ATLANTIC ZOOPLANKTON JOURNEY TO THE ARCTIC OCEAN: HOW TO GET THERE?

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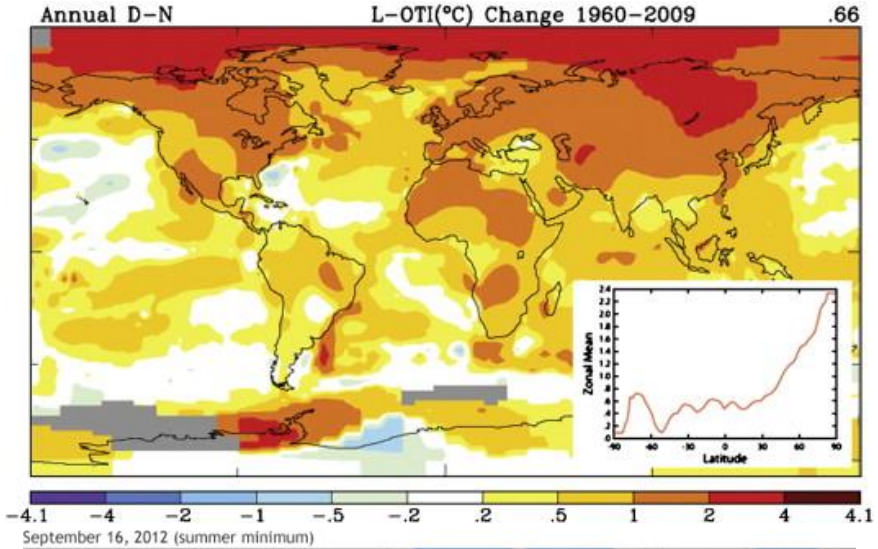
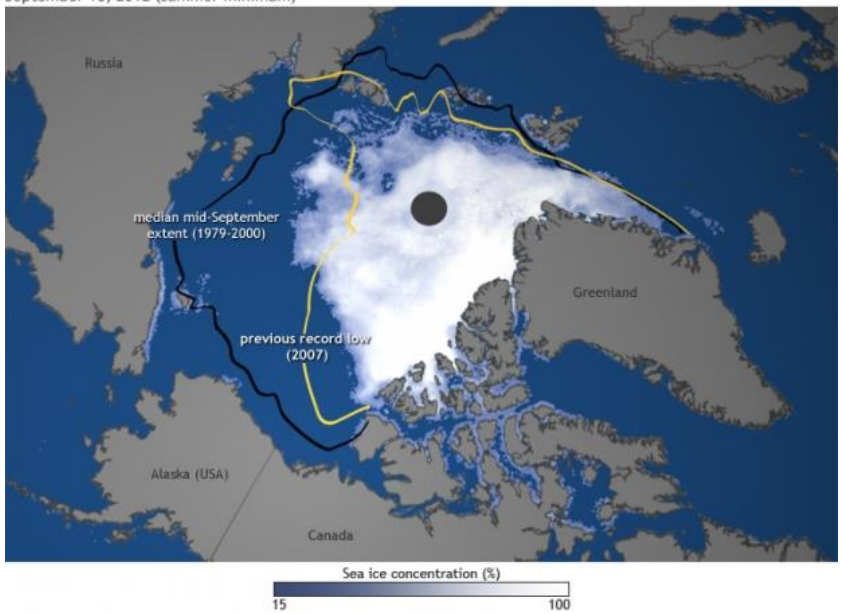
no POL-NOR/202006/10/2013

INTRODUCTION
- study motivation -



Anomalies in annual mean surface air temperature for the period 1960–2009

from http://www.arctic.noaa.gov



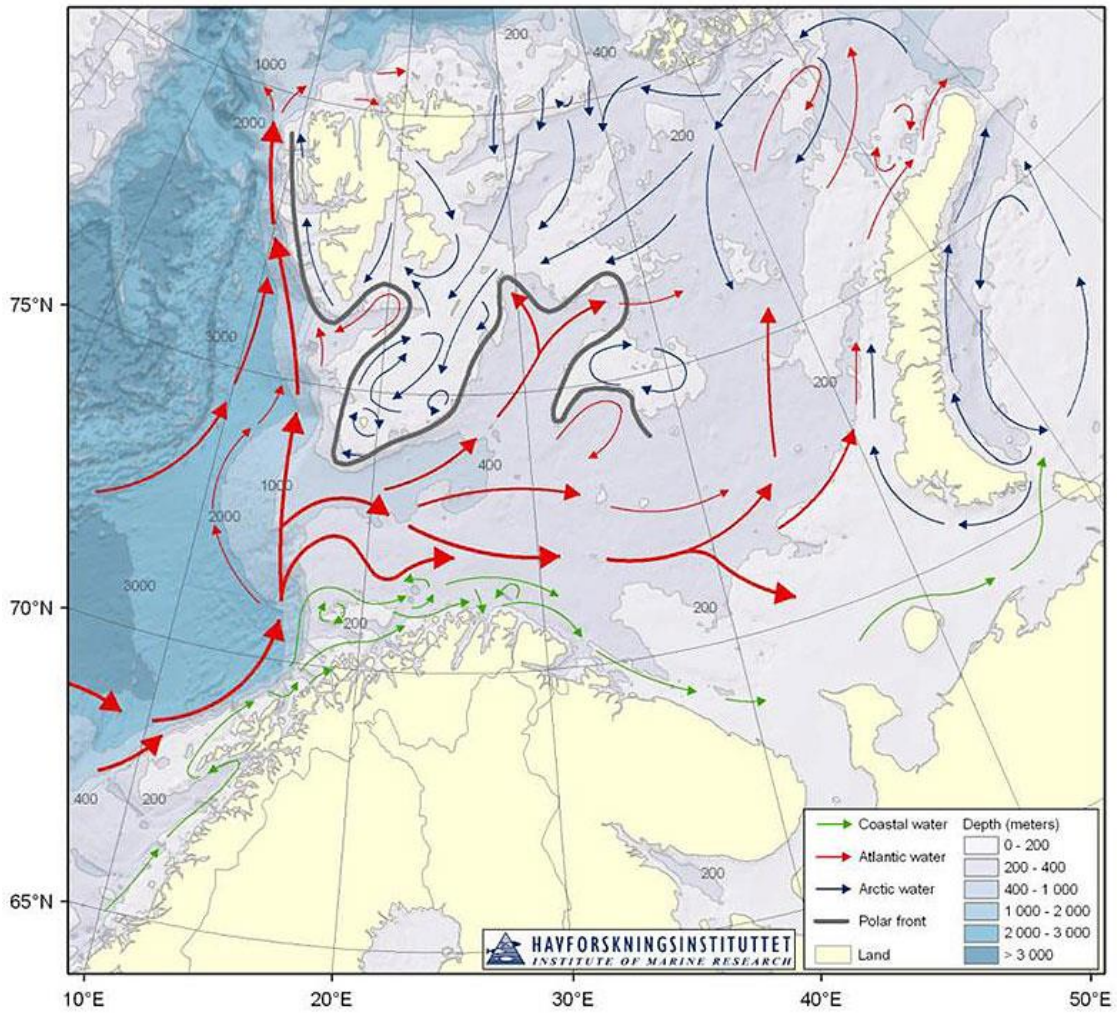
Arctic sea ice: 2012 record low
18% smaller than previous record, nearly 50 percent below average

from NSIDC at nsidc.org/data/seaice_index

Arctic amplification :
an integral characteristic of the global climate system with many causes operating on different time and space scales

INTRODUCTION
- study motivation -

Loeng and Drinkwater, 2007



Atlantic water:

- provides the principal contribution of salt and sensible heat and matter to the Arctic Ocean
- has a complex two-branched structure

Farm Strait branch - deep, the inflow of heat into the Arctic Ocean: 26-50 TW

Barents Sea branch – shallow, the inflow of heat into the Arctic Ocean - negligible

INTRODUCTION
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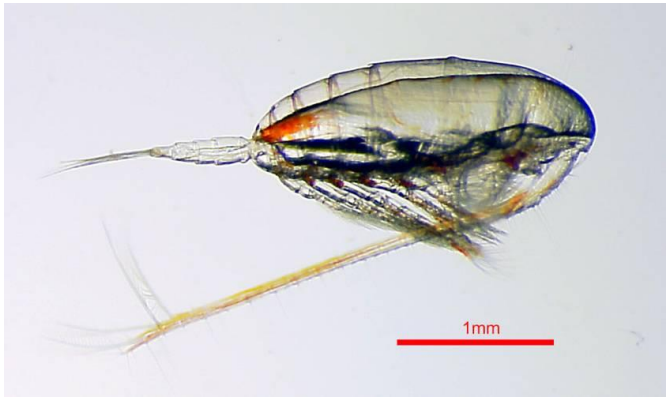
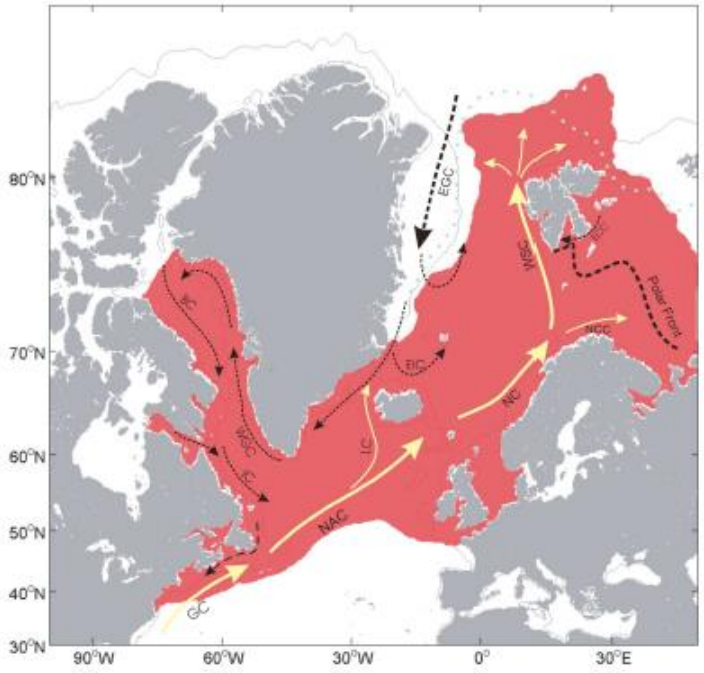




Zooplankton

- links pelagic primary producers and top consumers
- plays important roles in biogeochemical cycles, including carbon cycle
- can be used as indicator of climate change in marine environment

Calanus finmarchicus:

- dominates the mesozooplankton biomass in many regions in the northern North Atlantic
- is a principal food for carnivore zooplankton, planktivorous fish and fish larvae

THE AIMS OF THE STUDY

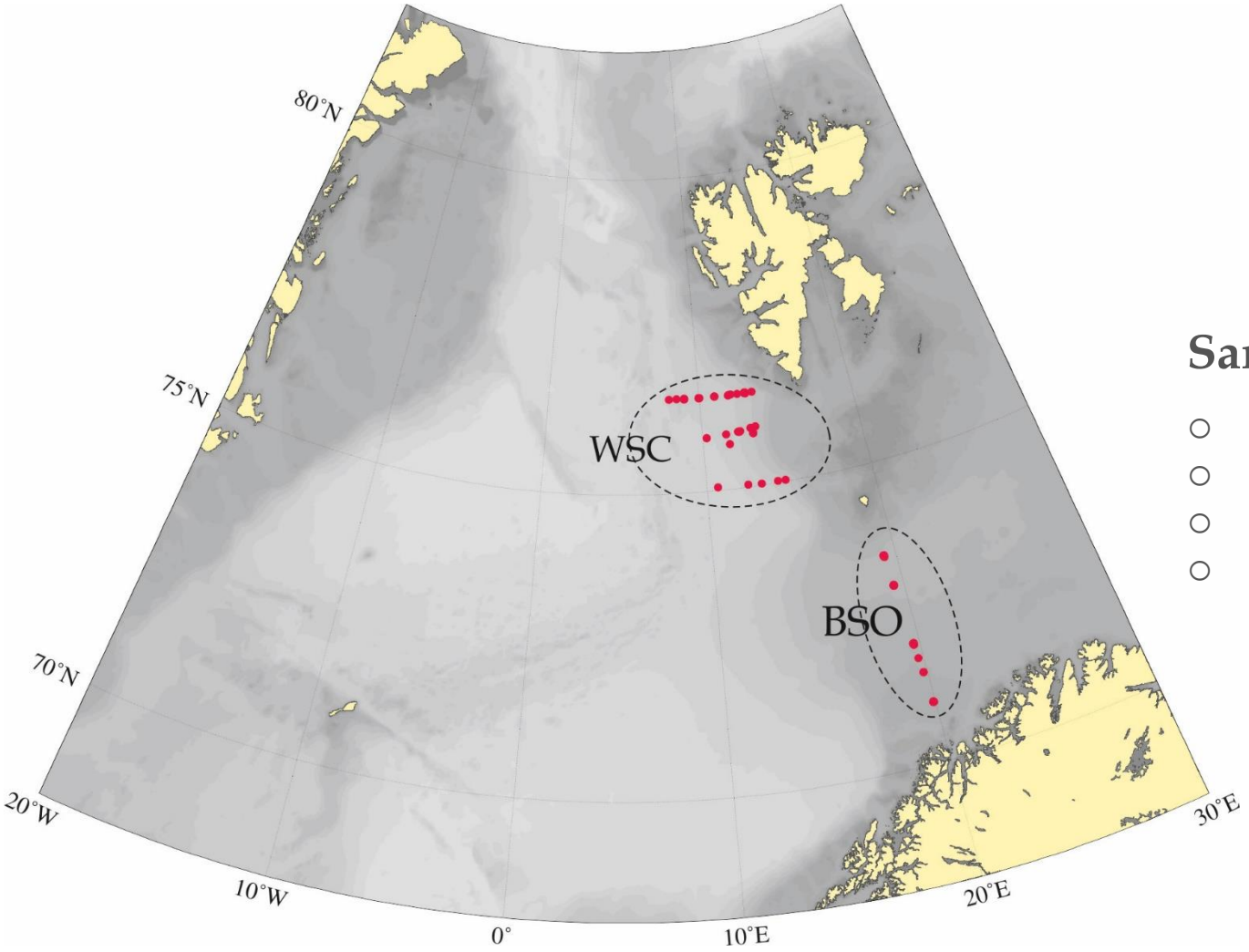
no POL-NOR/202006/10/2013

The main goal of the study was to evaluate the impact of the complex AW flow in the Fram Strait and Barents Sea branches on zooplankton transport, with focus on *Calanus* (*Calanus finmarchicus*)

The main questions were:

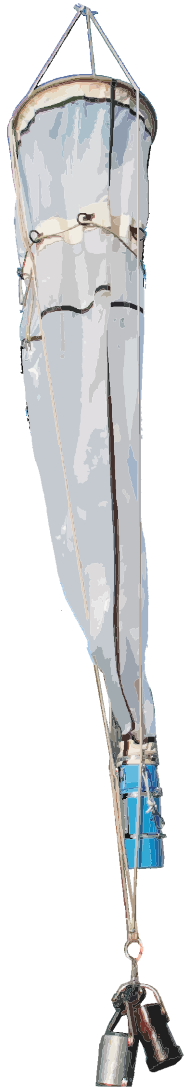
- What are the differences in zooplankton between the Fram Strait and the Barents Sea Opening branches?
- How does the inter-annual variability of the Atlantic Water advection influences the zooplankton?

METHODS
- sampling design -



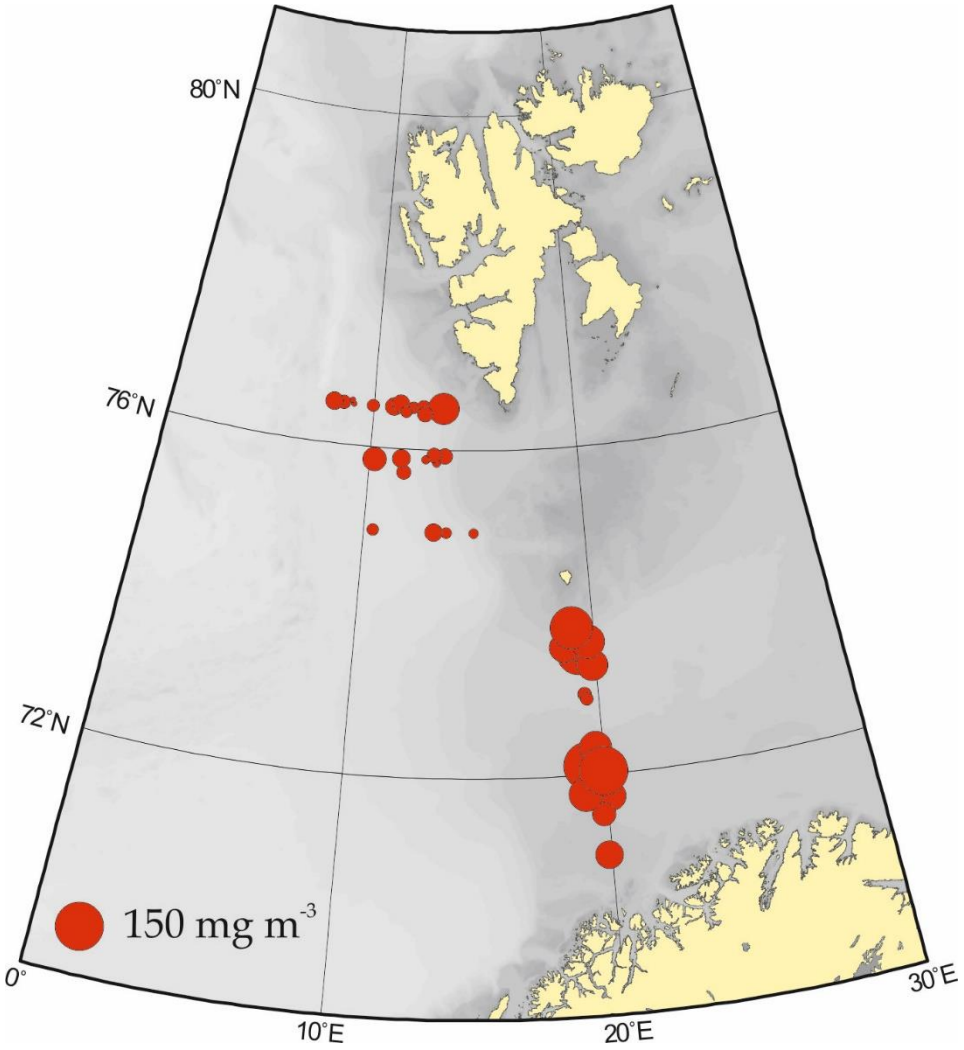
Sample collection:

- summers of 2001 – 2014 (June)
- research cruises of IO PAN and IMR
- WP2 180 μm net
- epipelagial zone

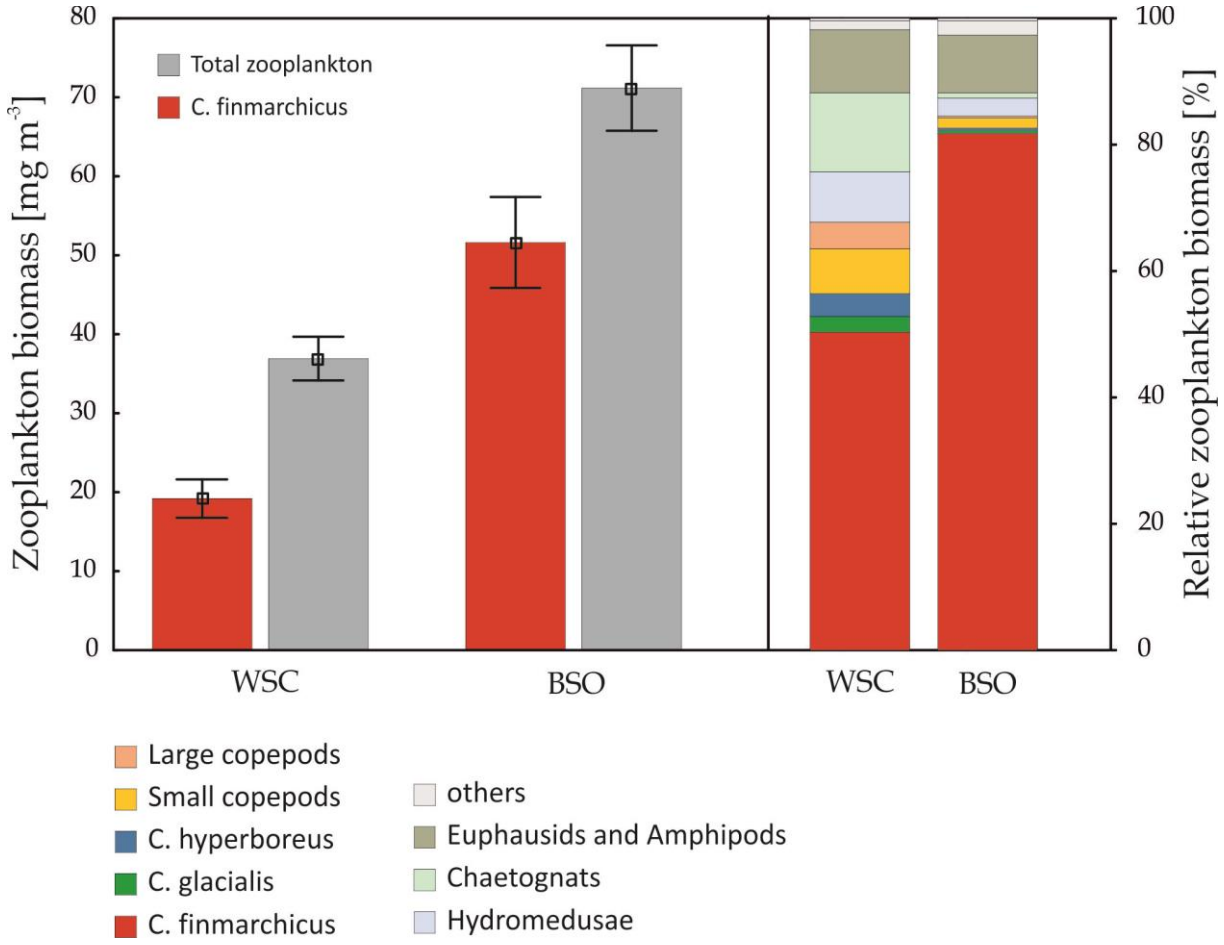


RESULTS

WSC vs. BSO – spatial patterns of zooplankton variability



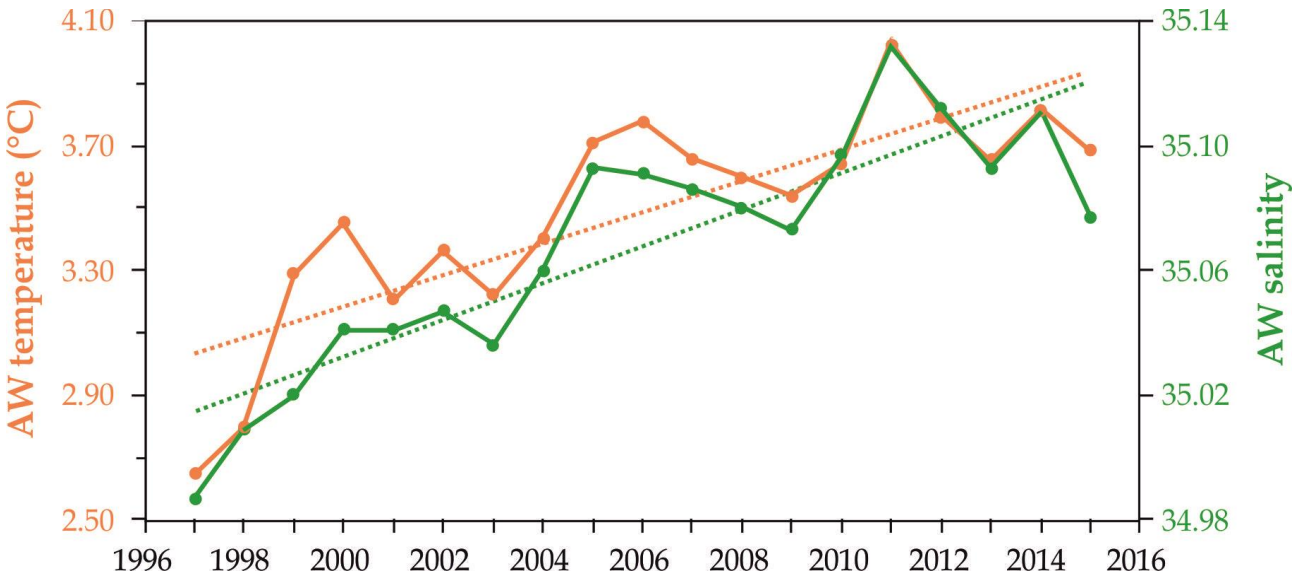
C. finmarchicus biomass (mg m^{-3})

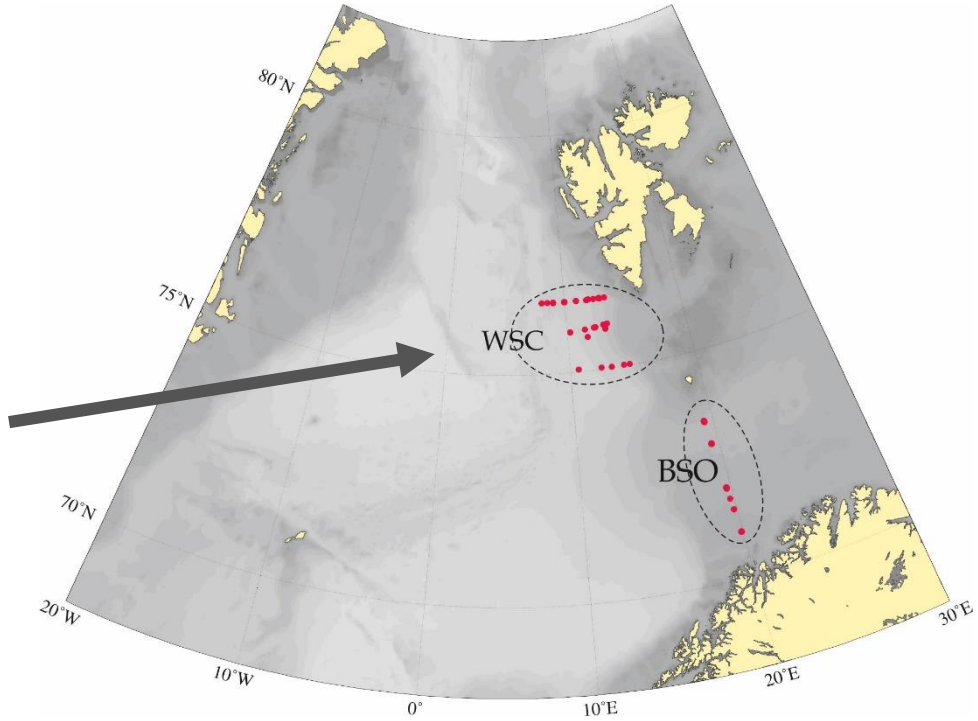


RESULTS

WSC– inter-annual variability of hydrographic characteristics

Mean AW temperature and salinity at section 76°30'N

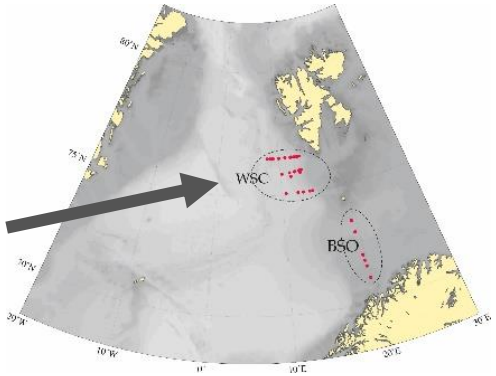


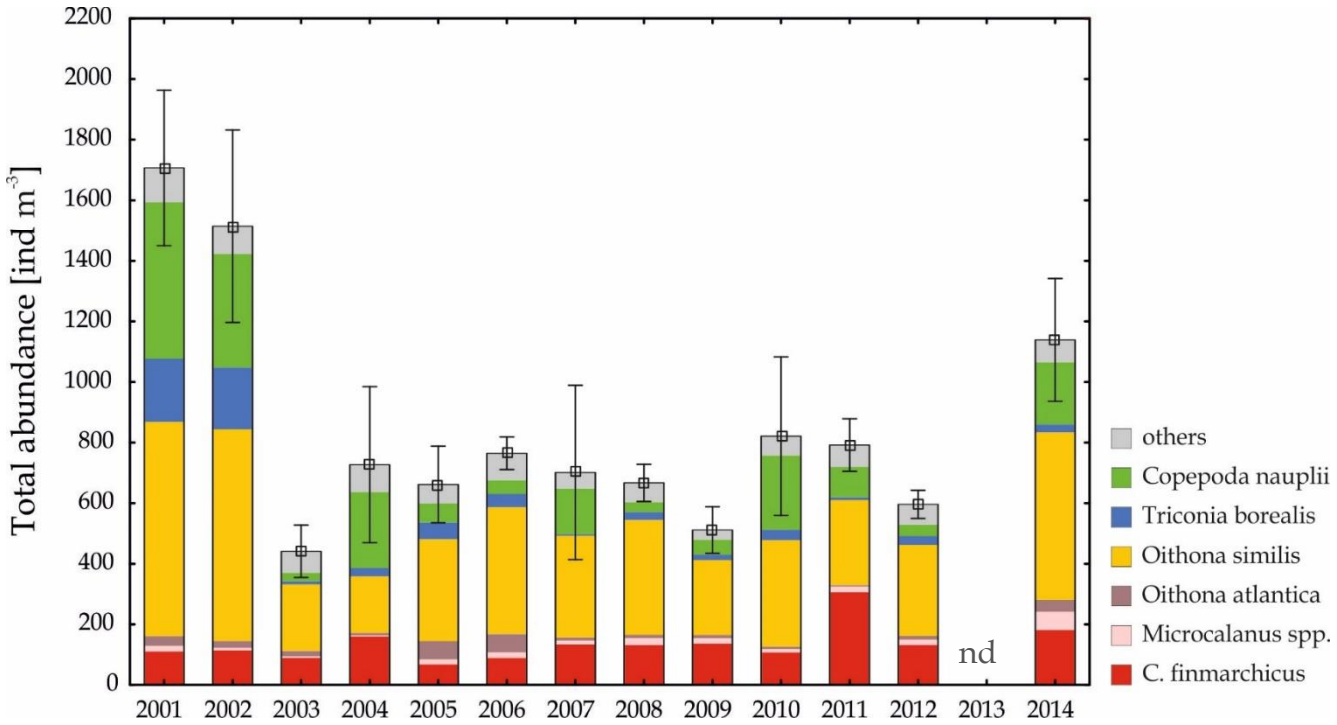


AW: T>2C and 27.7>SigmaTheta>27.97 (after Rudels et al. 2005)

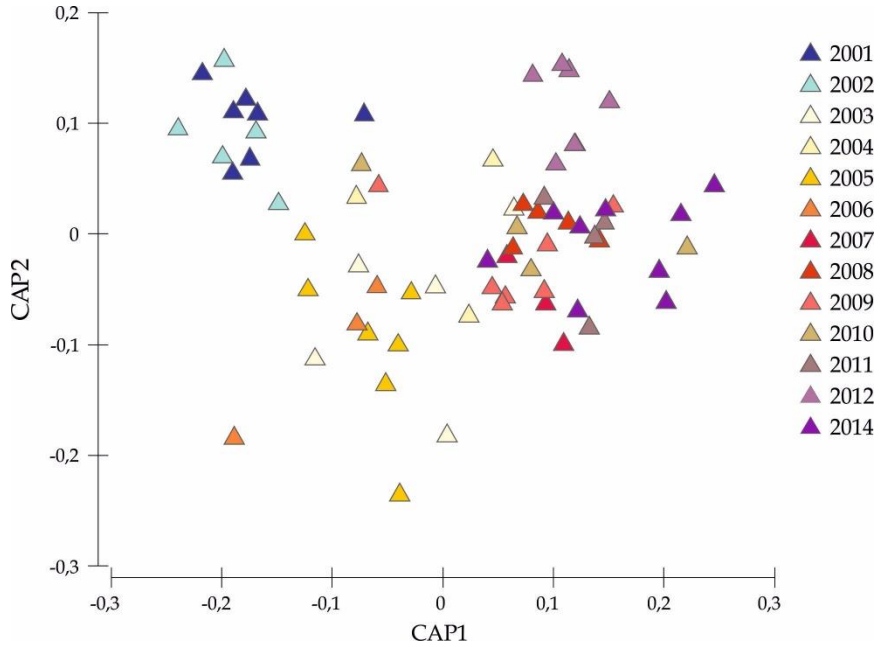
RESULTS

WSC– inter-annual variability of zooplankton community





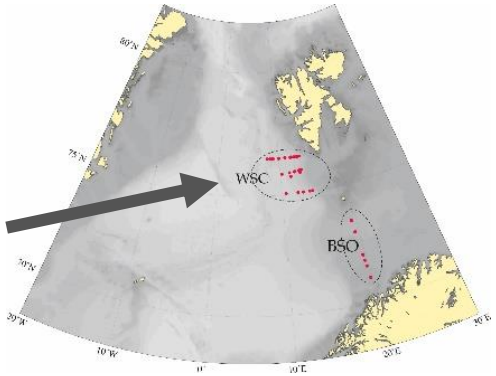
CAP ordination - best discriminating groups of samples defined by years

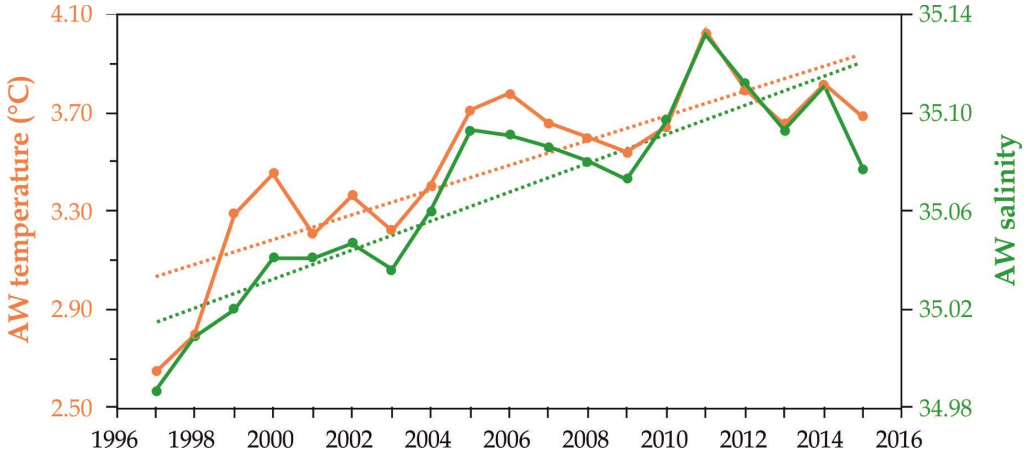


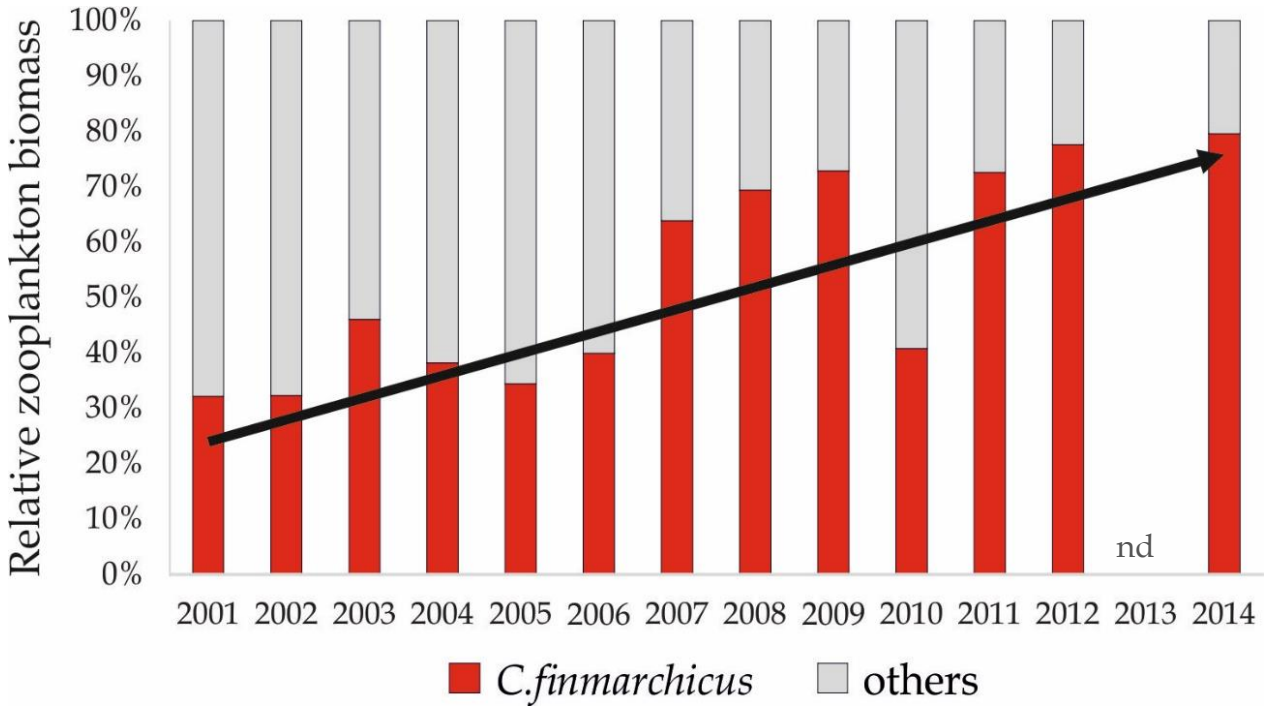
- *Oithona similis* – overall the most abundant taxon
- 2001-2002 – the highest abundances of almost all species
- 2005-2006 – relatively high numbers of *O. atlantica*

RESULTS

WSC– inter-annual variability in relative biomass of *C. finmarchicus*





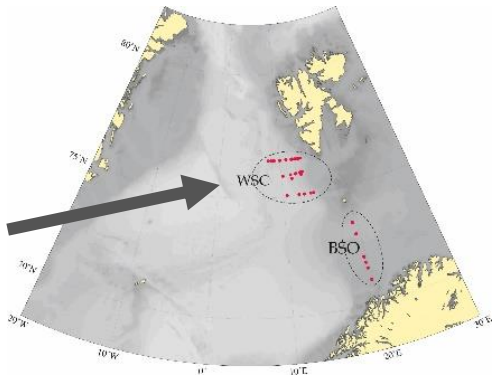


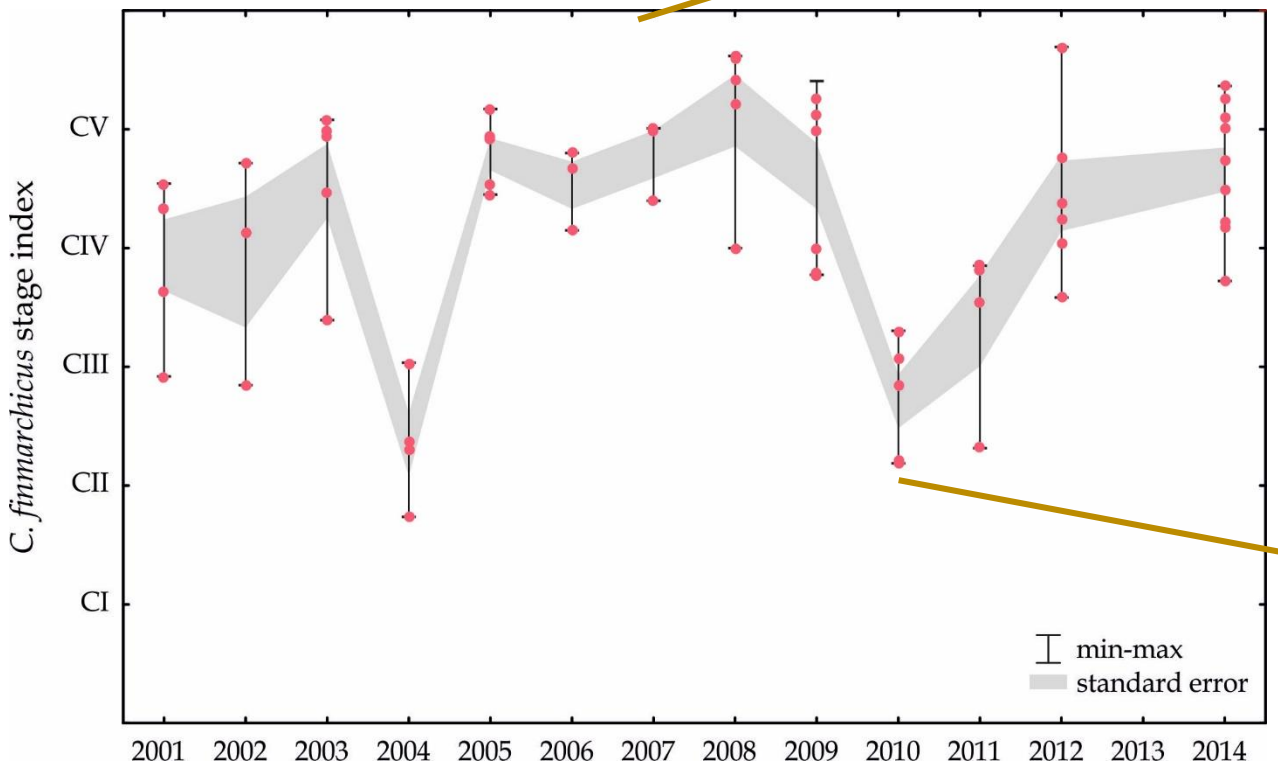
2001-2014 - a smooth change towards the dominance of boreal species

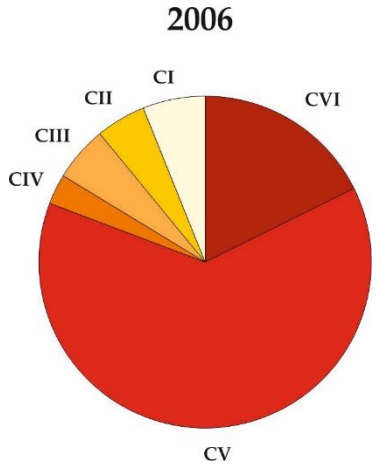
Results are consistent with the findings of Weydmann et al. 2014

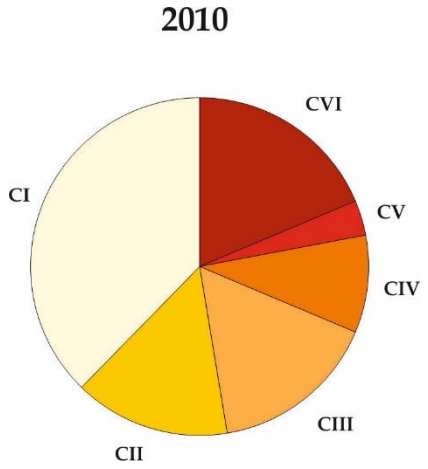
RESULTS

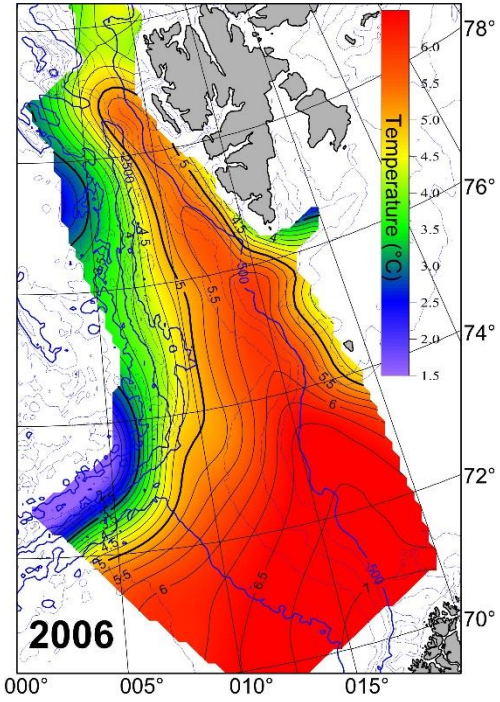
WSC– inter-annual variability of C. *finmarchicus* stage index

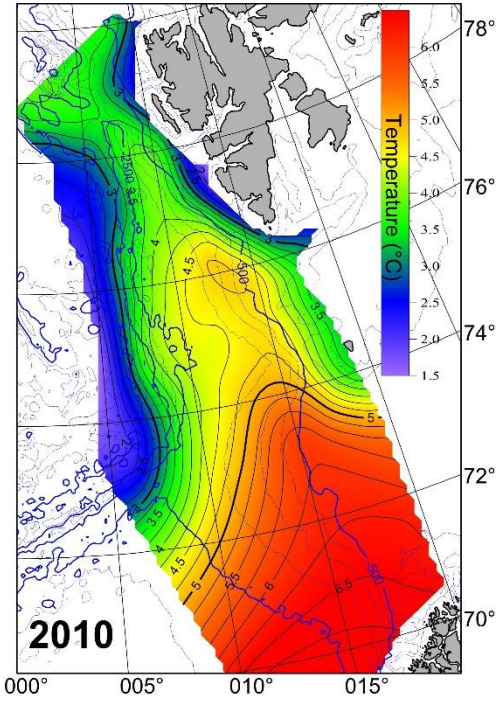






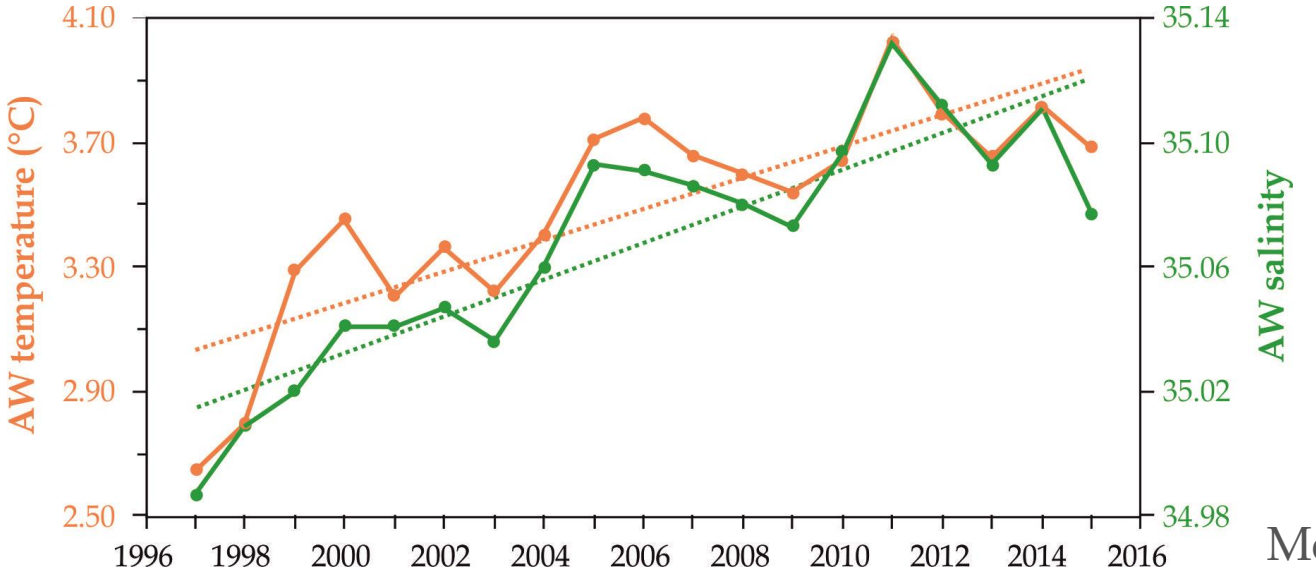


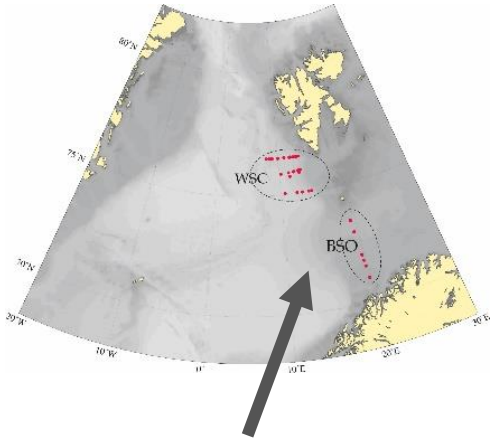




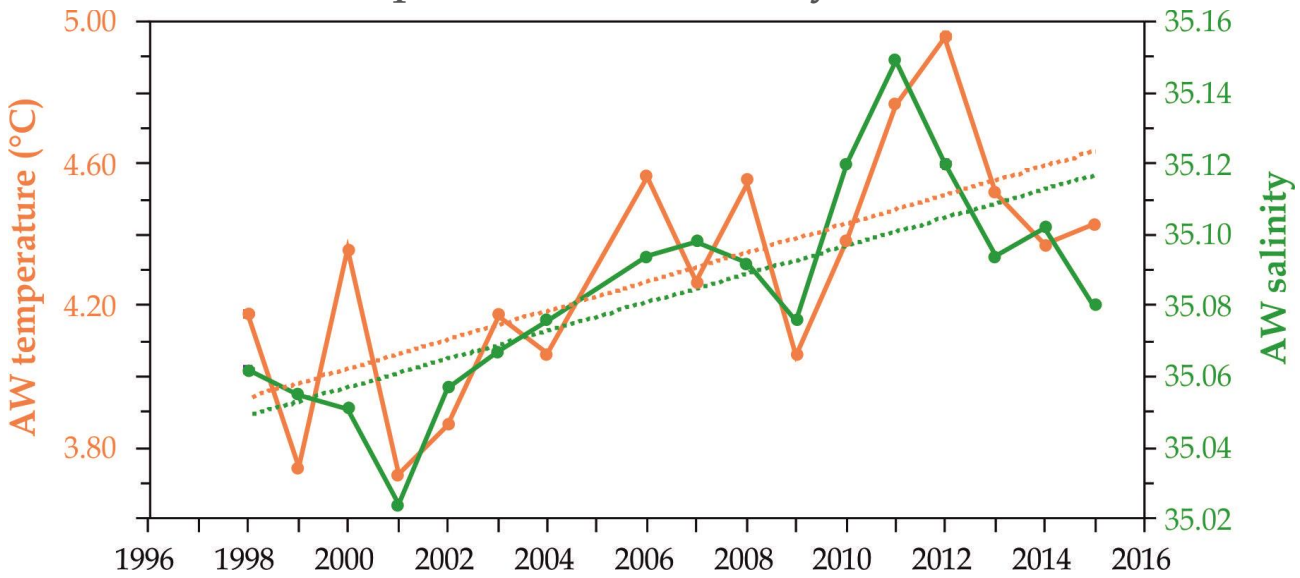
RESULTS

BSO – inter-annual variability of hydrographic characteristics





Mean AW temperature and salinity at section FB



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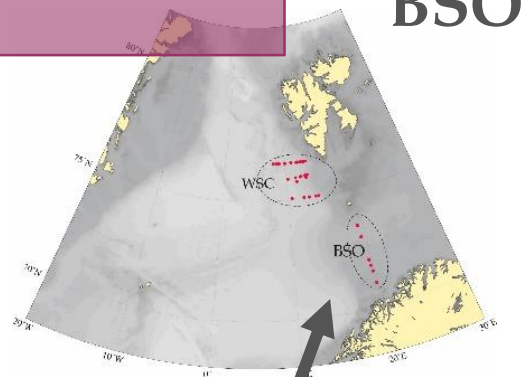
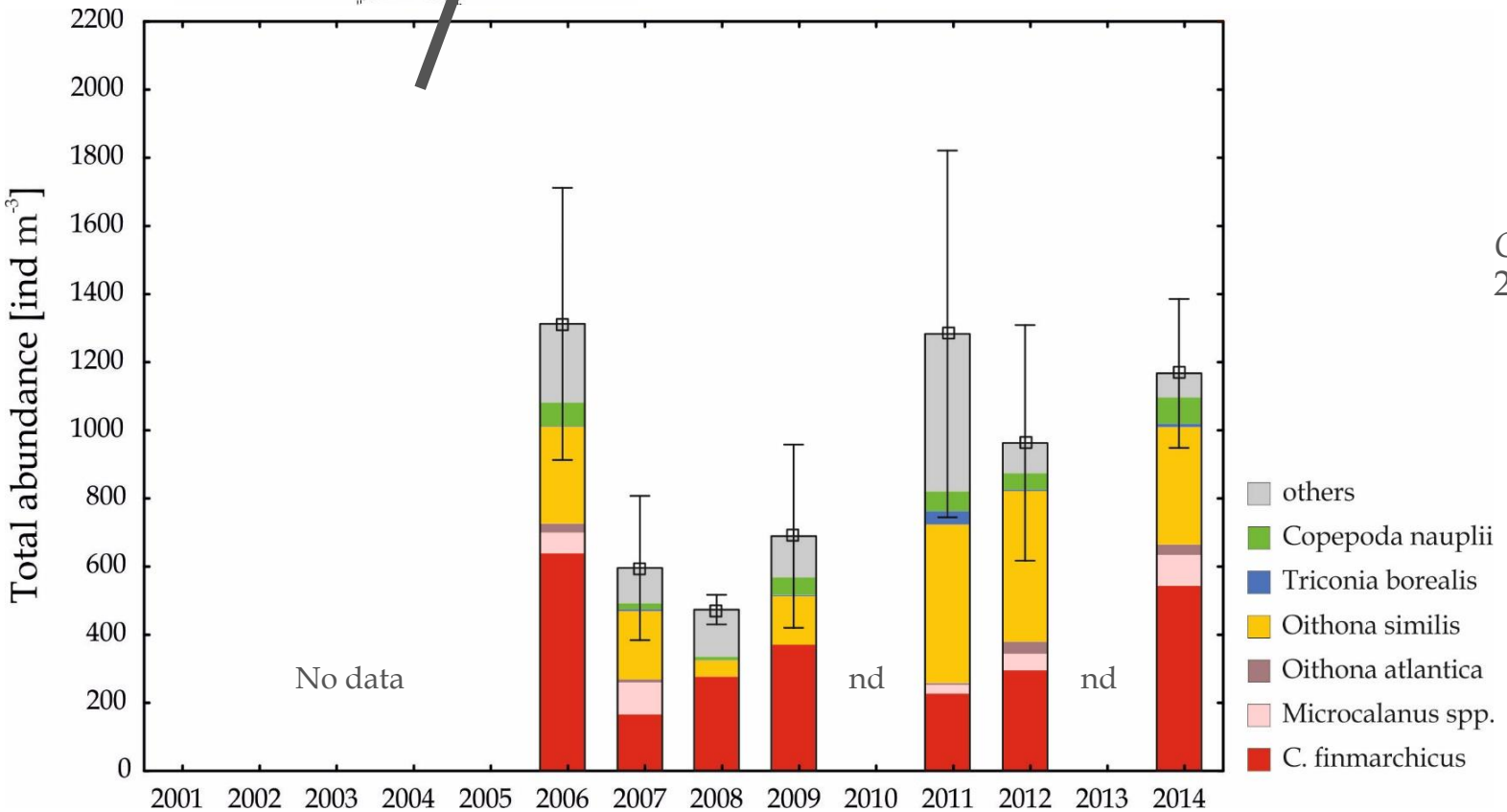
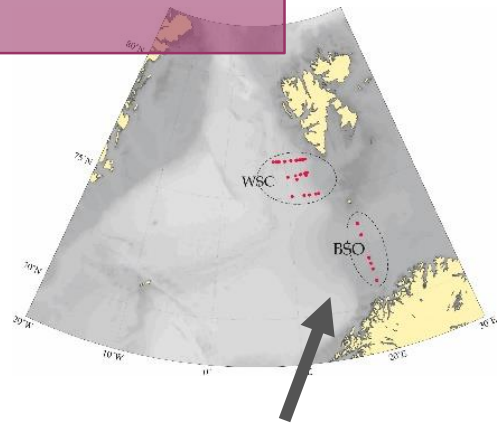


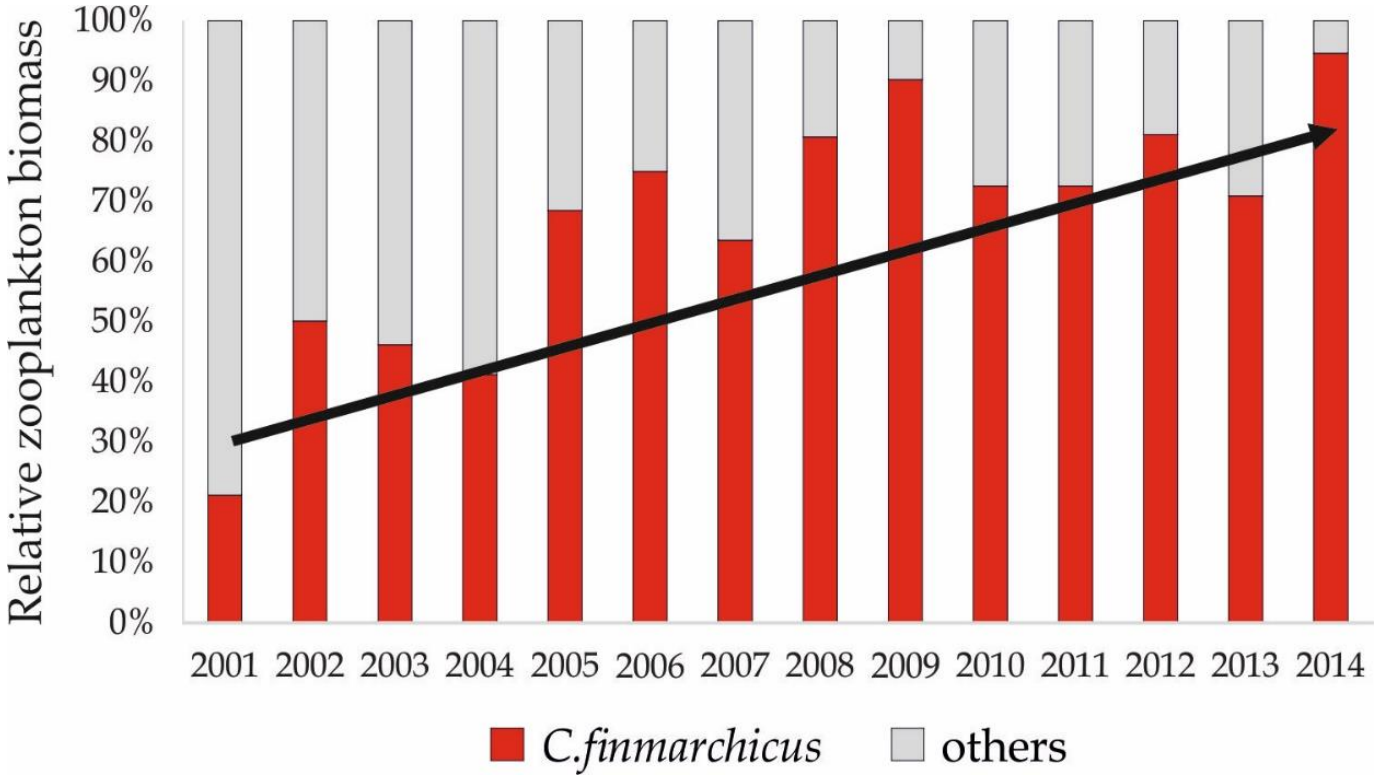


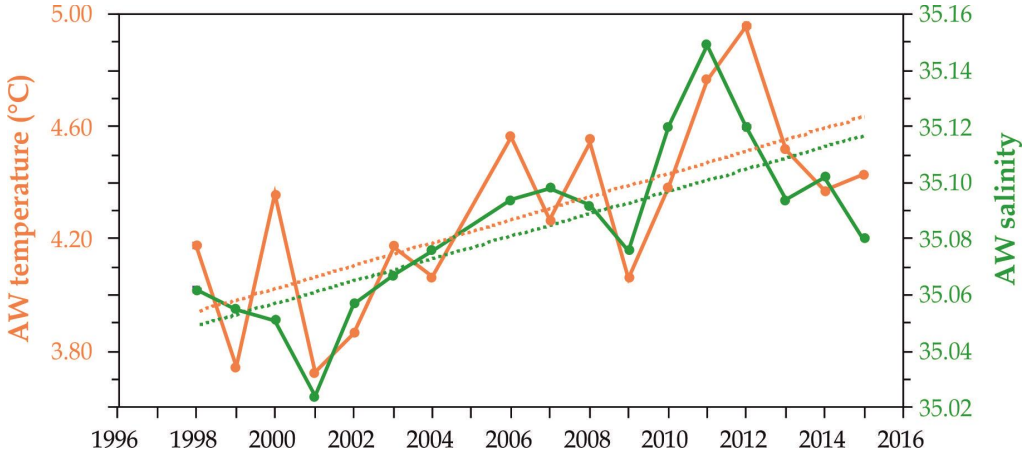
Calanus finmarchicus– the most abundant taxon 2011-2014 – relatively high numbers of *O. similis*

RESULTS

BSO – inter-annual variability in relative biomass of *C. finmarchicus*



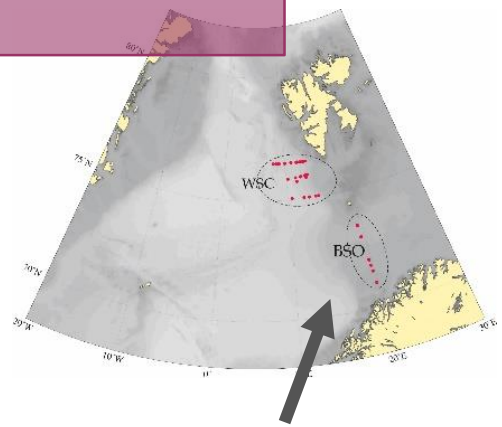


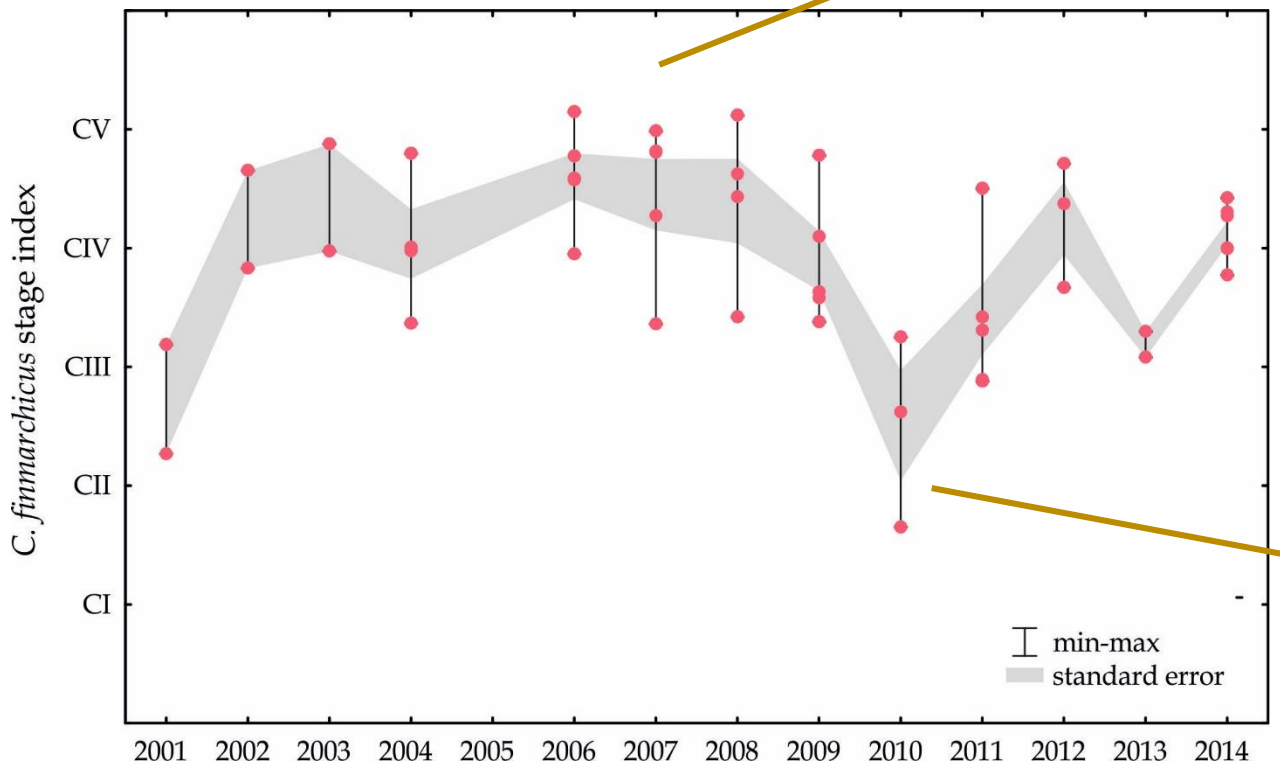


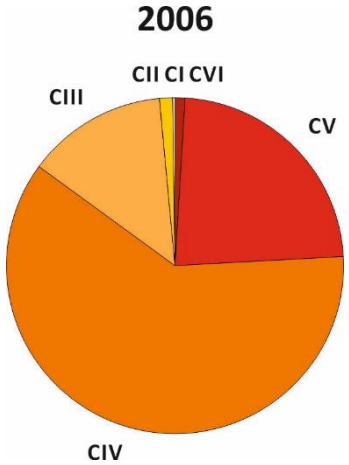
2001-2014 - a smooth change towards the dominance of boreal species

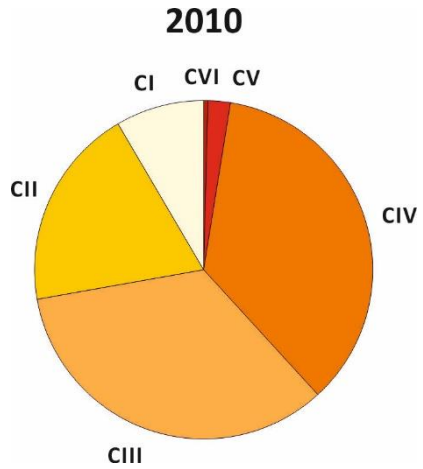
RESULTS

BSO - inter-annual variability of C. *finmarchicus* stage index



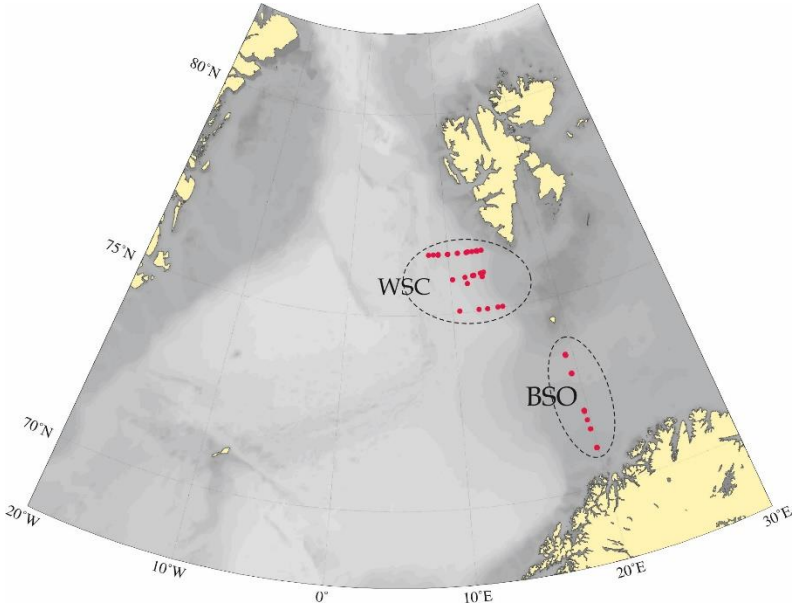






ATLANTIC ZOOPLANKTON JOURNEY TO THE ARCTIC OCEAN: HOW TO GET THERE?

WSC vs. BSO



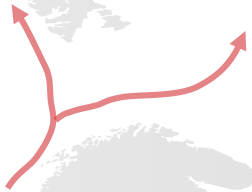
During the study period the Atlantic Water temperature and salinity in both branches, showed a noticeable increase, however in an oscillating manner.

The most important zooplankton community components, in terms of numbers, was *Oithona similis* in the WSC region and *C. finmarchicus* in the BSO area.

The main biomass components of the studied zooplankton were copepods and *C. finmarchicus* predominating.

The gradual change in hydrography was reflected in changes in zooplankton biomass structure and the development of key zooplankton component – *C. finmarchicus*.

Increasing proportion of boreal zooplankton supports the notion of an ongoing 'Atlantification'



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CONCLUSIONS

the way of transport of *Calanus* species with different branches of the AW flow does not have well unequivocal effect on species abundance

but

the interannual variability of AW advection influences species distributions, composition and development.