



Interannual zooplankton distribution in the HAUSGARTEN area (eastern Fram Strait) in relation to environmental conditions

BACKGROUND/OBJECTIVES

In the past 20 years, the West Spitsbergen Current has warmed at a rate of 0.06 °C year⁻¹ [1]. Such increases in seawater temperature can lead to shifts in zooplankton species distribution [2]. When large cold-water species with high biomass are replaced by smaller warm-water species with relatively low biomass, this might have strong impacts on the food web dynamics and the whole ecosystem functioning. Since 2011, we therefore monitor the summer mesozooplankton abundance and community composition in the eastern Fram Strait within the framework of the long-term ecological research observatory HAUSGARTEN [3, 4] in order to detect changes in the zooplankton community in relation to changing environmental conditions.

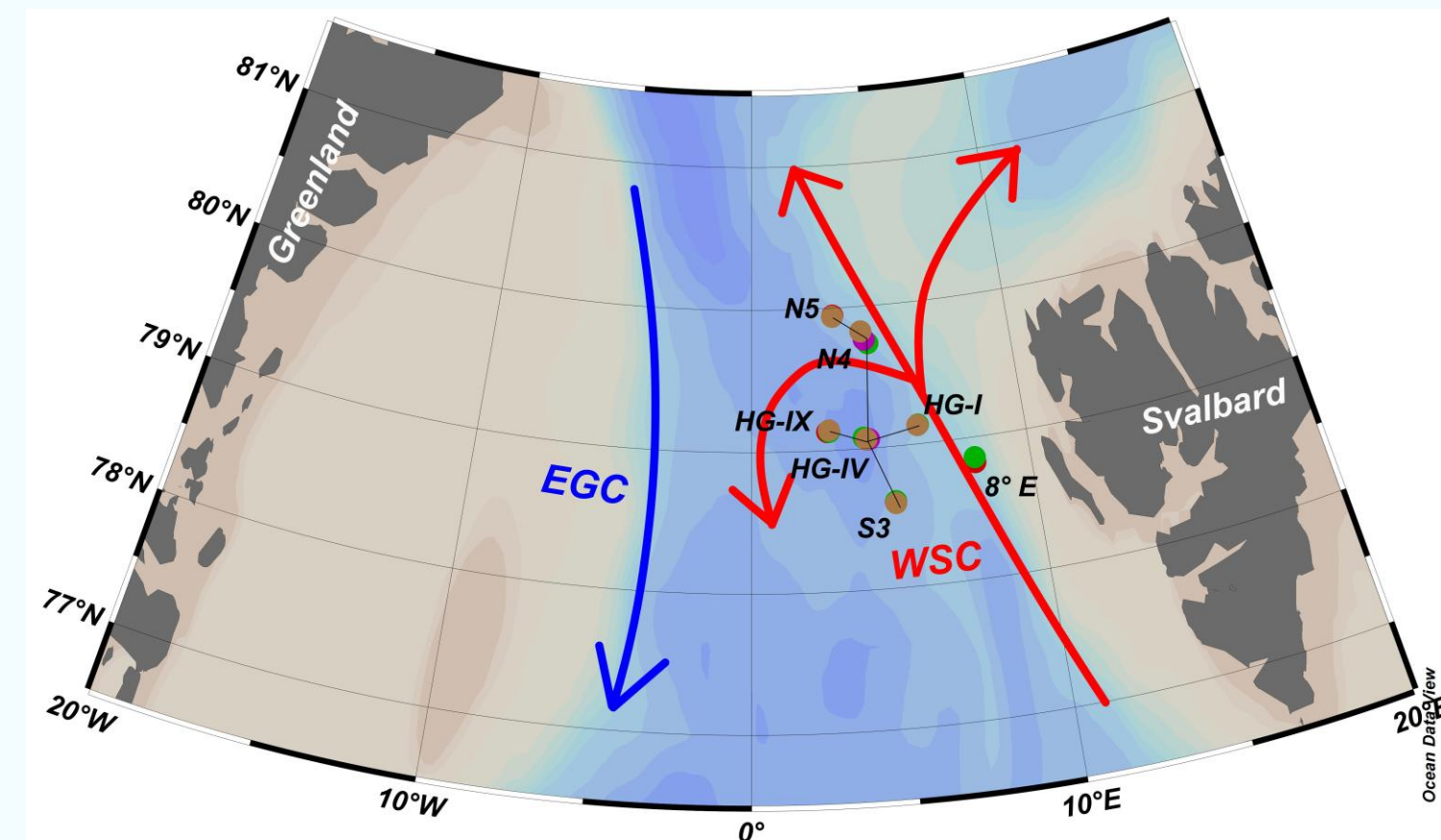


Fig. 1: Zooplankton sampling sites in the HAUSGARTEN area (Fram Strait).

Multinet stations sampled in 2011 (red circles), 2012 (green circles), 2014 (purple circles) and 2015 (brown circles); station names are depicted in black. EGC: East Greenland Current; WSC: West Spitsbergen Current. The map was compiled using the program Ocean Data View [5].

ZOOPLANKTON MONITORING

- Data from research cruises ARK-27/1+2 (June/July 2012), PS 85 (June 2014) and PS 93.2 (July/August 2015) with RV *Polarstern* to Fram Strait are presented
- Vertical Multinet hauls (mesh size: 150 µm; net opening: 0.25 m³) in the HAUSGARTEN area (Fig. 1)
- 5 depth strata (0-50-200-500-1000-1500 m)
- Mesozooplankton samples were preserved in 4 % formalin buffered with hexamethylenetetramine
- Organisms were determined to the lowest possible taxonomical level using a stereomicroscope

RESULTS

- Water temperatures at the presented sampling stations in the West Spitsbergen Current ranged between 2 and 6 °C in the upper 50 m; at greater depths, variations in temperature were less pronounced among stations/years (data were compiled after [6-9])
- Total zooplankton abundance was highest at the surface and lowest in deep waters (Fig. 2)
- In the upper 50 m, total zooplankton abundance was positively correlated with water temperatures (Fig. 2)
- Copepods dominated the mesozooplankton communities at all stations, depths and years (76-99 % of all zooplankton organisms)
- The intra-annual copepod community composition is similar among stations whereas the non-copepod community is more variable (Fig. 4)
- In the relatively cold year 2014, high abundances of lipid-rich *Calanus hyperboreus* were present, while smaller species (*C. finmarchicus*, *Oithona* spp., *Oncaea* spp.) dominated in relatively warm years (2012, 2015) (Fig. 3, 4)
- The abundance of gelatinous zooplankton (appendicularians, cnidarians) was positively correlated with water temperatures (Fig. 3c)

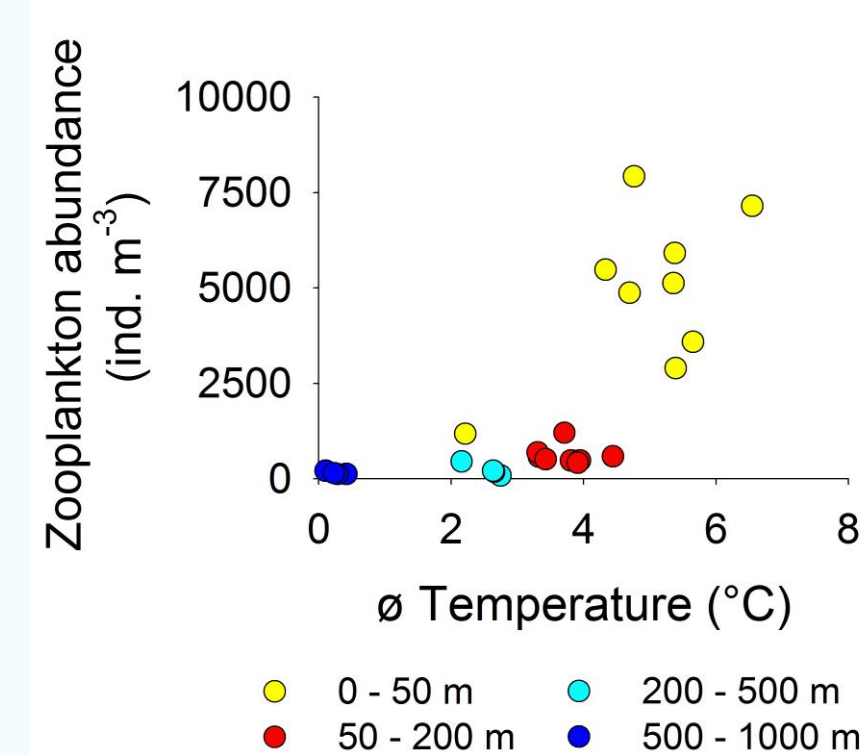


Fig. 2: Total zooplankton abundance in the upper 50 m in relation to average water temperatures.

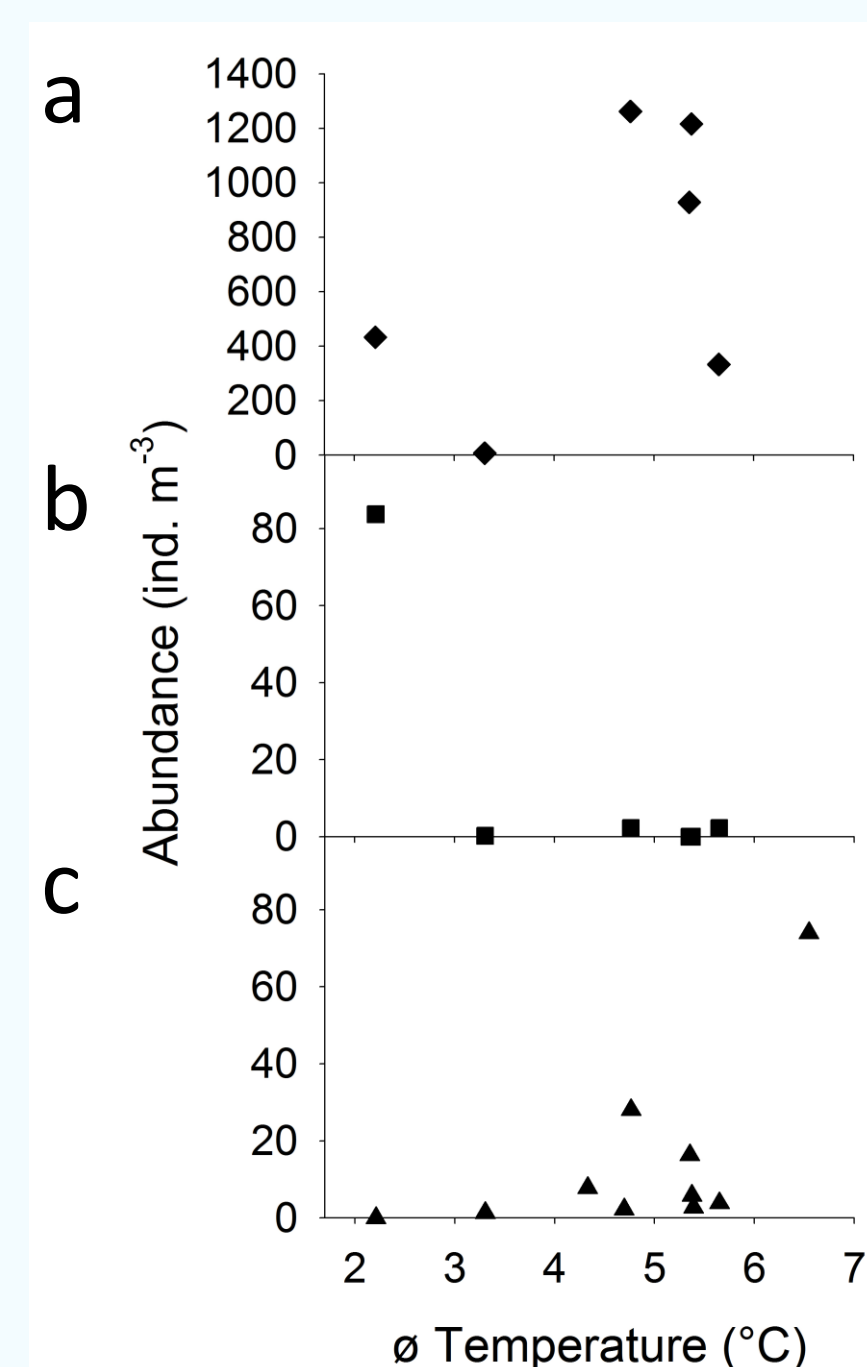


Fig. 3: Total abundance of (a) *Calanus finmarchicus*, (b) *C. hyperboreus* and (c) gelatinous zooplankton (0-50 m) in relation to average water temperatures.

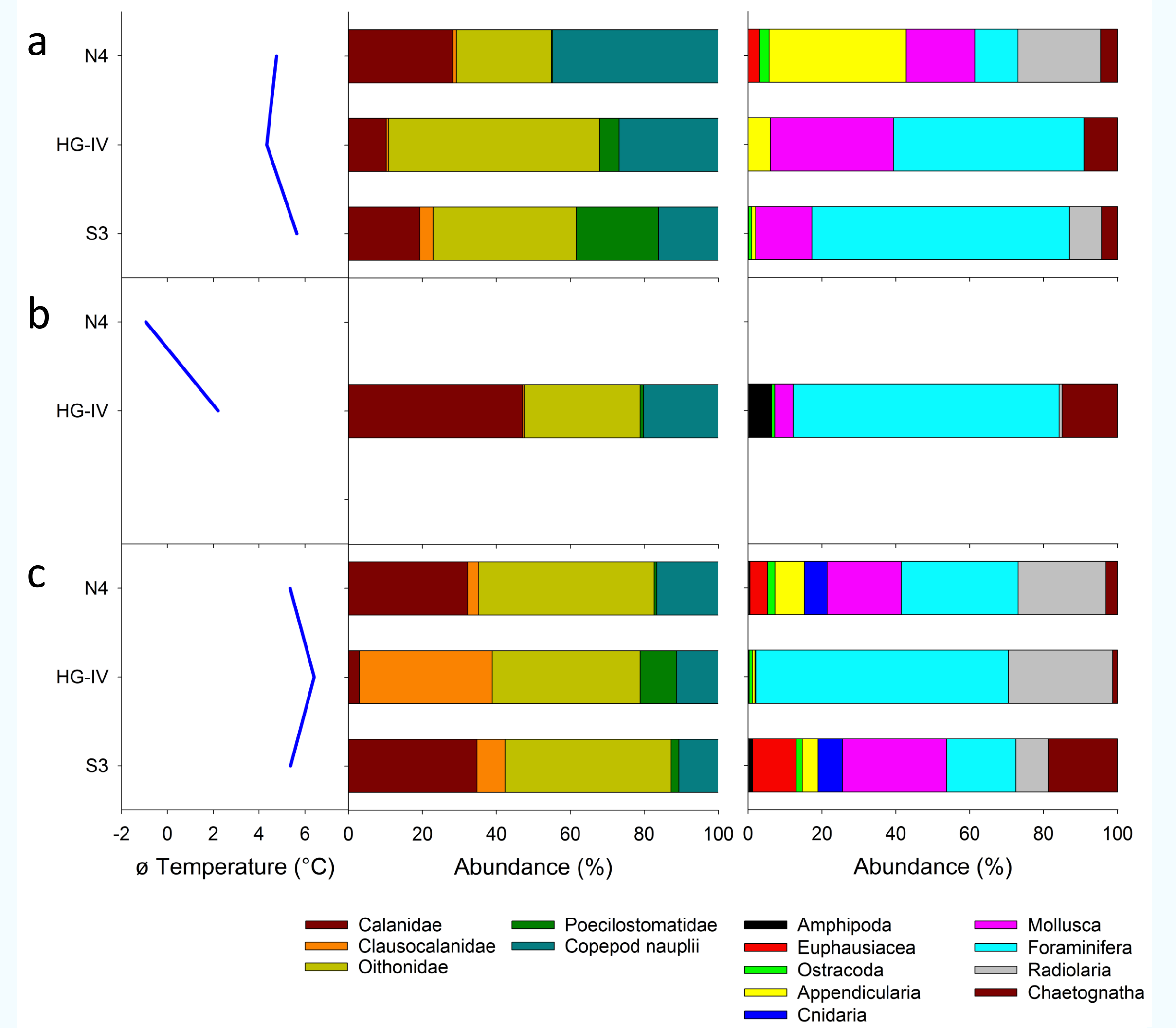


Fig. 4: Average seawater temperatures (left panel) and community composition of copepods (mid panel) and non-copepods (right panel) in the upper 50 m along a north-south transect in HAUSGARTEN in (a) 2012, (b) 2014 and (c) 2015.

Rare genera/classes (< 1% of the copepod/non-copepod community) were excluded from the graph.

CONCLUSIONS

- Increasing water temperatures in the West Spitsbergen Current might lead to higher total mesozooplankton abundances in the eastern Fram Strait
- Total zooplankton biomass might decrease with increasing water temperatures which could affect the Arctic pelagic food web