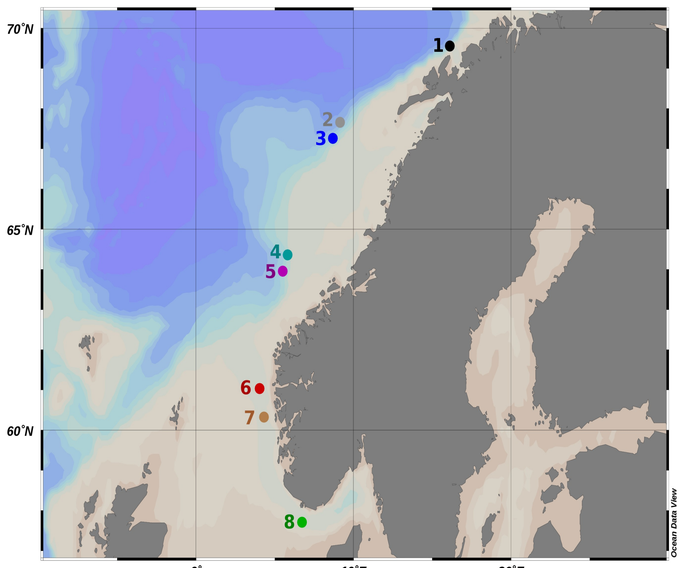


Figure 1. Sampling stations

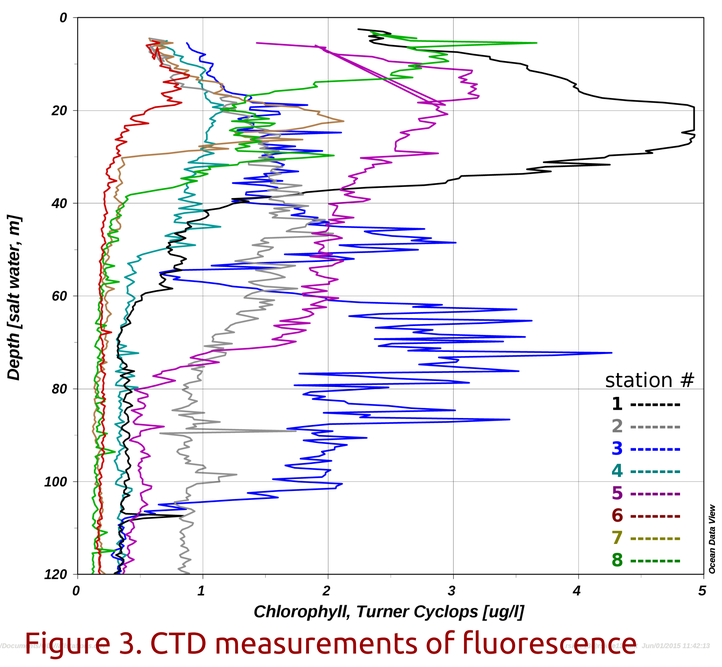


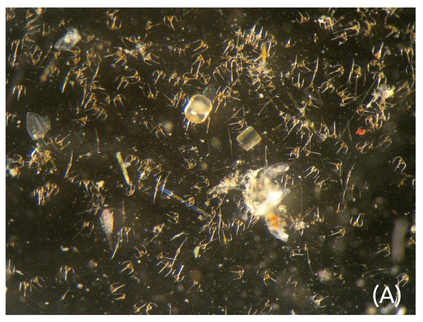
Figure 3. CTD measurements of fluorescence

CASE STUDY: RV Dana Cruise, Norwegian and North Seas, May 24th - 28th

With the end of the spring bloom, dinoflagellates (fig. 2A) were the most abundant group of phytoplankton observed (*Ceratium sp., Protoperidinium sp.*). These are some of the largest phytoplankton in the oceans, and therefore could be observed even in a stereo microscope.

Calanus finmarchicus (fig. 2B, 2C), the main contributor to the zooplankton biomass in the North Atlantic, was the dominant secondary producer. However it was more abundant in the northern stations, possibly due to the end of the spring bloom in the region.

Crustaceans were the most abundant group of zooplankton observed. The most important representatives were copepods (fig. 2B), amphipods, calanoids, cladocerans (*Daphnia sp.*) (fig. 2D) and euphasids. Chaetognaths (fig. 2E) were common in all stations. Ctenophores (fig. 2F), tunicates and polychaetes also occurred occasionally The most common meroplankton were echinoderms and crustacean larvae.



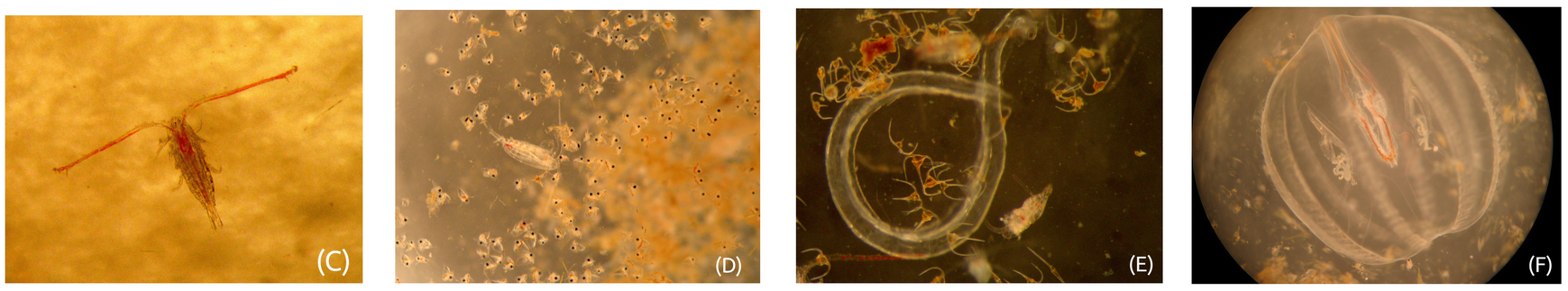


Figure 2. Plankton observed in the cruise under a stereo microscope

DISCUSSION

The chlorophyll peak detected by the CTD fluorescence measurements (fig. 3) was higher in the first stations, which evidences the lag in timing of the spring bloom from the northern Arctic waters in comparison to southern coastal waters. The high chlorophyll levels observed on deeper waters (~70m) in the north could be related to a dinflagellate (or even a phaeocystis) bloom. These facts together reinforce the transition period between the Spring and Summer seasons in the plankton cycle. The new generation of *Calanus sp.* is still maturing at this time of the year, and adults could have already laid eggs during the peak bloom.

The spring bloom is essential for the maintenance of the North Atlantic ecosystem. Diatoms are the favoured food source for copepods, which in turn are the main food source for many fisheries and sea mammals. The impact of climate change and warming temperatures in the phenology of plankton are not yet known, and a mismatch between the diatom and copepod cycles could have potentially dire consequences for the whole marine environment.

The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under the Networking Activity of the EUROFLEETS2 project, grant agreement n°312762

REFERENCES:

1. Reid et al. *Phytoplankton of the North Sea and its dynamics: a review.* Netherlands Journal of Sea Research (2004)
2. Loeng & Drinkwater. *An overview of the ecosystems of the Barrents and Norwegian Seas and their response to climate variability.* Deep Sea Research II (2007)
3. Melle et al. Zooplankton: The link to higher trophic levels. Skjoldal, H.R. (Ed.), The Norwegian Sea Ecosystem (2004)
4. Broms & Melle, *Seasonal development of Calanus finmarchicus in relation to phytoplankton bloom dynamics in the Norwegian Sea.* Deep-Sea Research II (2007)