Decadal environmental changes in the Newfoundland and Labrador ecosystem

F. Cyr, D. Bélanger, E. Colbourne, G. Maillet & P. Pepin

Fisheries and Oceans Canada,

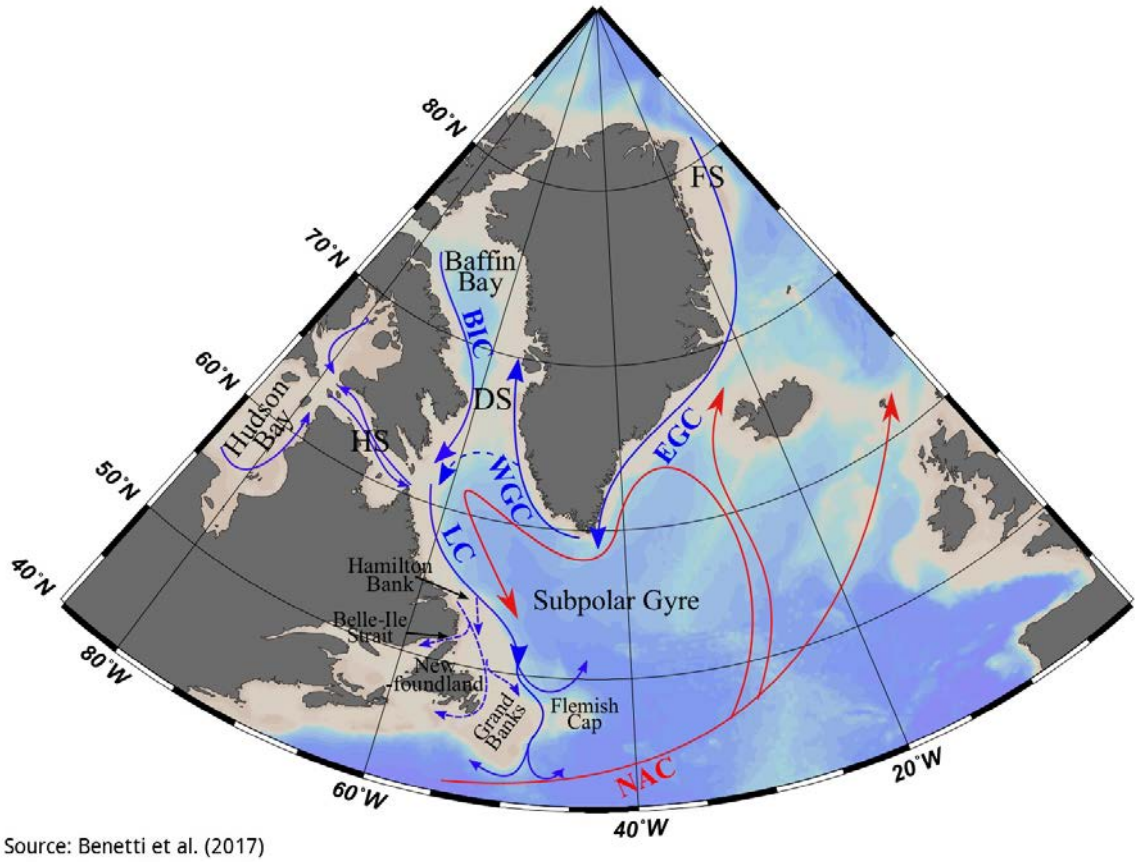
Northwest Atlantic Fisheries Centre,

St. John's, NL

4th International Symposium on the Effect of Climate Change on the World Ocean
Washington DC, 4-8 June 2018

Canada

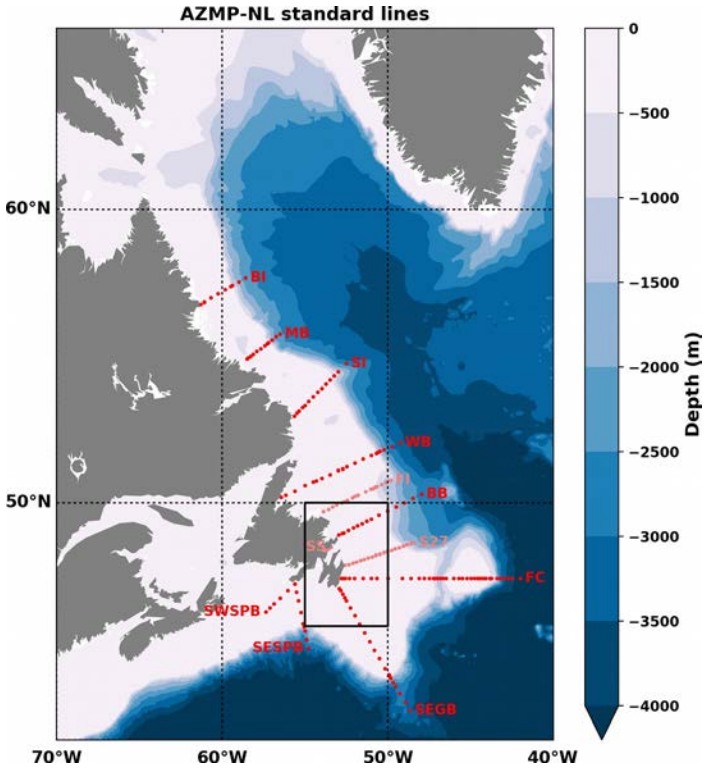
Context: NL shelves a crossroads of the North Atlantic Circulation



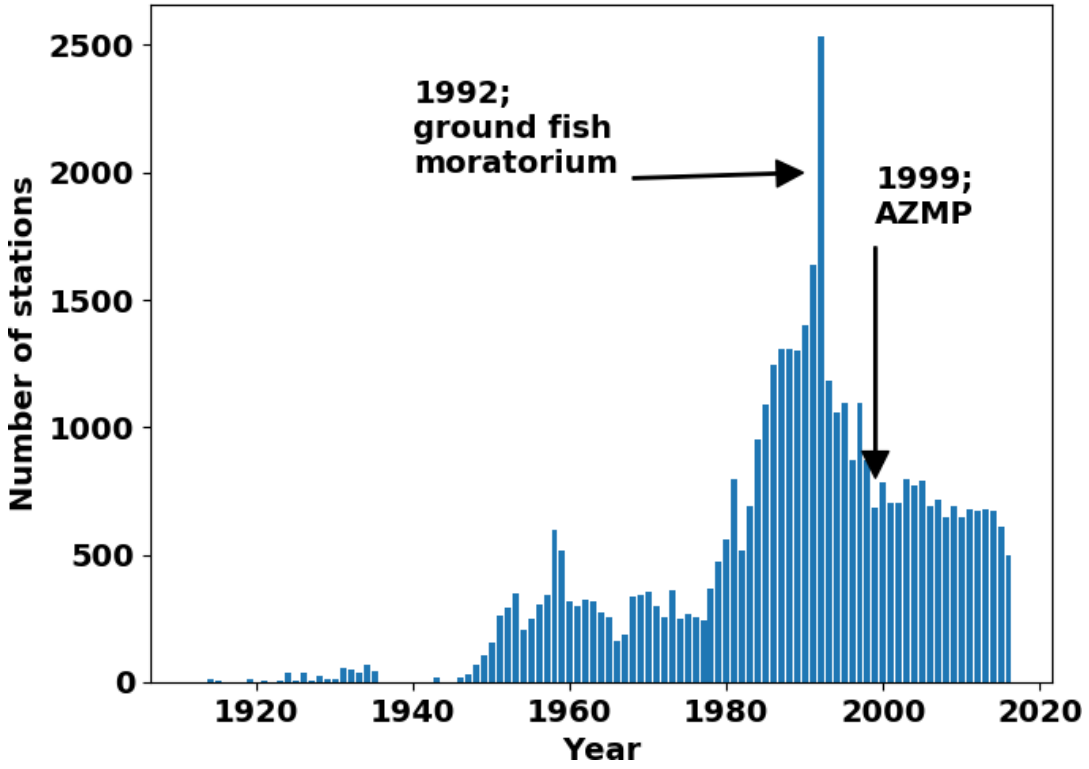
Source: Benetti et al. (2017)

Context: Long history of measurements on NL shelves (physical and biogeochemical)

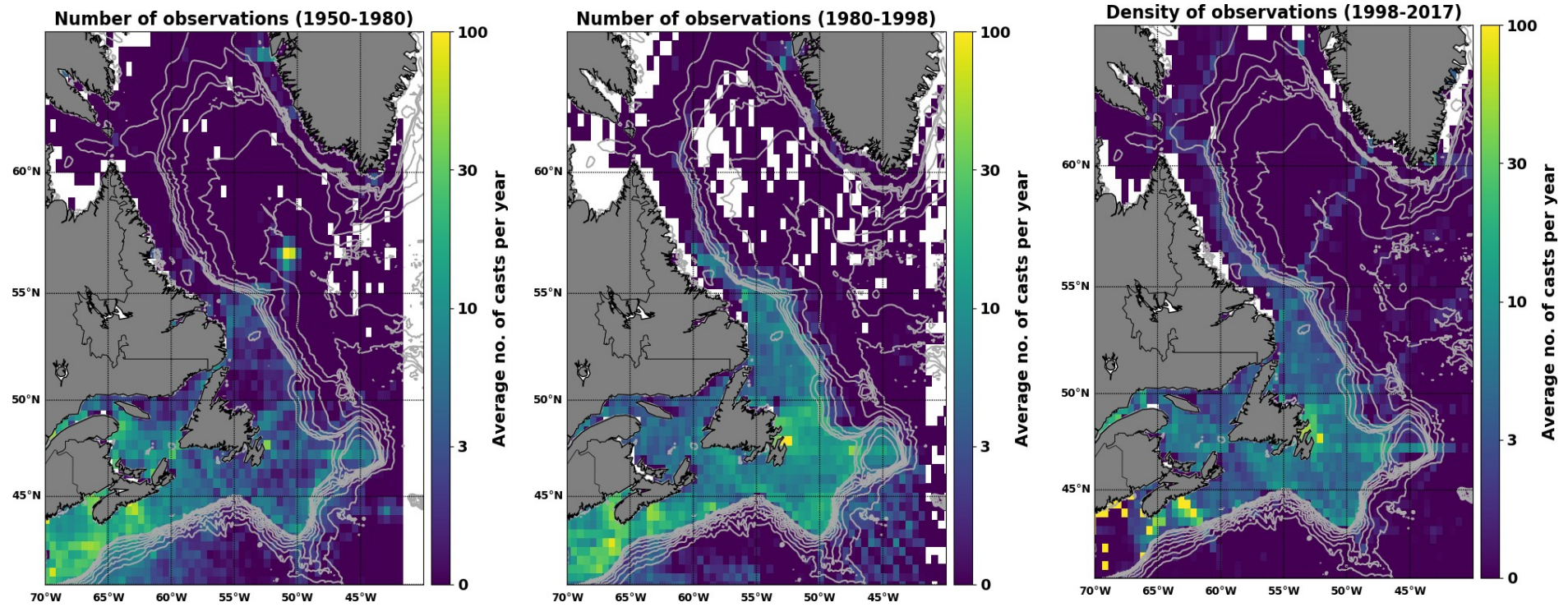
Atlantic Zone Monitoring Program (AZMP)



Temperature casts



Context: Long history of measurements on NL shelves (physical and biogeochemical)



→ **+700K observations**

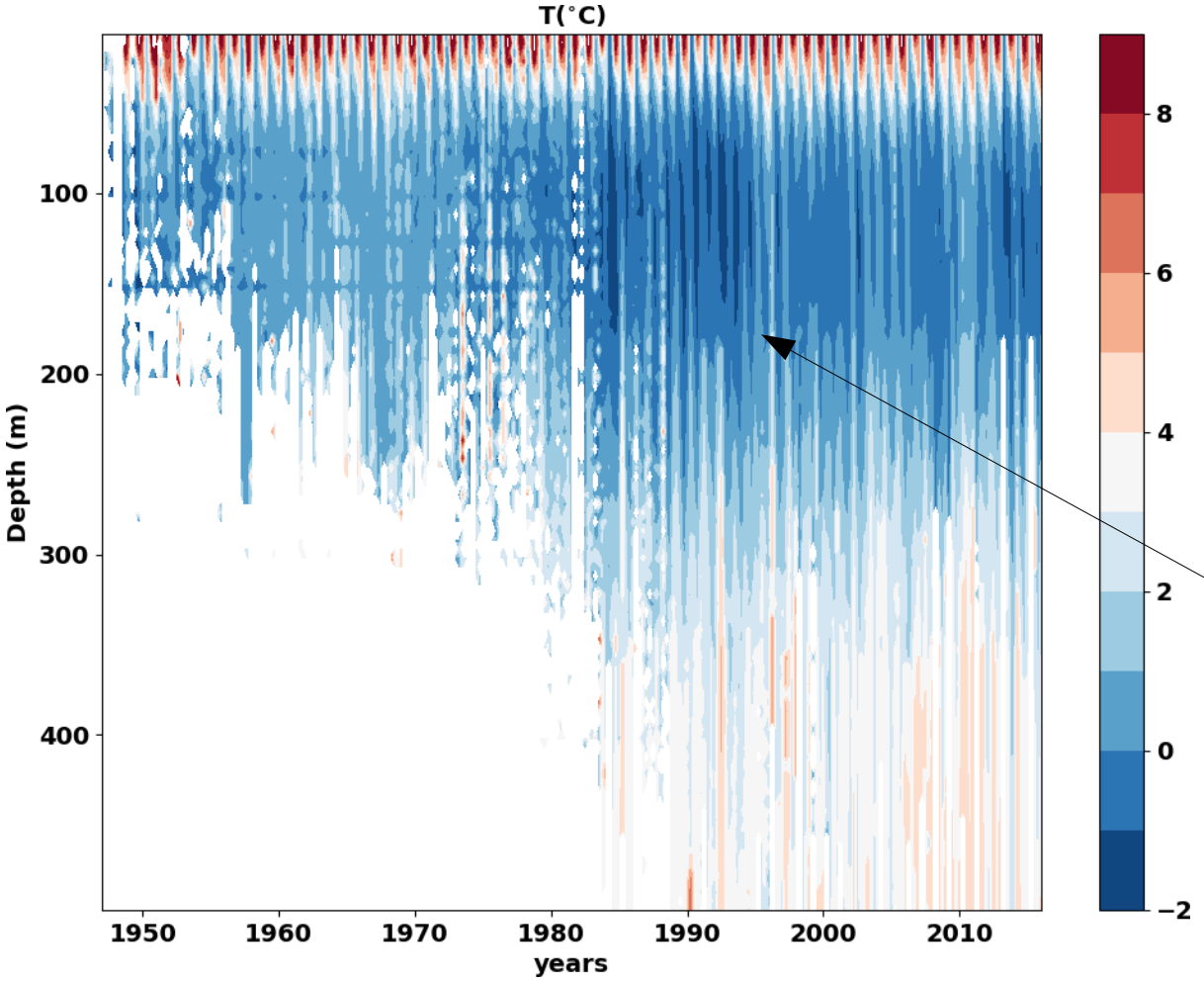
The project:

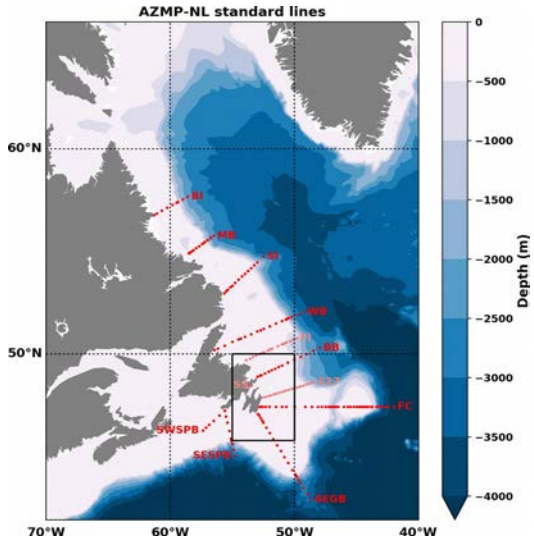
What can we tell from these historical data?

→ ACCASP project started Jan. 2018 (DFO initiative for climate change)

Physical oceanography (1948-2018)

Interannual temperature field (since 1948)

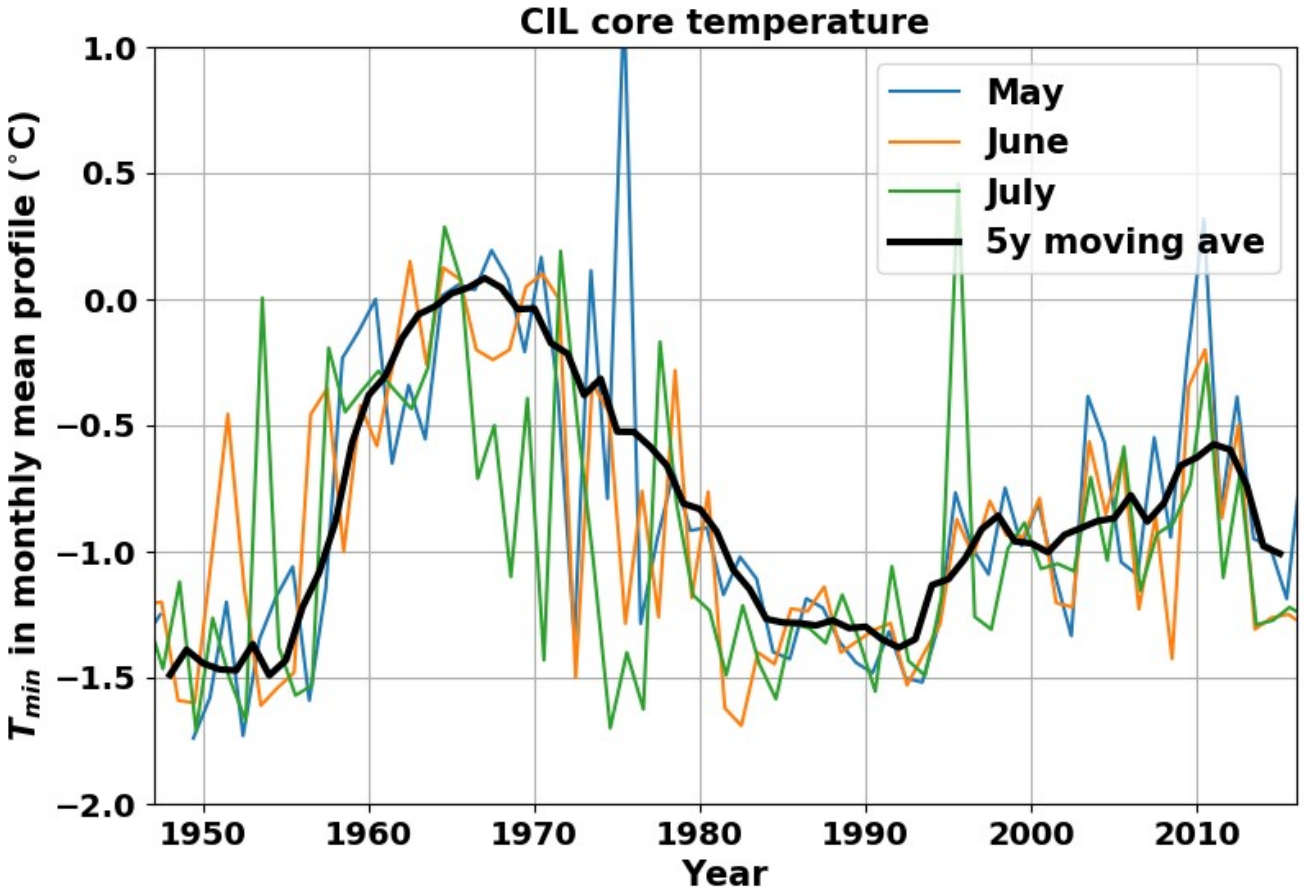




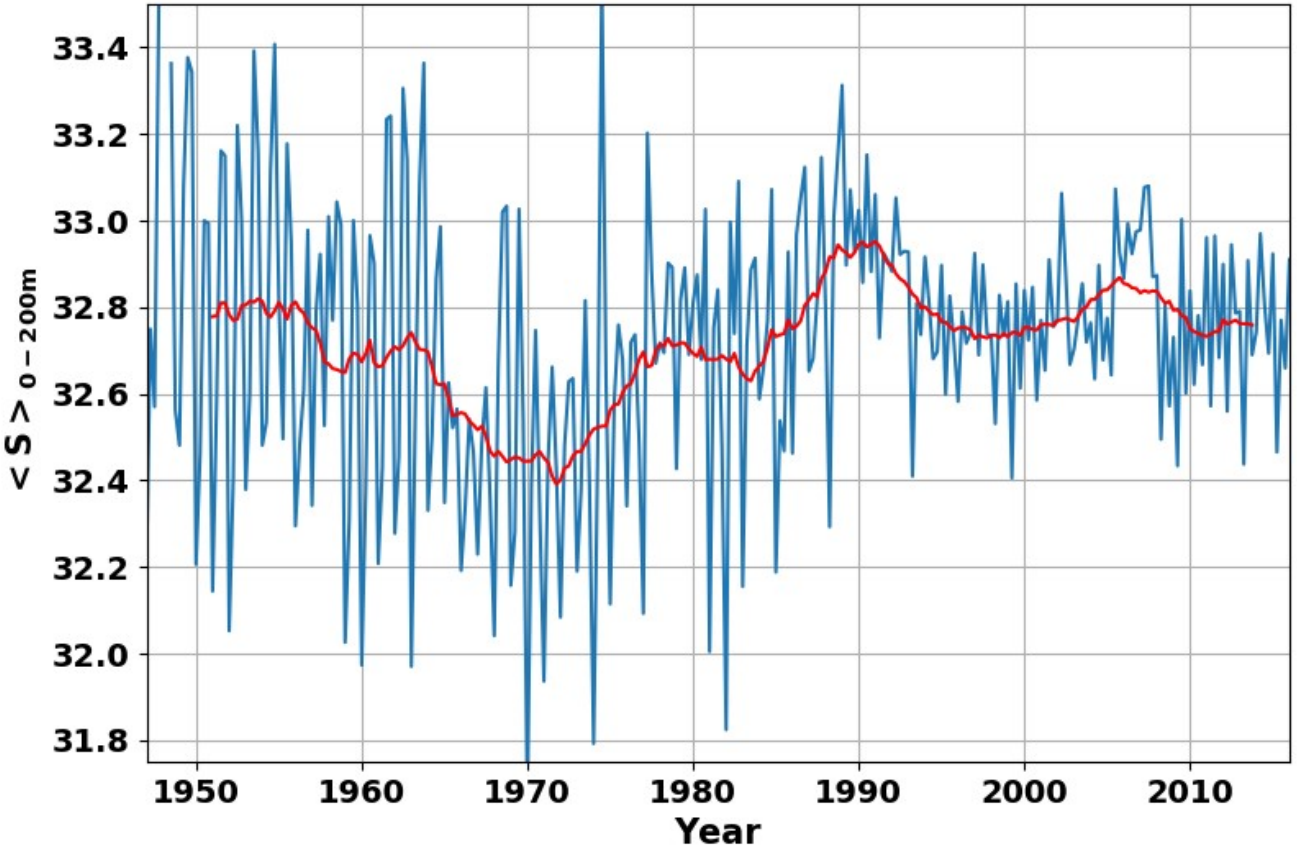
CIL variations

→ aggregation of 50K+ stations in monthly profiles

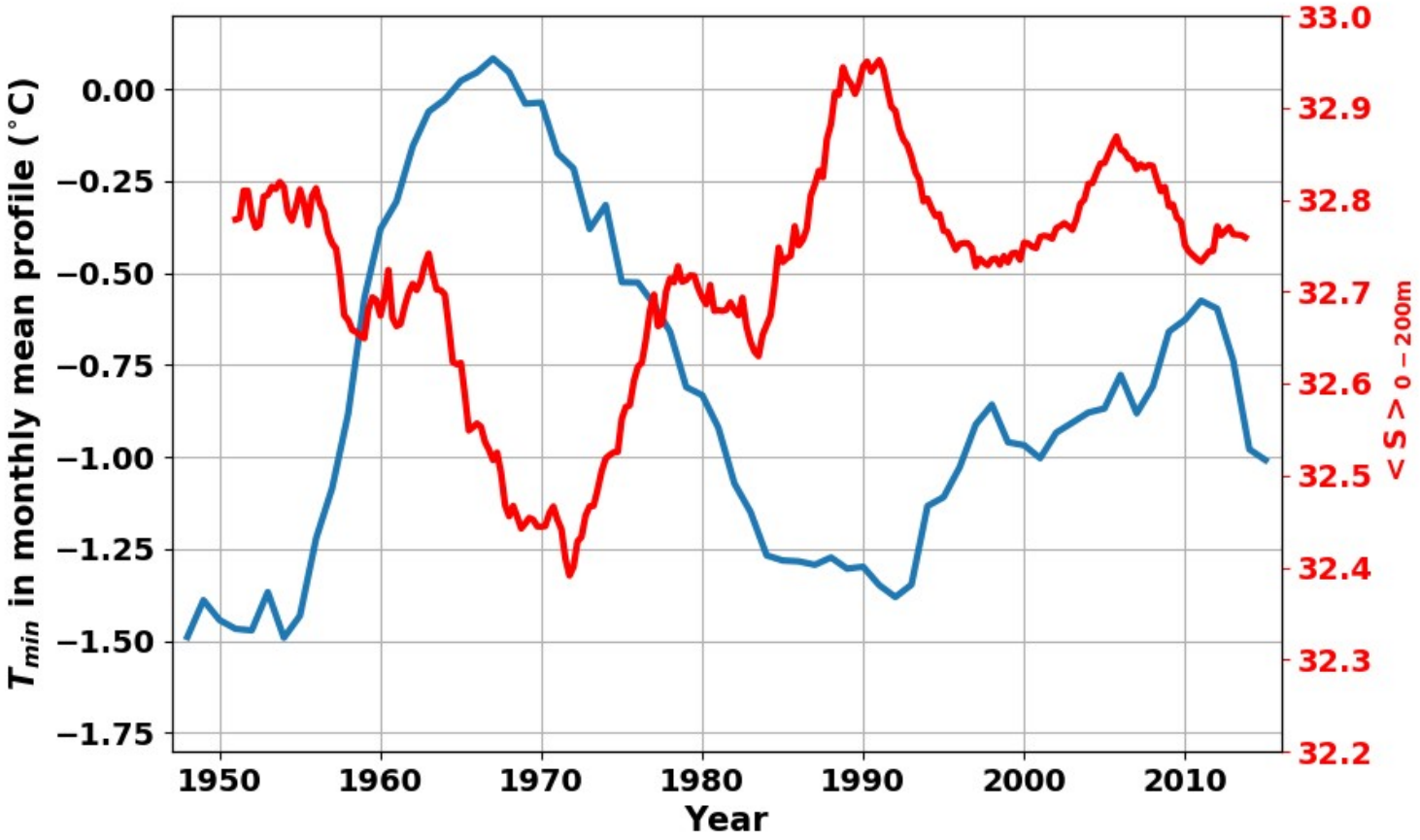
CIL summer core temperature



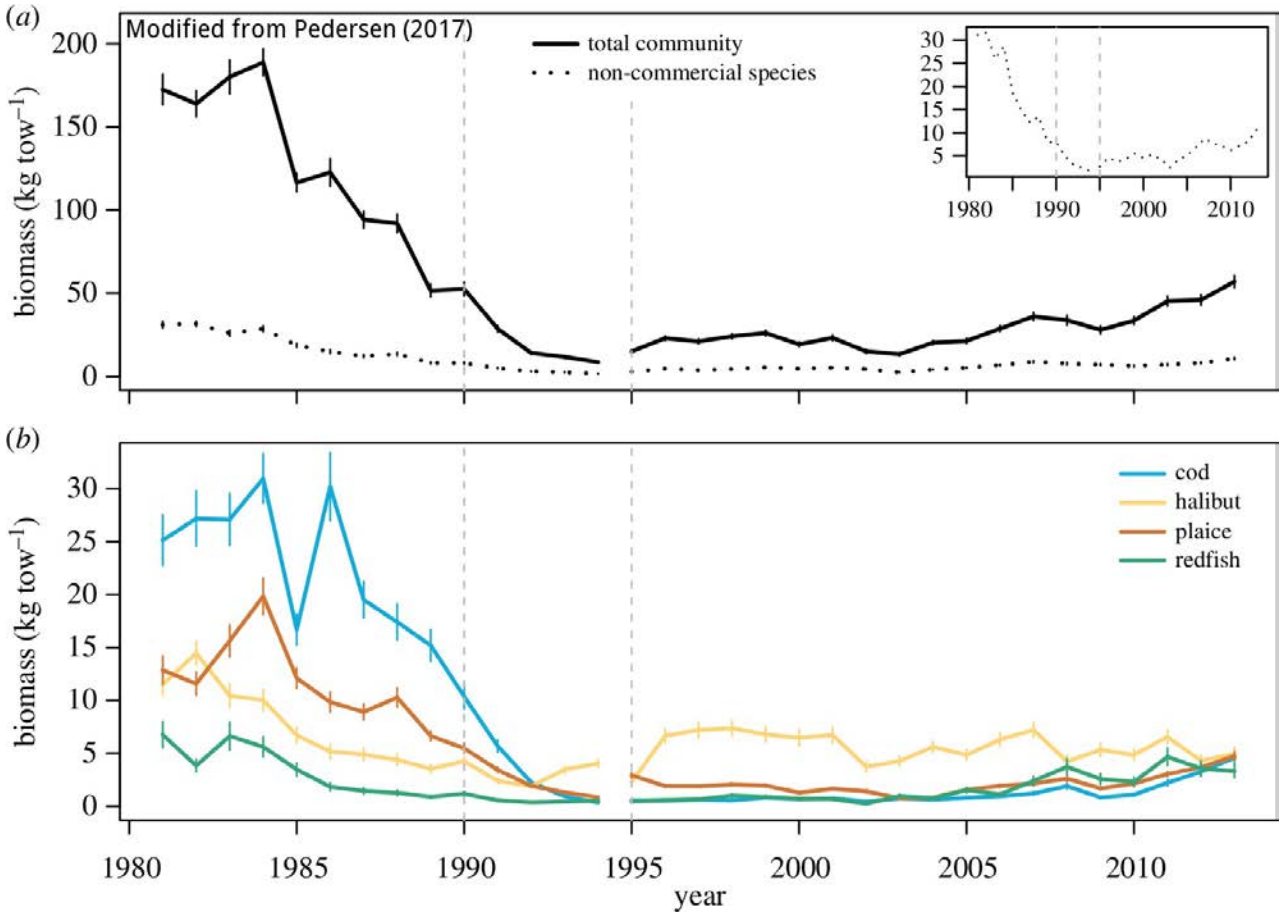
Salinity (0-200m average)



Significant environmental changes at decadal scales



A changing ecosystem (e.g. ground fish stocks decline)



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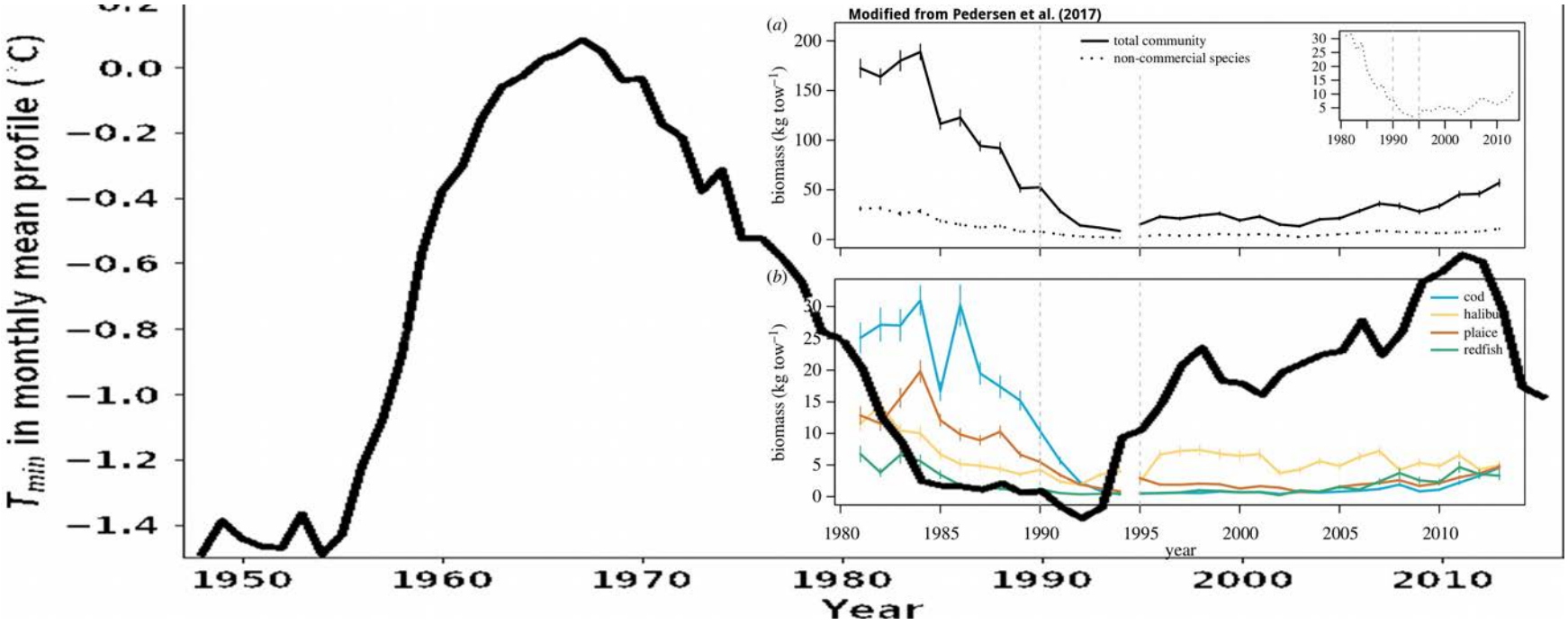
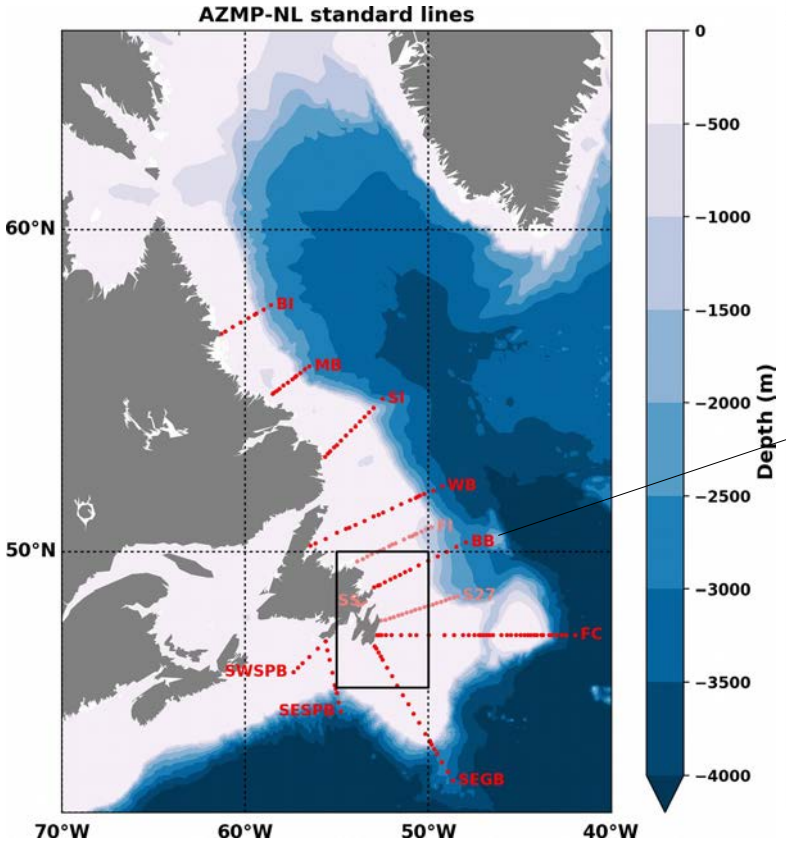
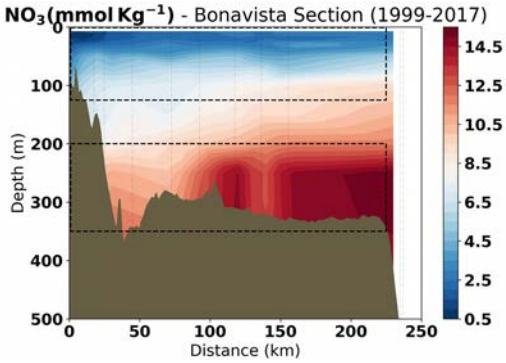
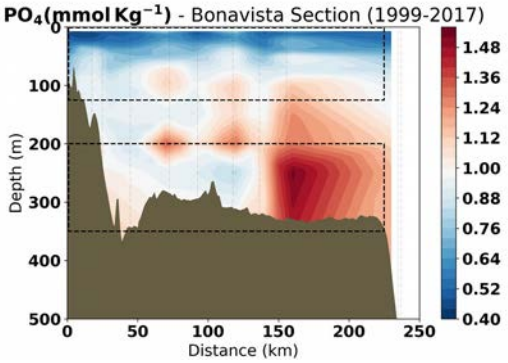


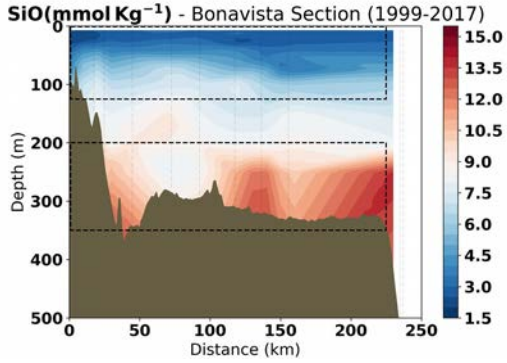
Biogeochemistry (AZMP; 1999-present)

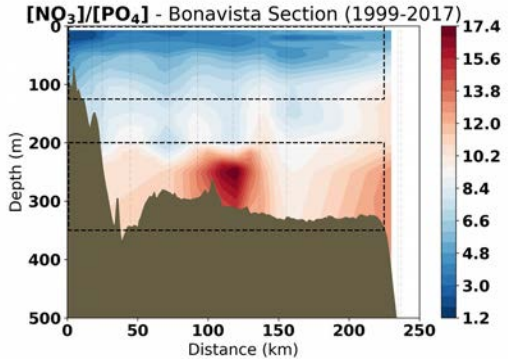
Nutrients (Bonavista section)











Nitrate/Phosphate ratio

AGU PUBLICATIONS
JGR
Journal of Geophysical Research: Oceans

RESEARCH ARTICLE

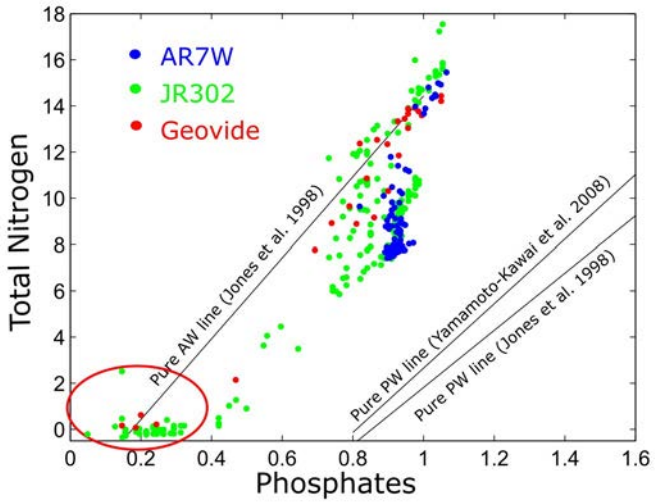
10.1002/2016JC012244

Composition of freshwater in the spring of 2014 on the southern Labrador shelf and slope

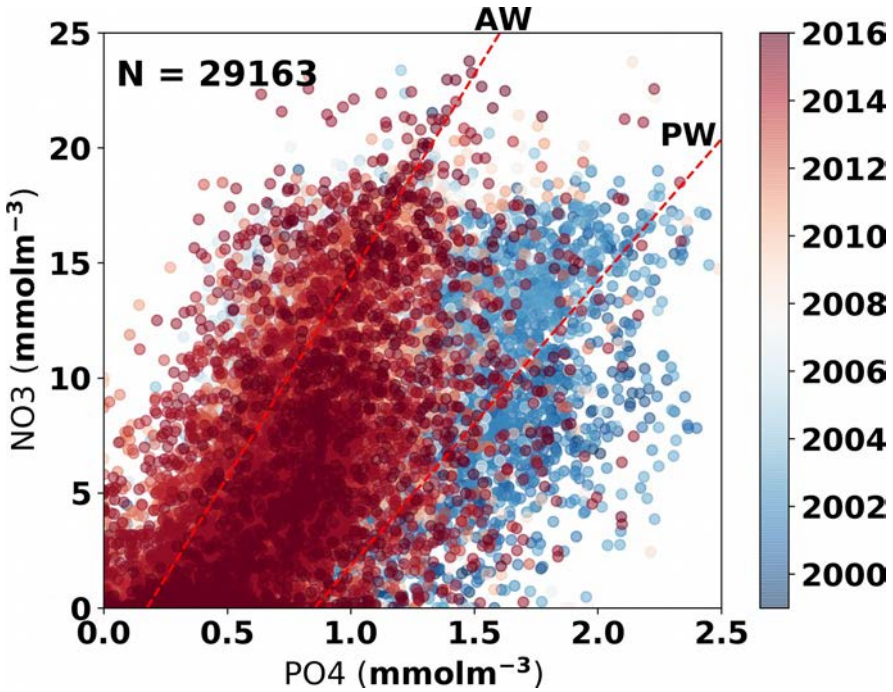
Key Points:
- The data set reveals a large contribution of water from the Canadian Arctic to the southern Labrador shelf
- There is evidence of advection of water from the slope region to the midshelf between 55°N and 52°N
- Observations from 1995 and 2008 suggest a higher fraction of brine and Pacific water on the shelf

M. Benetti[1,2], G. Reverdin[1], C. Lique[3], I. Yashayaev[4], N. P. Holliday[5], E. Tynan[5], S. Torres-Valdes[5], P. Lherminier[3], P. Tréguer[6], and G. Sarthou[6]

[1]Sorbonne Universités (UPMC, Univ Paris 06)-CNRS-IRD-MNHN, LOCEAN Laboratory, Paris, France, [2]Institute of Earth Sciences, University of Iceland, Reykjavik, Iceland, [3]Ifremer, Univ. Brest, CNRS, IRD, Laboratoire d'Océanographie Physique et Spatiale (LOPS), IUEM, F-29280, Plouzané, France, [4]Department of Fisheries and Oceans, Ocean Sciences Division, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, [5]National Oceanography Centre, Southampton, UK, [6]Laboratoire des Sciences de l'Environnement Marin (UMR 6539 CNRS/UBO/IRD/Ifremer), Plouzané, France

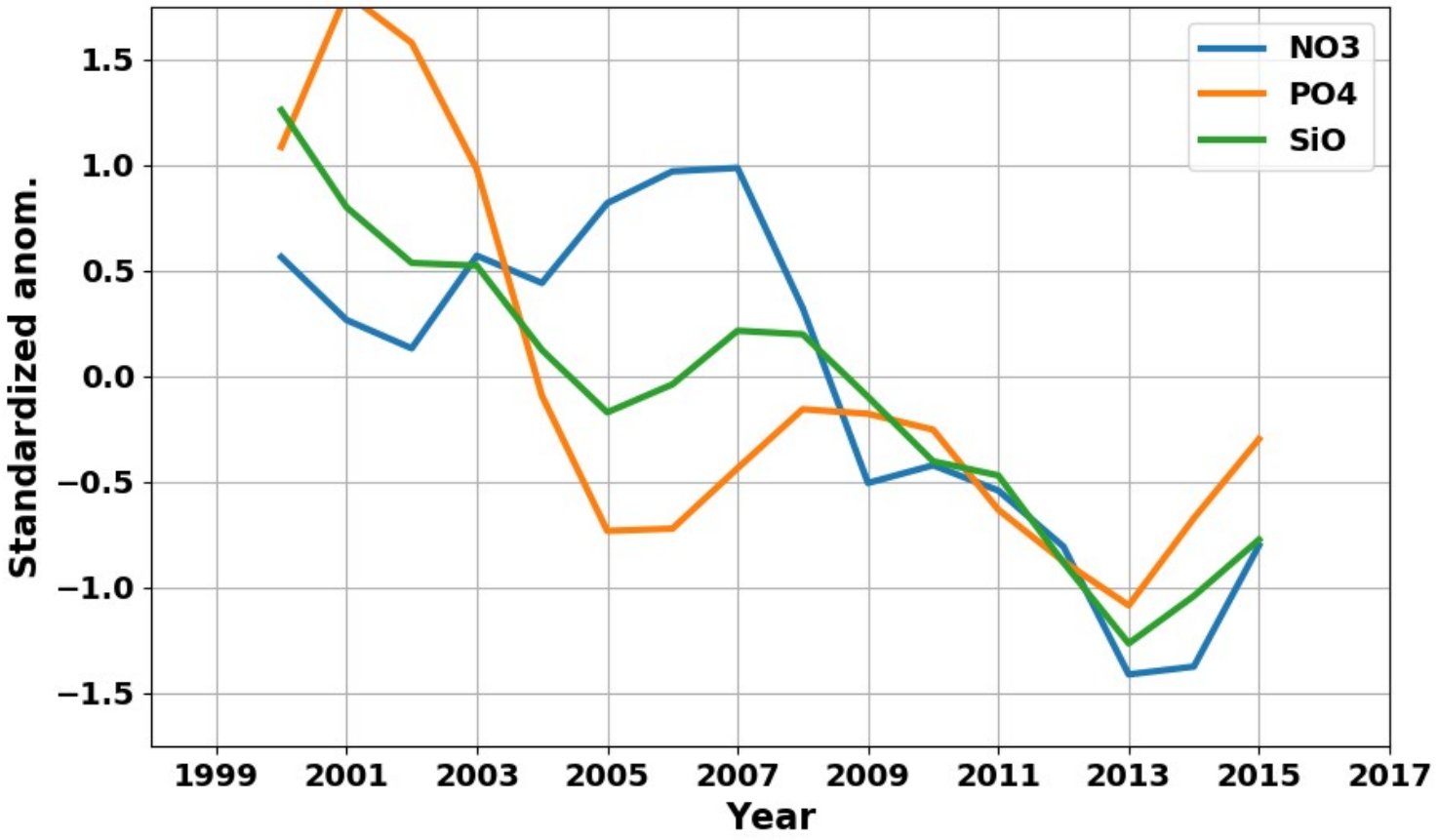


→ **Recent changes towards less Pacific/Arctic waters**



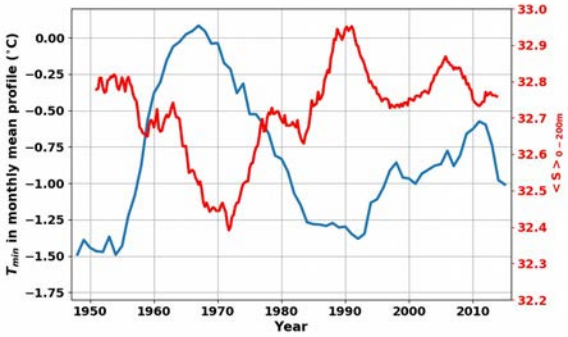
Benetti et al. (2017)

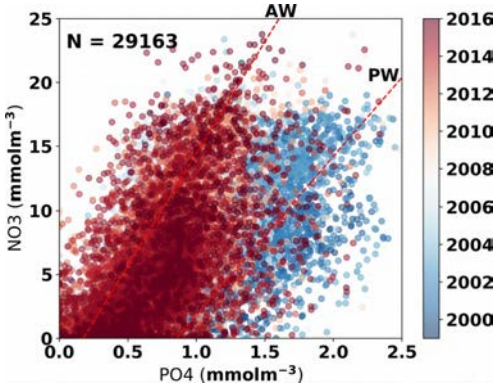
Overall decrease in nutrient concentration



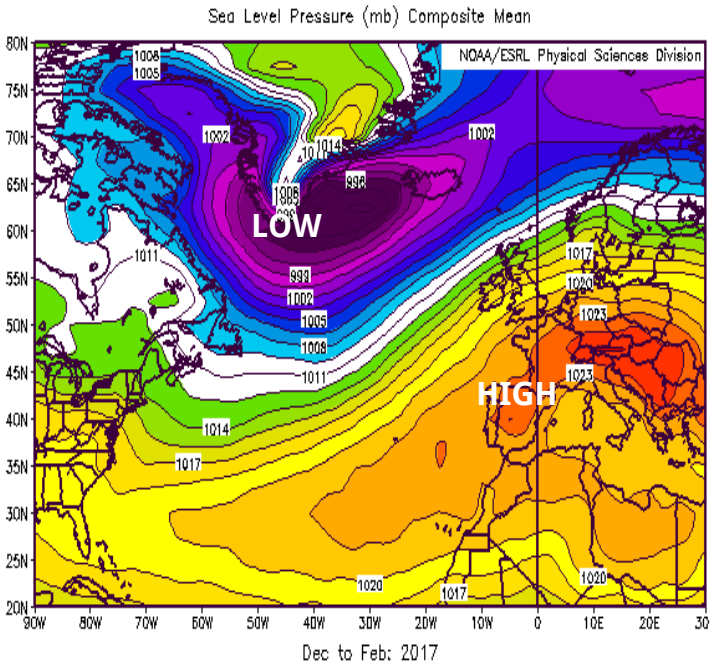
Origin and impact of these change : A review of 2 climate indices

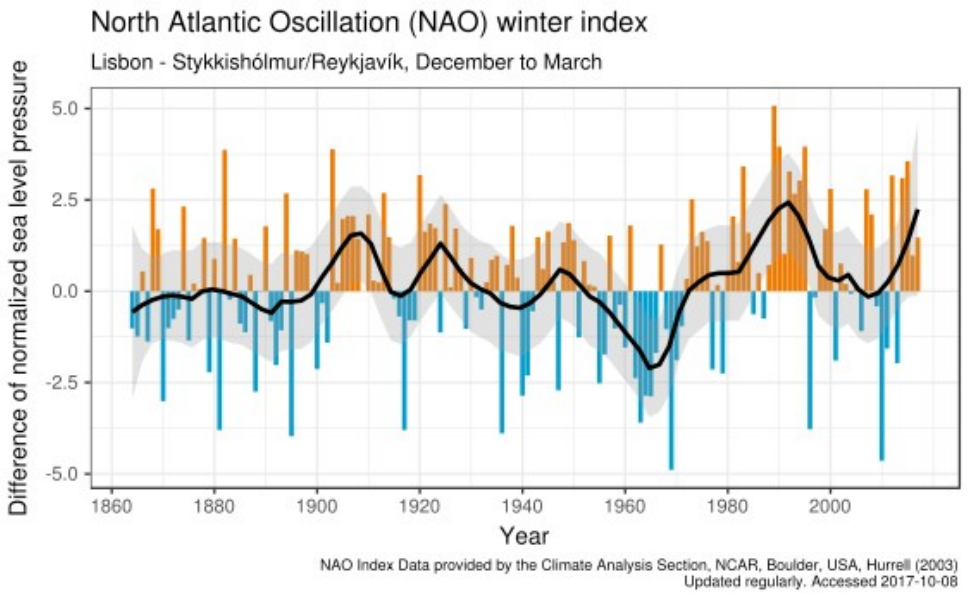
→ Preliminary *qualitative* analysis





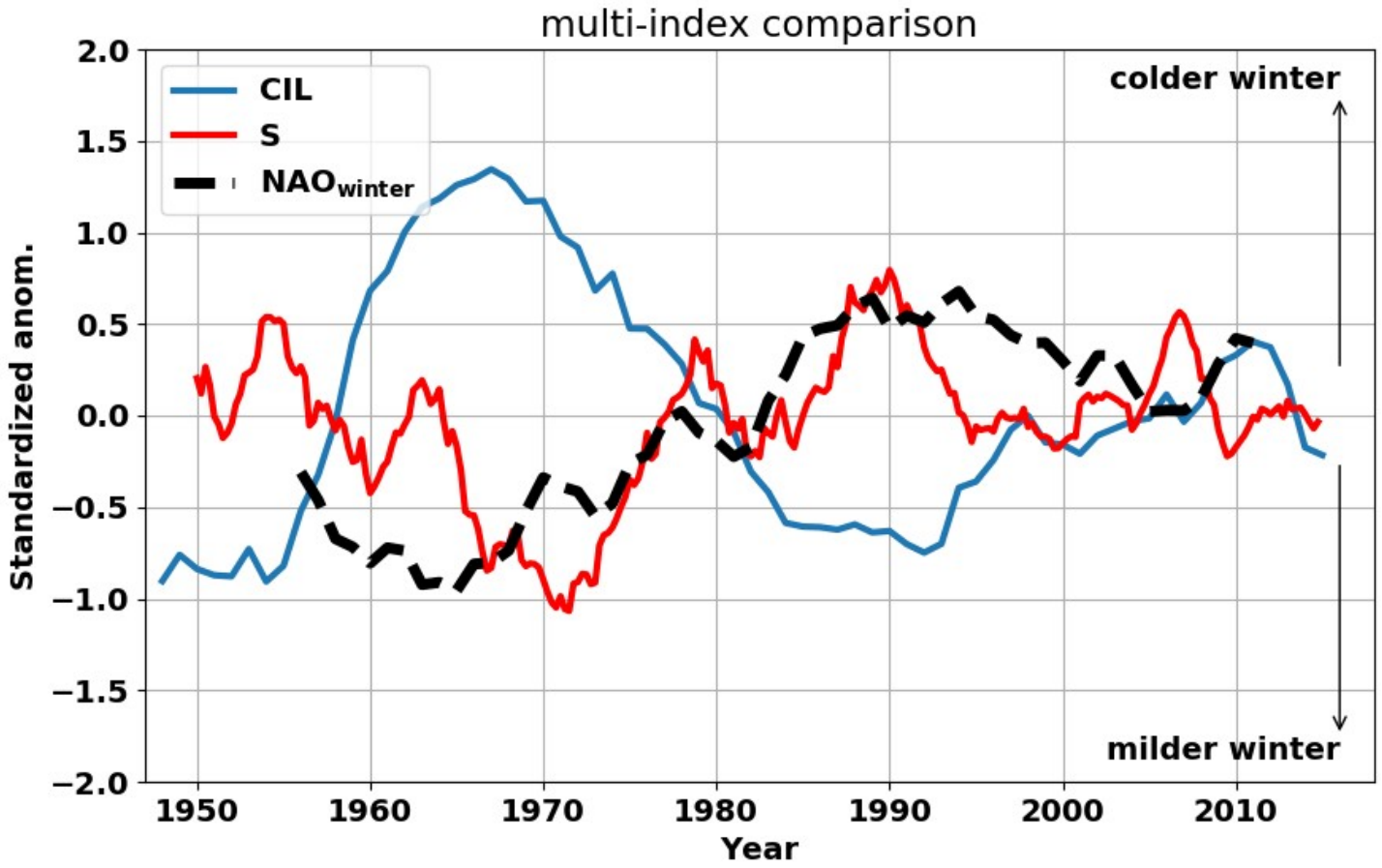
1. North Atlantic Oscillation (NAO)



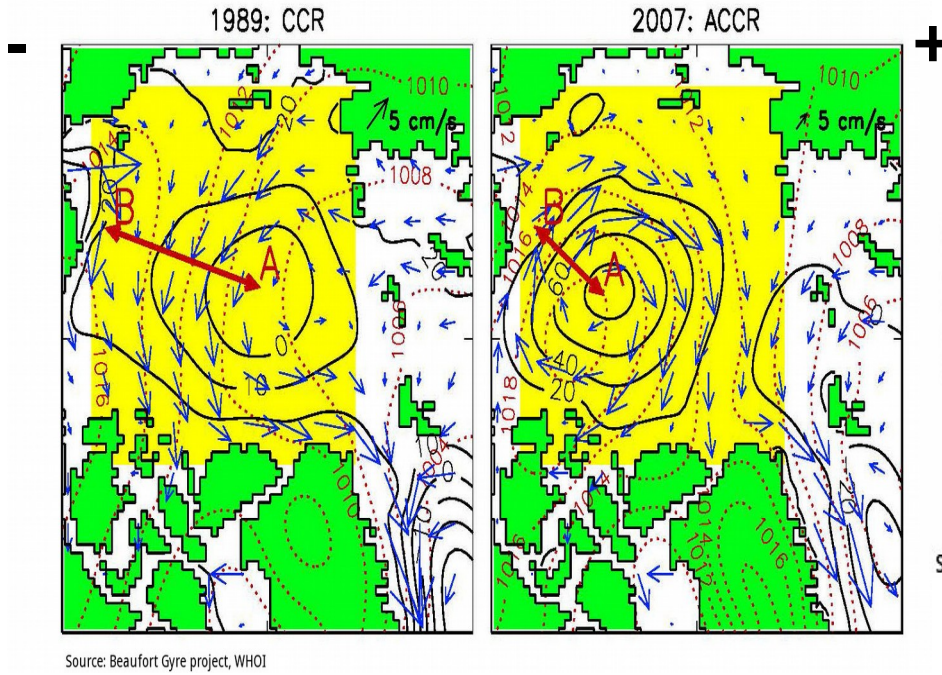


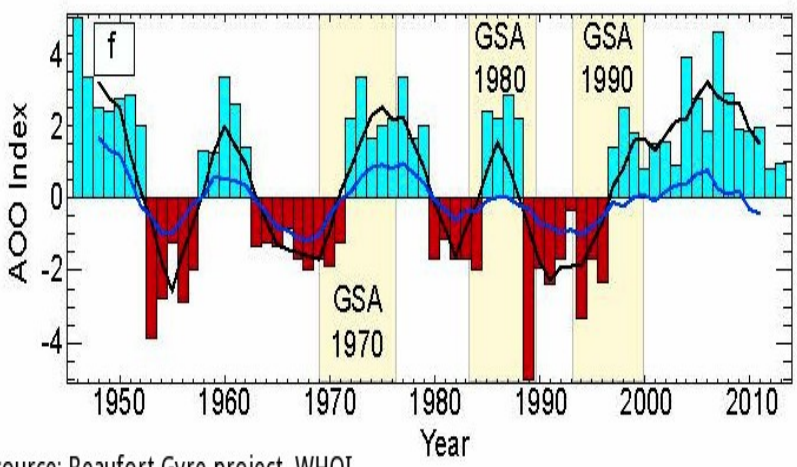
- *Atmospheric index*
- Explains a large portion of climate variability in NA (e.g. harsh winters)

1. North Atlantic Oscillation (NAO)



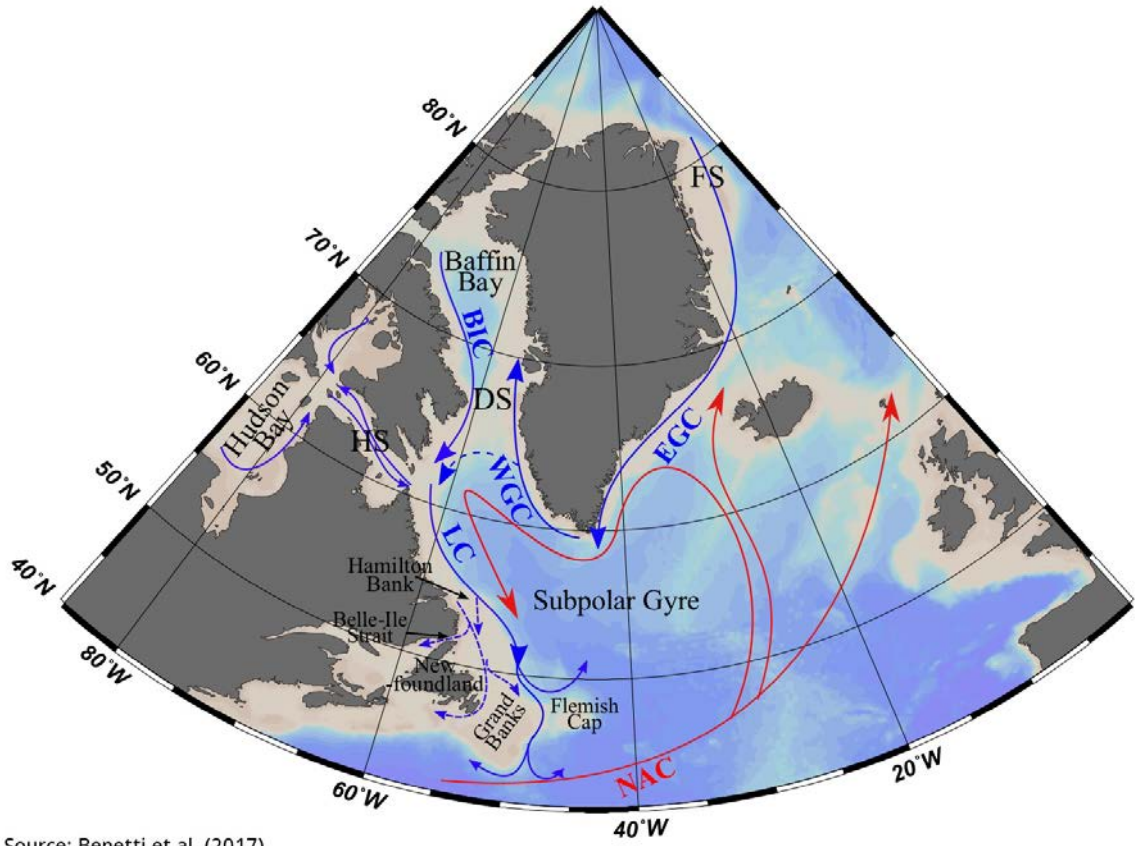
2. Arctic Ocean Oscillation (**AOO ≠ AO**)





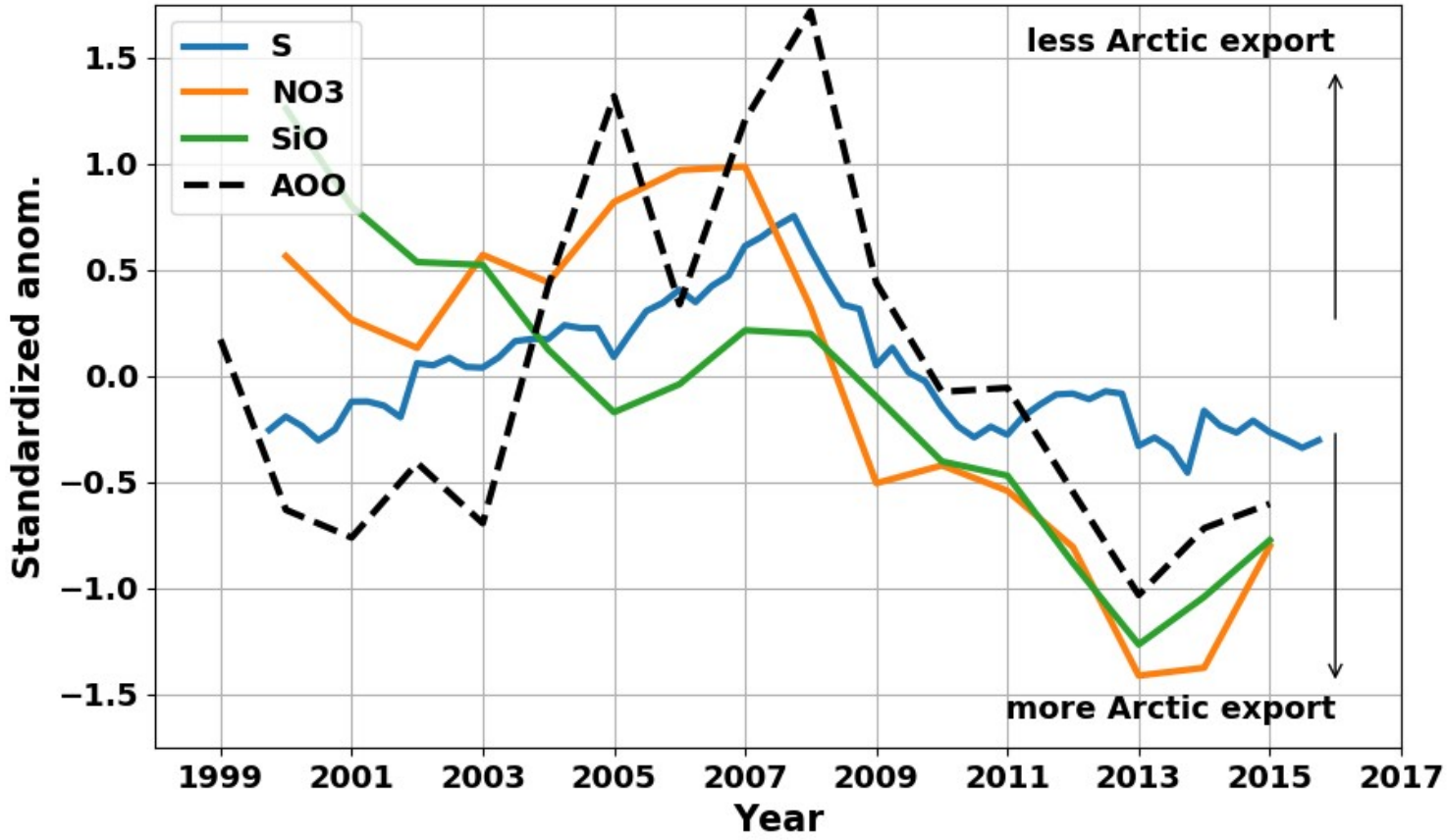
- Index based on wind-driven SSH patterns (cyclonic / Anticyclonic)
  -> e.g., Proshutinky et al., 2015 – Arctic circulation regimes
- Explains a large portion of freshwater export from Arctic (e.g. nutrient-rich waters)

Circulation on the NL shelves



Source: Benetti et al. (2017)

Recent AOO vs Nutrients (50-150m)



→ Less nutrients seems incompatible with more Arctic export...

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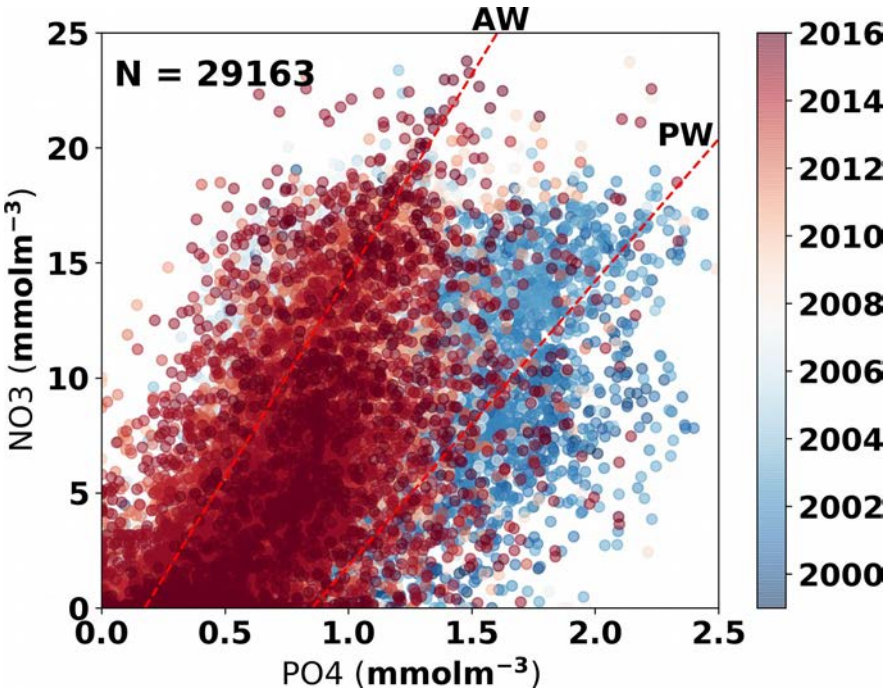
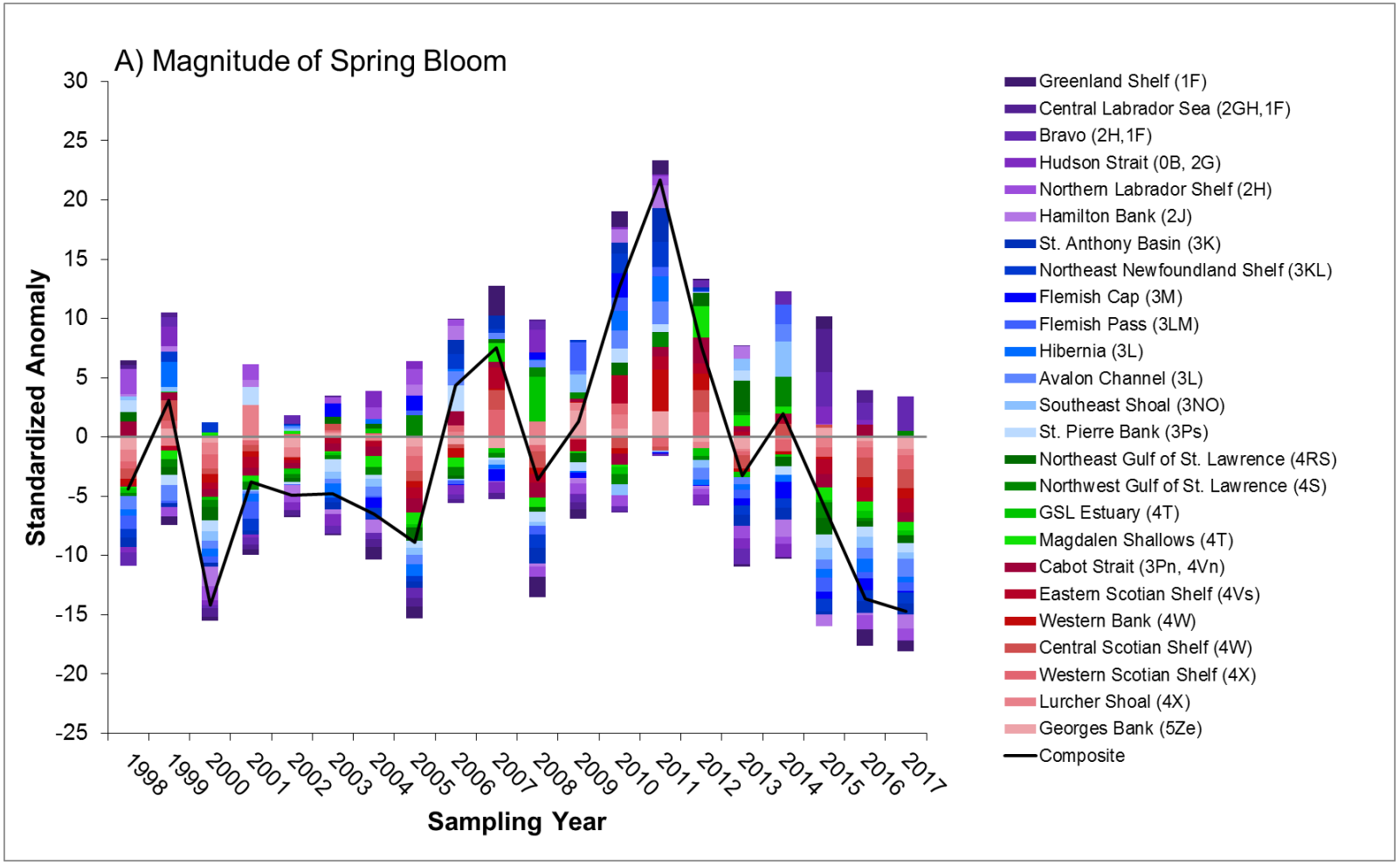


→ Recent changes towards less Pacific/Arctic waters

Primary production



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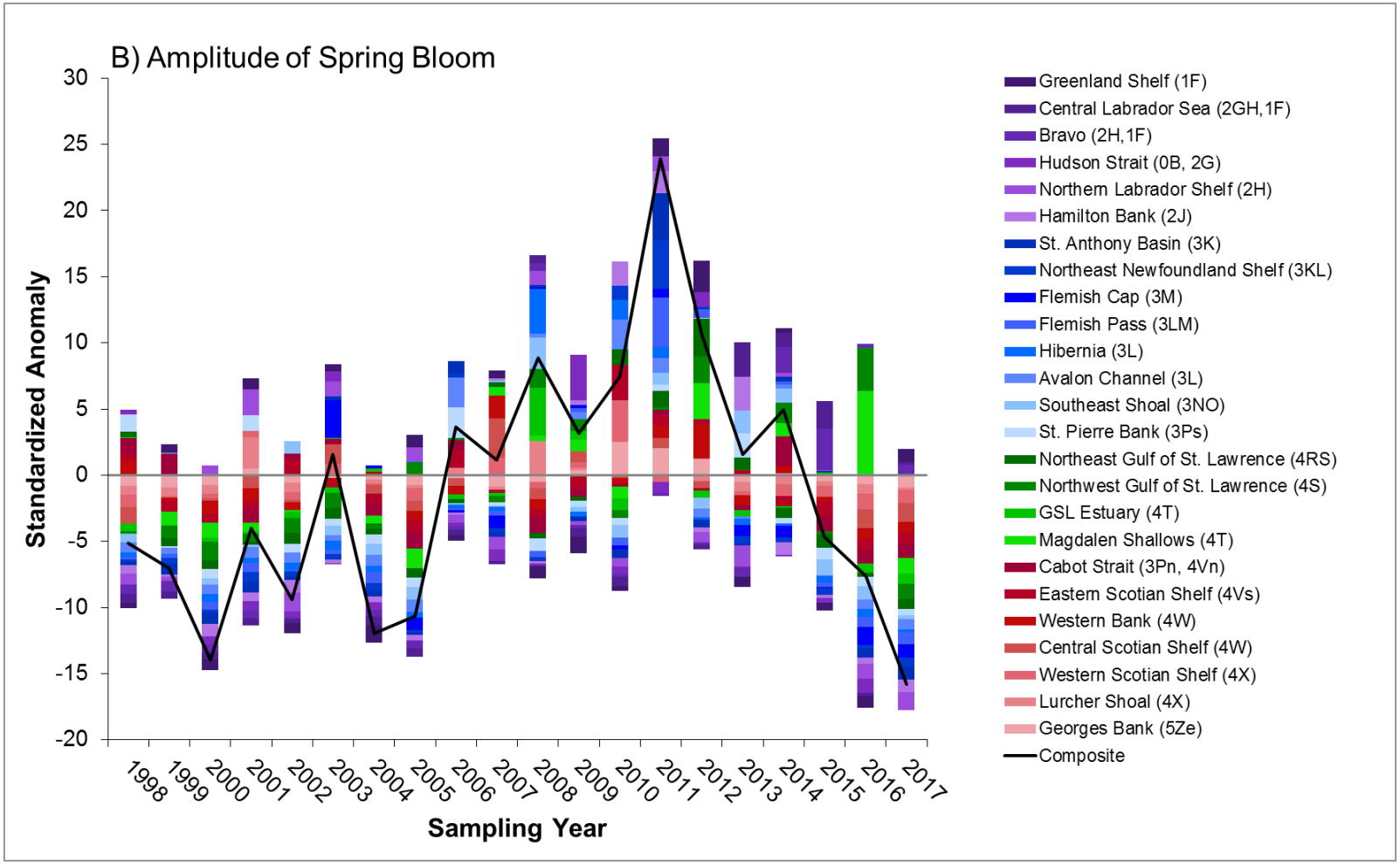

Conclusion

What can we tell from these historical data?

- Decadal changes in physical environment that fits NAO;
- Recent change in proportion of Atlantic/Pacific waters (less Pacific waters) that doesn't fit AOO;
- Recent decrease in nutrient concentrations consistent with less Arctic water in the system.

Thanks for listening!
Questions or comments?

Thanks to everyone making AZMP possible, specially J. Holden and D. Senciall who helped with the database.

To follow up :


Frederic.Cyr@dfo-mpo.gc.ca


cyrf0006.github.io


@cyrf0006