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Mesozooplankton abundance and distribution in Fram Strait in comparison between a cold and a warm year

BACKGROUND/OBJECTIVES

In Fram Strait (Fig. 1), the only deep water connection to the Arctic Ocean (AO), relatively warm Atlantic water masses (AW) flowing northward with the West Spitsbergen Current (WSC) encounter cold polar water masses that are transported southward with the East Greenland Current (EGC). Zooplankton organisms are associated to distinct water masses. As the amount and temperature of AW entering the AO increase in the course of climate change [1, 2], zooplankton abundance and species composition might change, with possible consequences for the pelagic food web. We therefore investigated interannual changes in the zooplankton community across Fram Strait in relation to water temperatures.

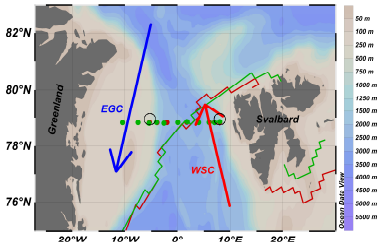

Fig. 1: Sampling sites and environmental conditions in Fram Strait.

Red circles: Multinet stations during ARK-XXVI/1 (2011); green circles: Multinet stations during ARK-XXVII/1 (2012); red line: sea ice extent in June 2011; green line: sea ice extent in June 2012; EGC: East Greenland Current; WSC: West Spitsbergen Current. The map was compiled using the program Ocean Data View [3]. Data on sea ice extent were obtained from NSIDC [4]. Black circles indicate stations for which results are presented.

METHODS

- Research cruises ARK-XXVI/1 (June/July 2011) and ARK-XXVII/1 (June/July 2012) with RV *Polarstern* to Fram Strait
- Vertical Multinet hauls (mesh size: 150 µm; net opening: 0.25 m³) on a transect at N 78° 50‘ (Fig. 1)
- 5 depth strata (0-50/50-200/200-500/500-1000/1000-1500 m)
- Mesozooplankton samples were preserved in 4% formalin buffered with hexamethylentetramine
- Organisms were determined to the lowest taxonomical level using a stereomicroscope

RESULTS

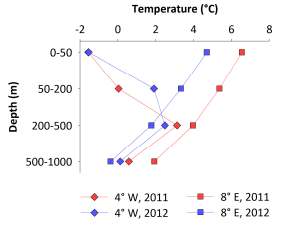

Fig. 2: Average water temperatures in Fram Strait at 4° W (diamonds) and 8° E (squares) in June/July 2011 (red) and 2012 (blue).

Data were compiled after [5, 6]

- In the WSC (Atlantic Water), temperatures down to 1000 m water depth were ~1.9 to 2.3 °C warmer in 2011 as compared to 2012
- In the EGC (Polar Water), water temperatures were generally similar in 2011 and 2012

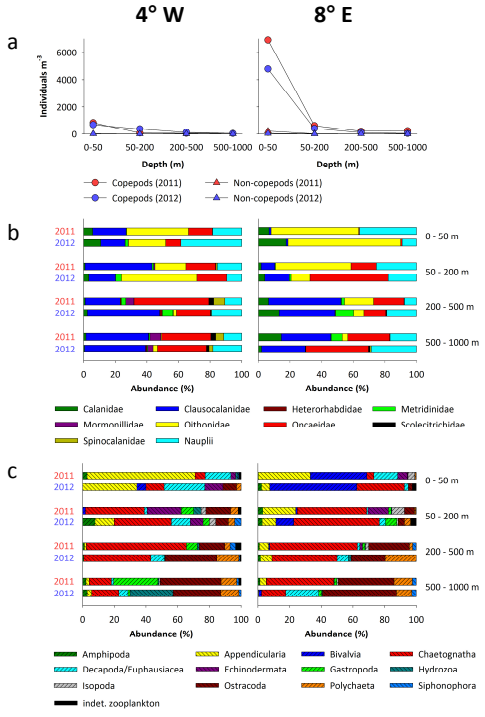

Fig. 3: Total zooplankton abundance (a), copepod community composition (b) and non-copepod community composition (c) at 4° W (left side) and 8° E (right side) in June/July 2011 and 2012

- Mesozooplankton abundance and community composition are exemplary shown for two stations down to 1000 m water depth covering the EGC (4° W) and the WSC (8° E)
- Copepods made up 82 to 98 % of all zooplankton organisms, with small species (*Oithona* spp., *Oncaea* spp., *Microcalanus* spp.) dominating the communities (Fig. 3a, b)
- Total zooplankton abundance was highest in surface waters of the WSC, whereas abundances in deeper water layers were similar between stations in the eastern and western Fram Strait (Fig. 3a)
- Total abundances in the WSC were higher in 2011 (warm AW) than in 2012 (cold AW) (Fig. 3a)
- The community composition of copepods and non-copepod zooplankton changed with depths (Fig. 3b, c)
- In the upper water layers, community composition changed with longitude
- For each depth layer, the community composition was similar in 2011 and 2012 (Fig. 3b, c)

CONCLUSIONS

- An increased inflow of warm Atlantic water masses into the Arctic Ocean might lead to higher mesozooplankton abundances in the eastern Fram Strait
- Changes in mesozooplankton community composition due to climate change might only be visible in the long term

References
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