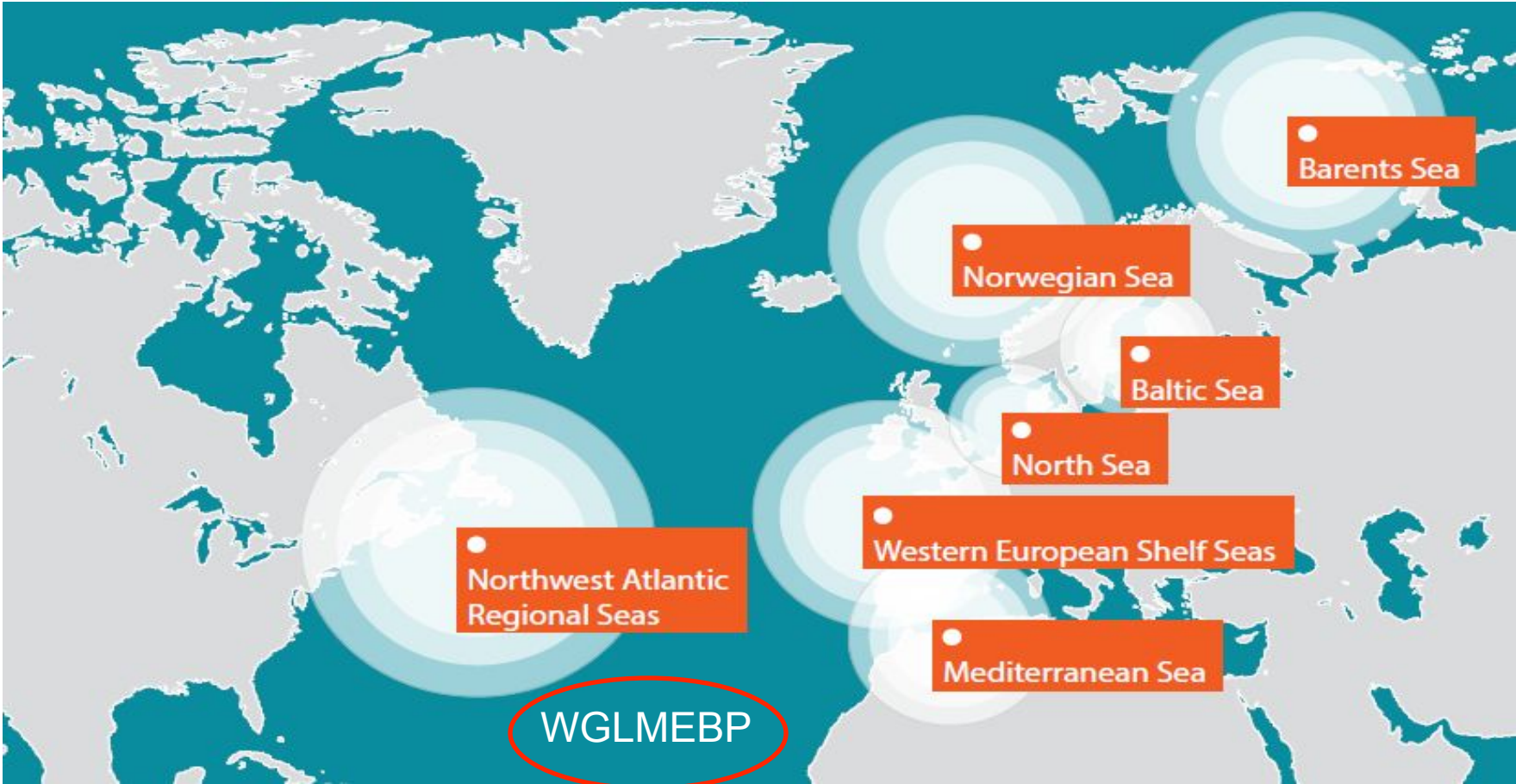


**Work in two ICES Working Groups for  
Integrated Ecosystem Assessment – WGIBAR  
for the Barents Sea and WGINOR for the  
Norwegian Sea Large Marine Ecosystems**

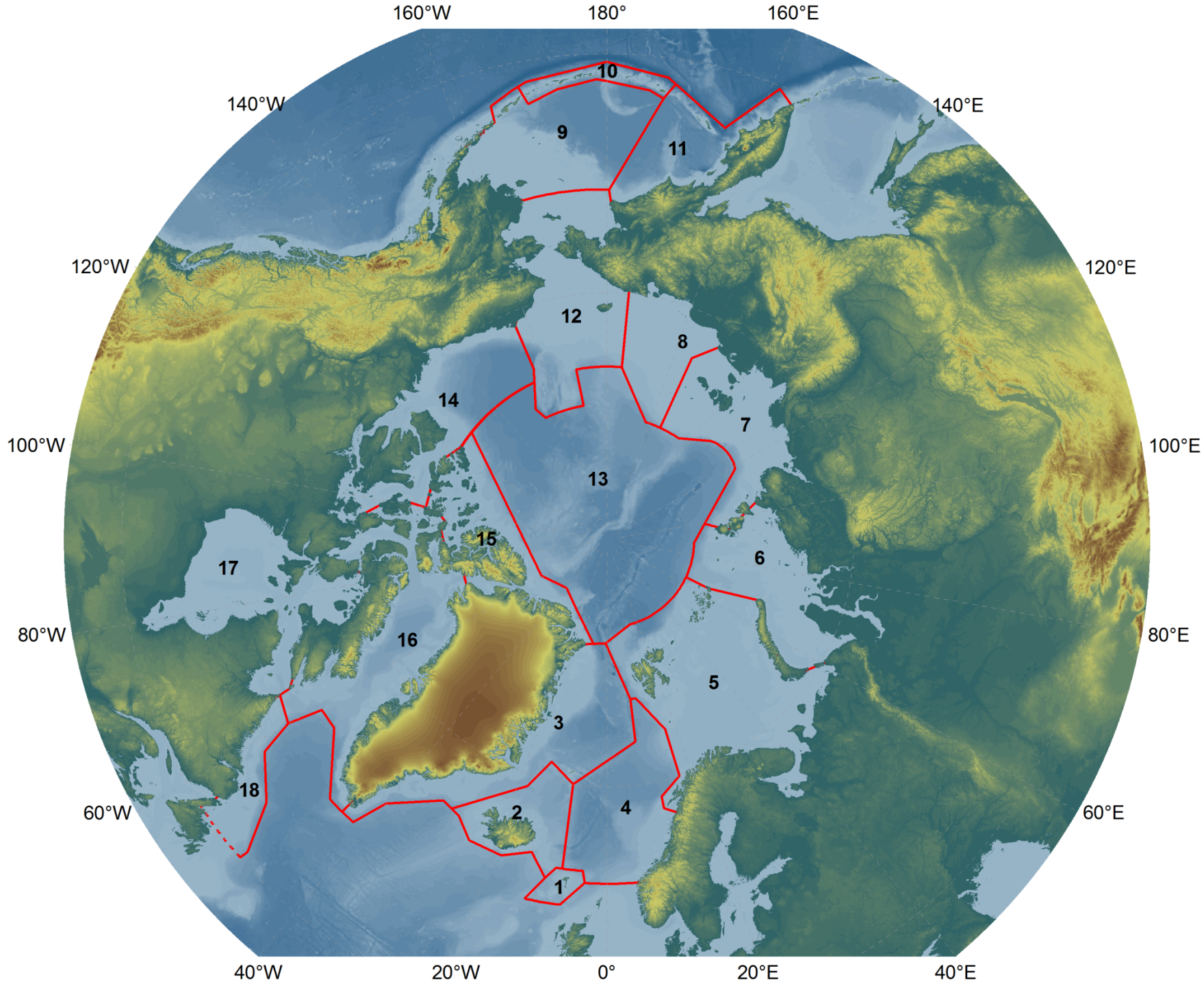
Hein Rune Skjoldal<sup>1</sup>, Geir Huse<sup>1</sup>, Edda Johannesen<sup>1</sup>,  
Yury Kovaljev<sup>2</sup> and Gudmundur J. Oskarsson<sup>3</sup>

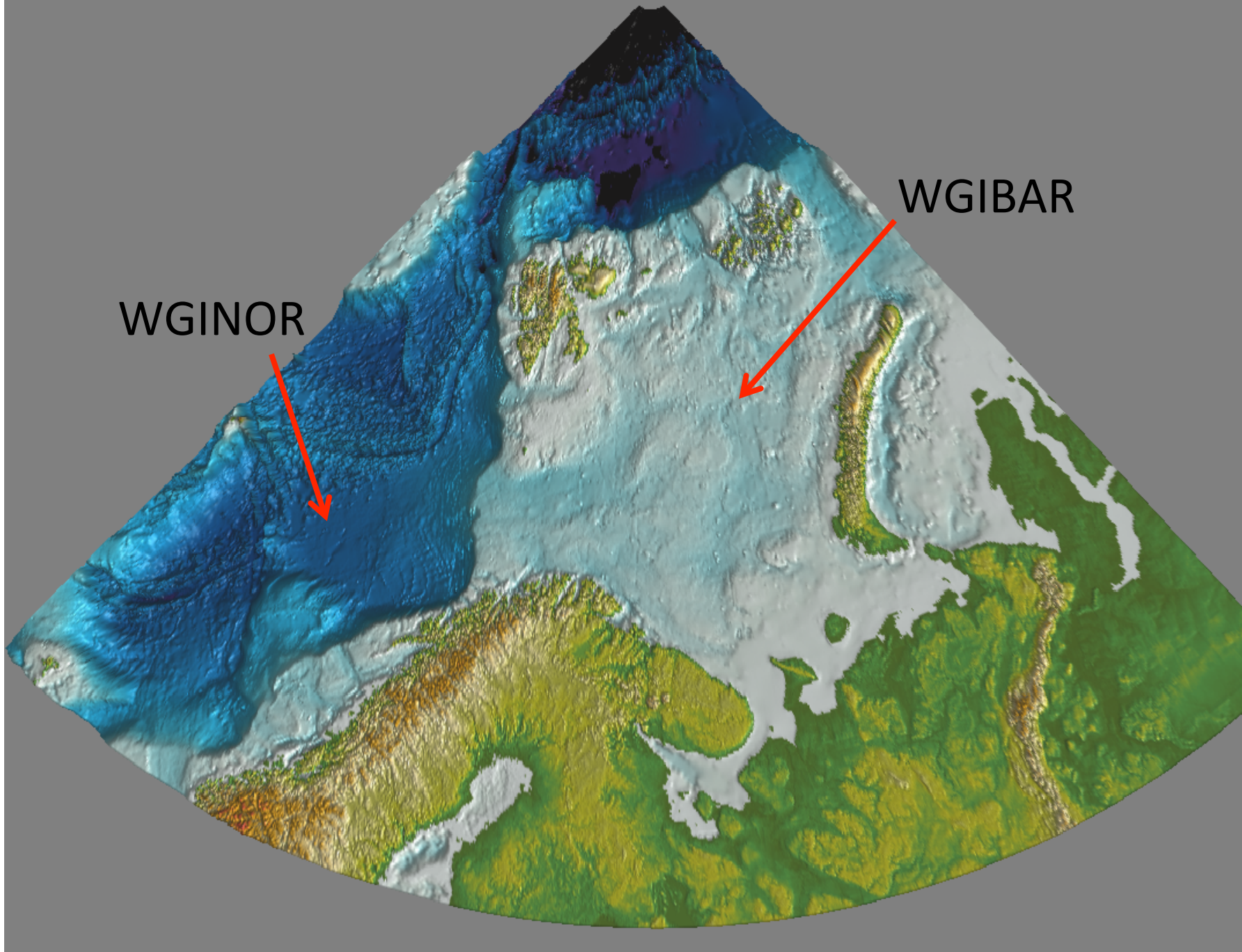
1 - IMR, Norway; 2 – PINRO, Russia, 3 - MRI, Iceland

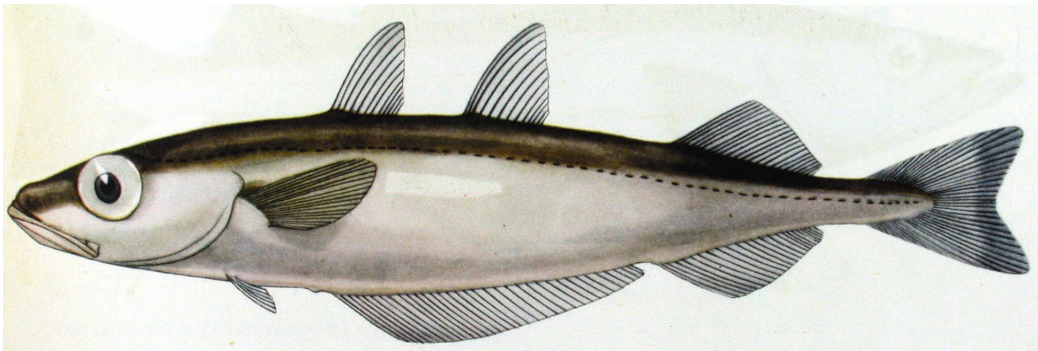
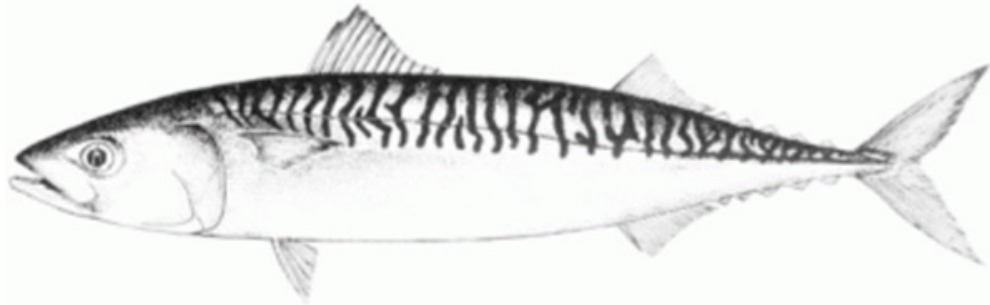
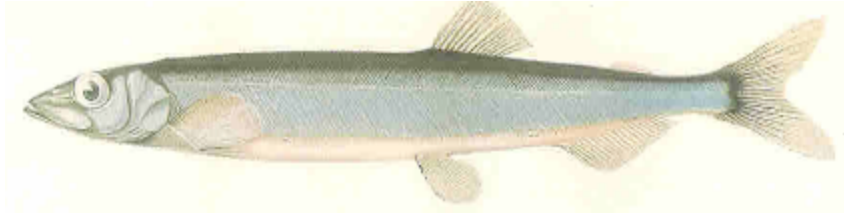
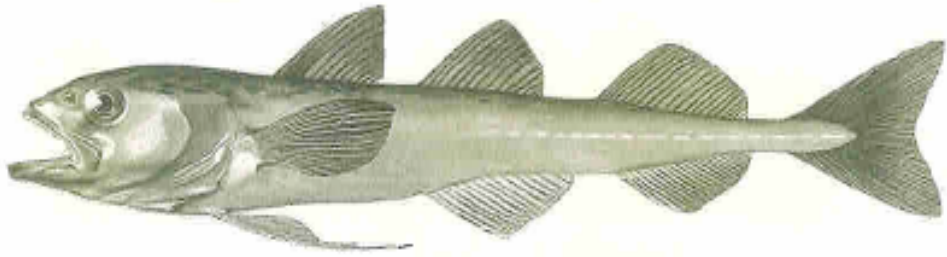
WGICA



Integrated Ecosystem Assessment Groups in ICES







# Scope and approach

- **Scope**

- Climate variability and change
- Fish stocks and fisheries

- **Approach**

- Assemble time series for spatially-aggregated variables
- Perform integrated analysis – multivariate, e.g. PCA
- Interpret patterns and trends using ecological knowledge
- Address on-going changes and events – 'breaking news'

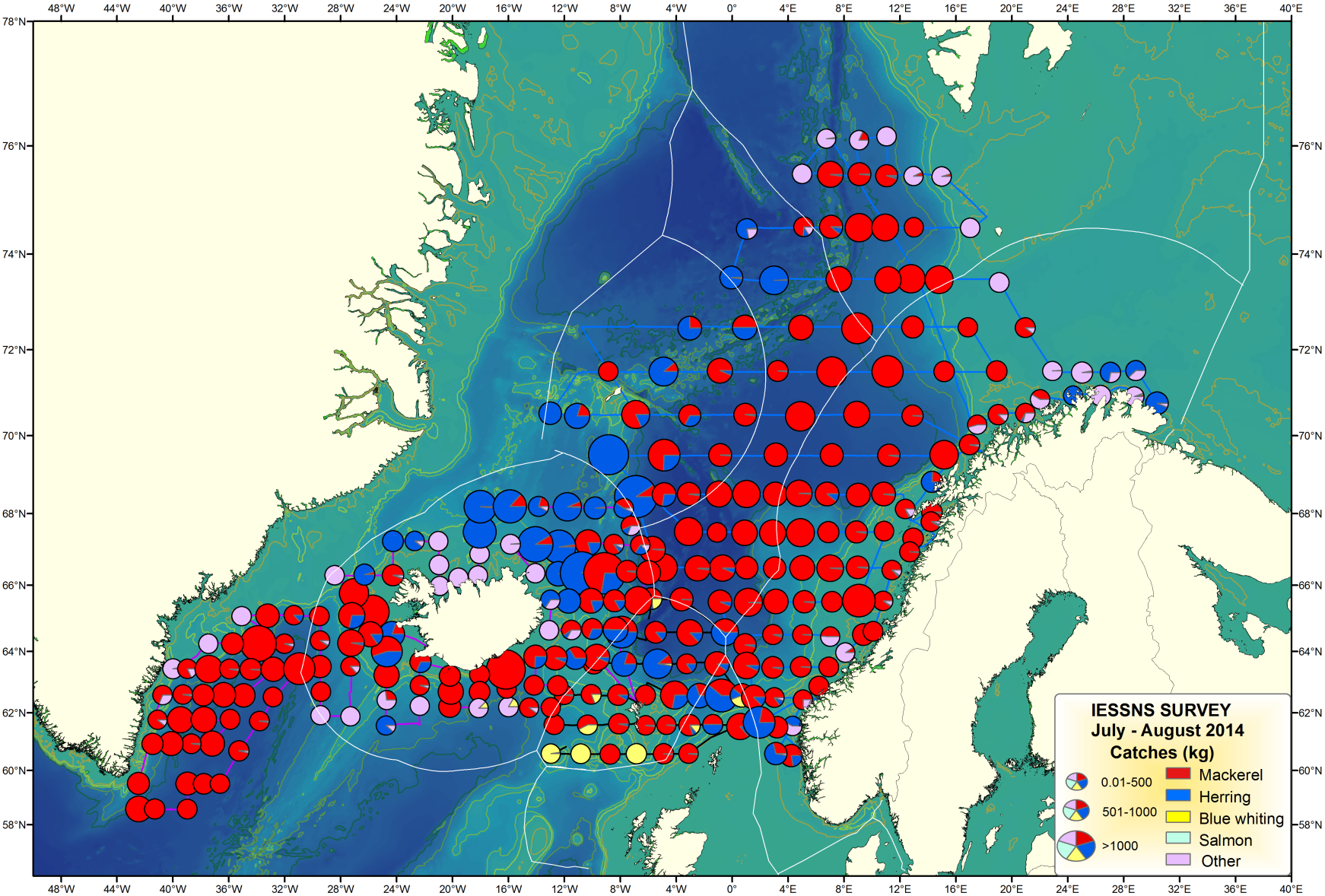
Norskehavet

Foto: Leif Norström

Comprehensive international effort provided new knowledge to the mackerel assessment advice

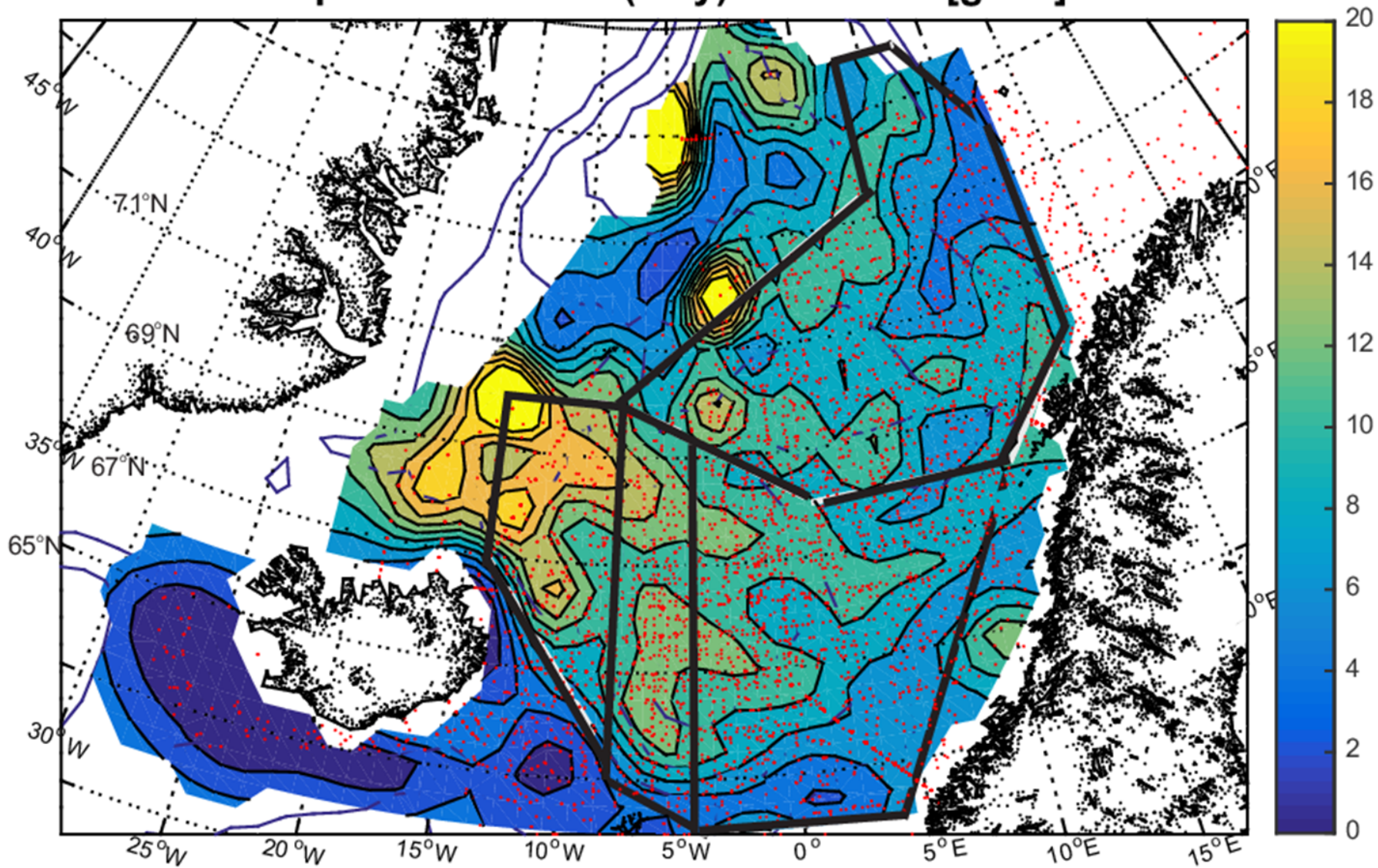


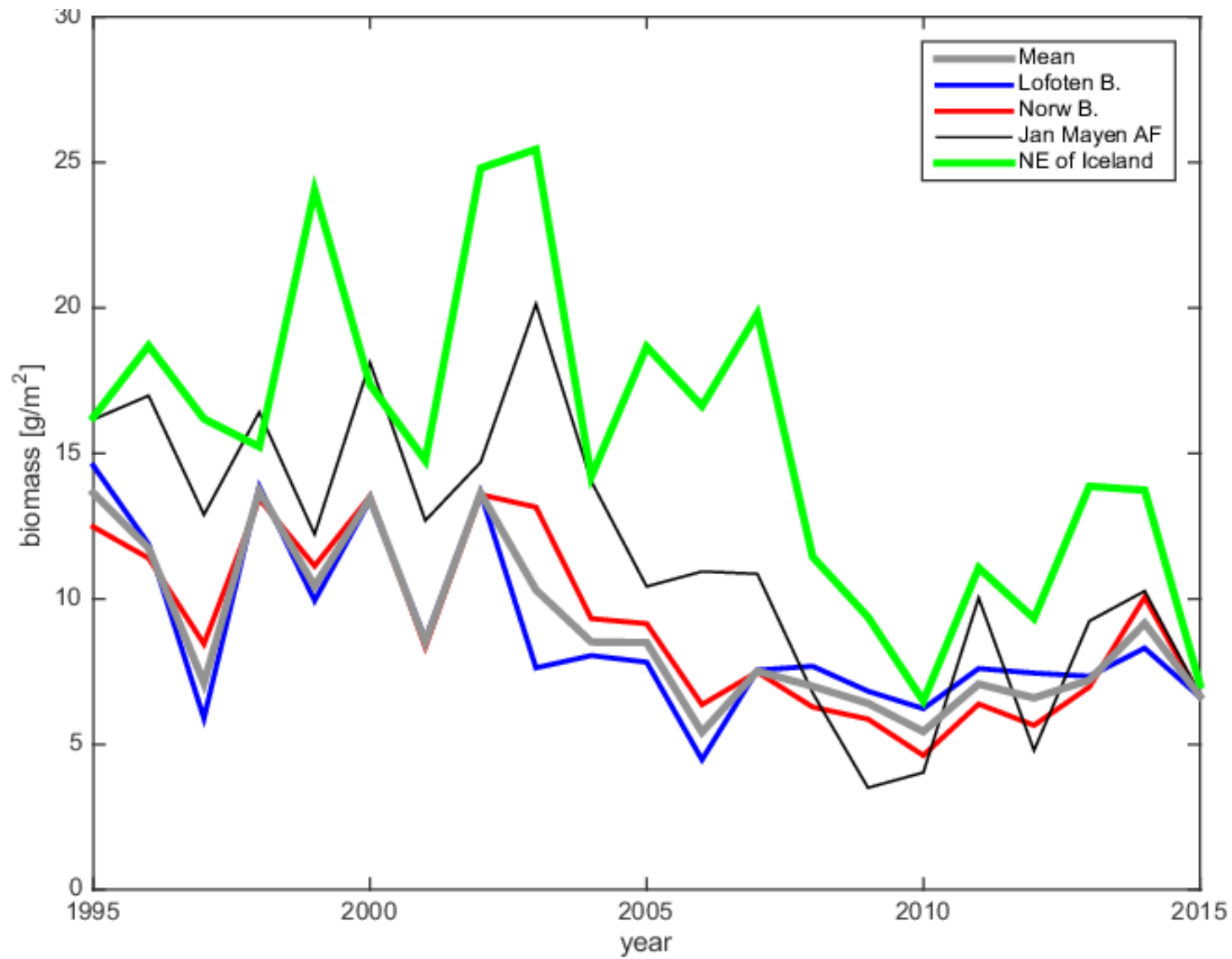
# Distribution and overlap of mackerel and herring

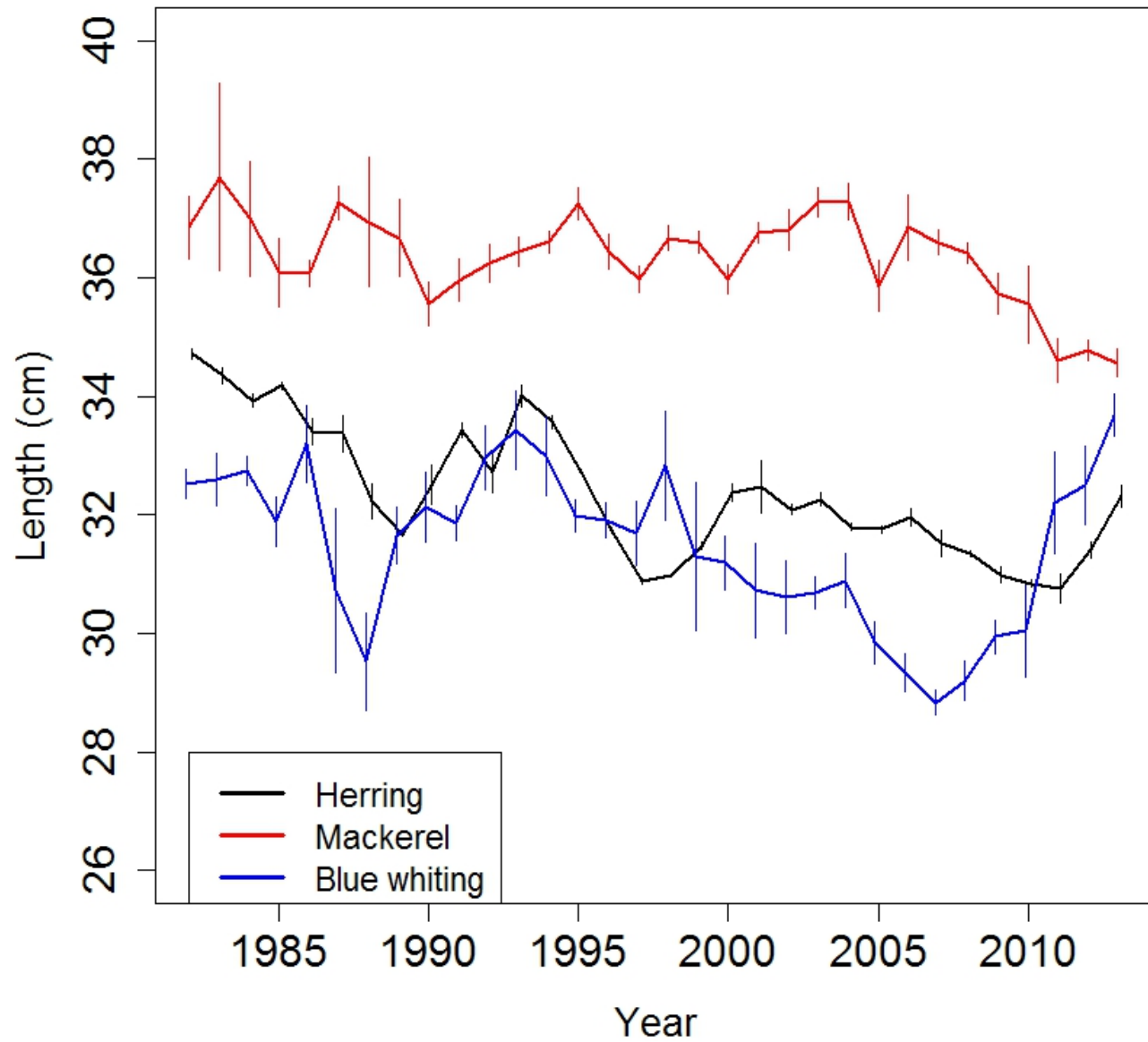


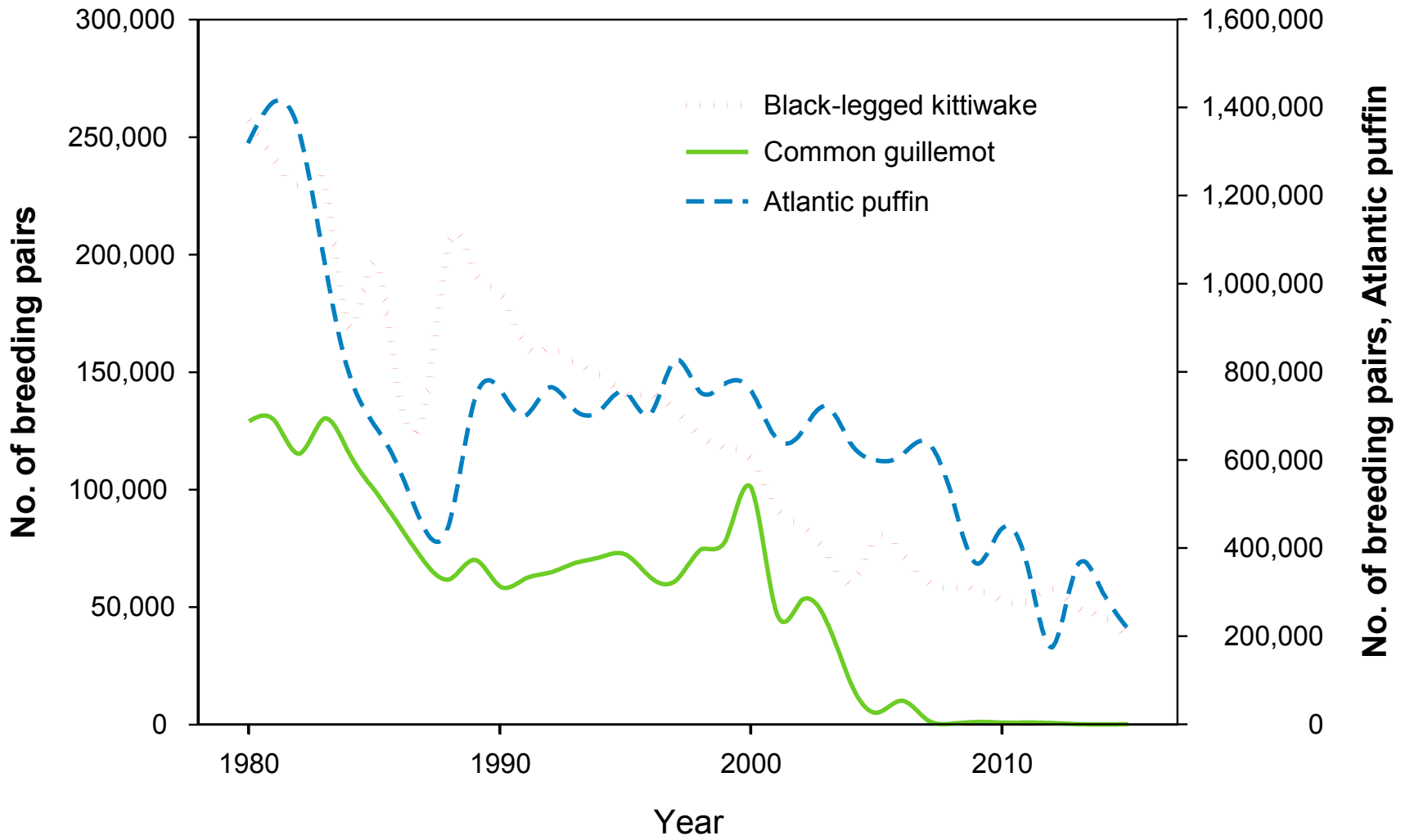


# Zooplankton: Mean (May) 1995-2015 [ $\text{gm}^{-2}$ ]

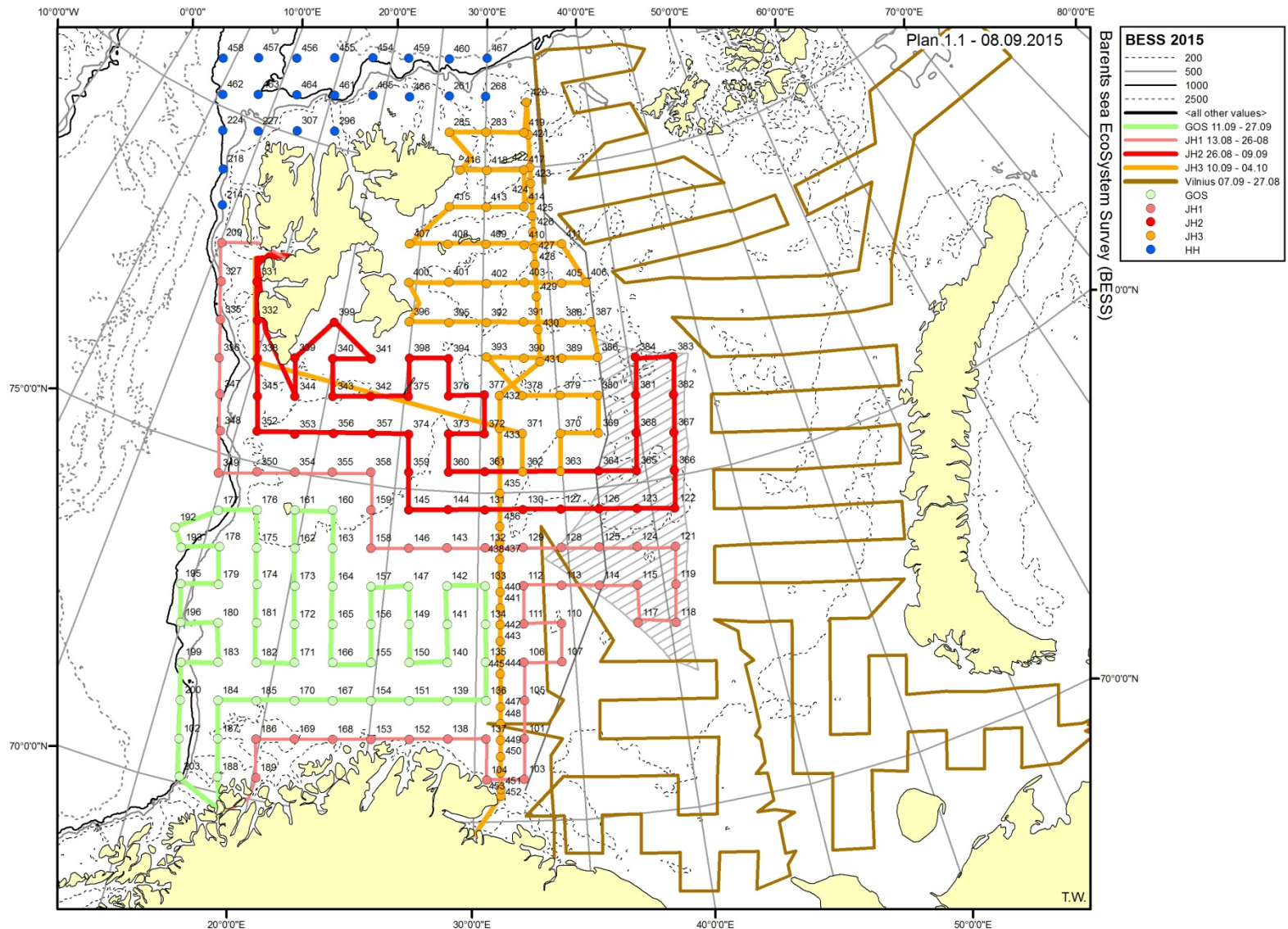








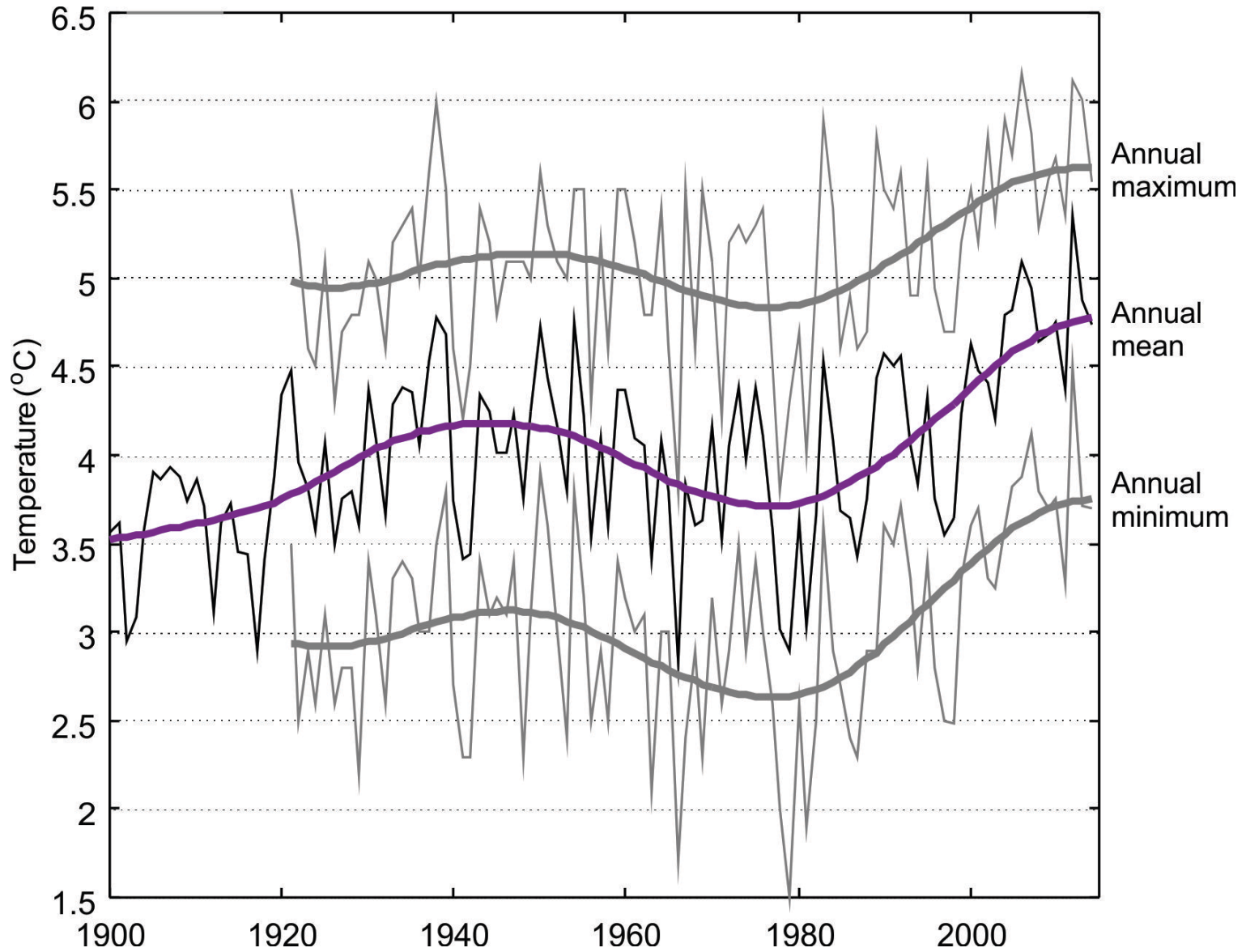
# Survey design 2015

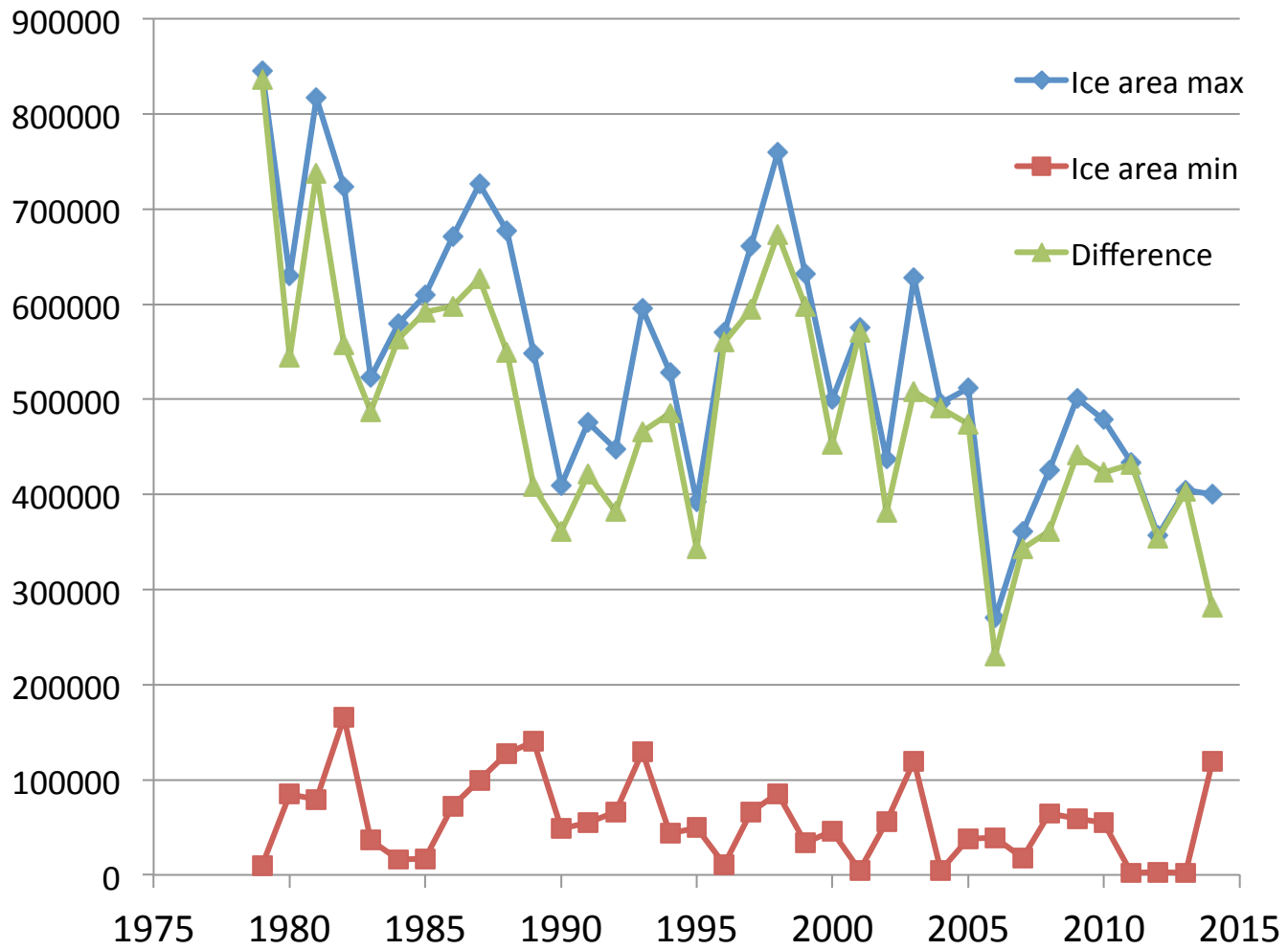


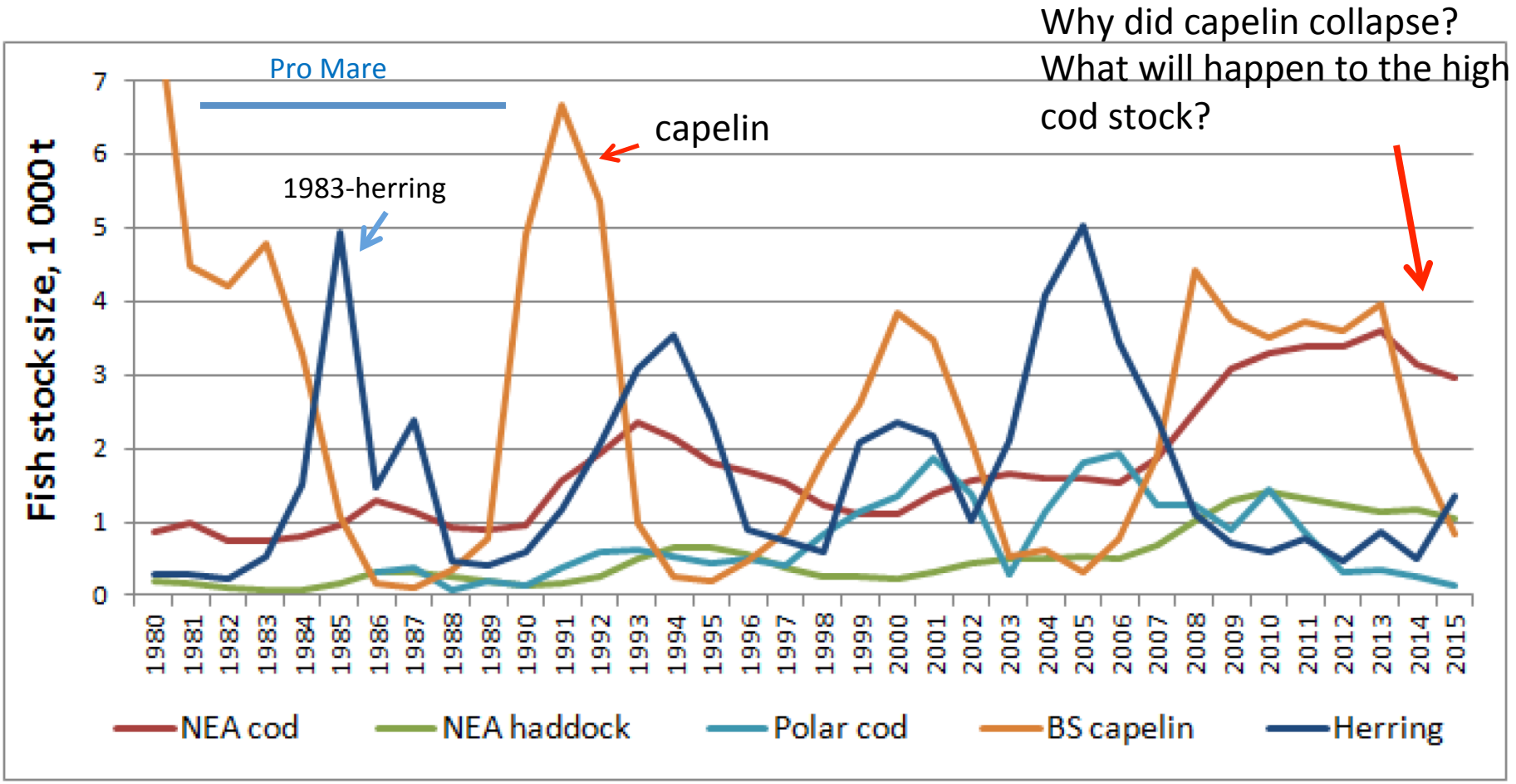
Hydrography and plankton stations

Bottom and pelagic trawl stations

# Temperature Kola section

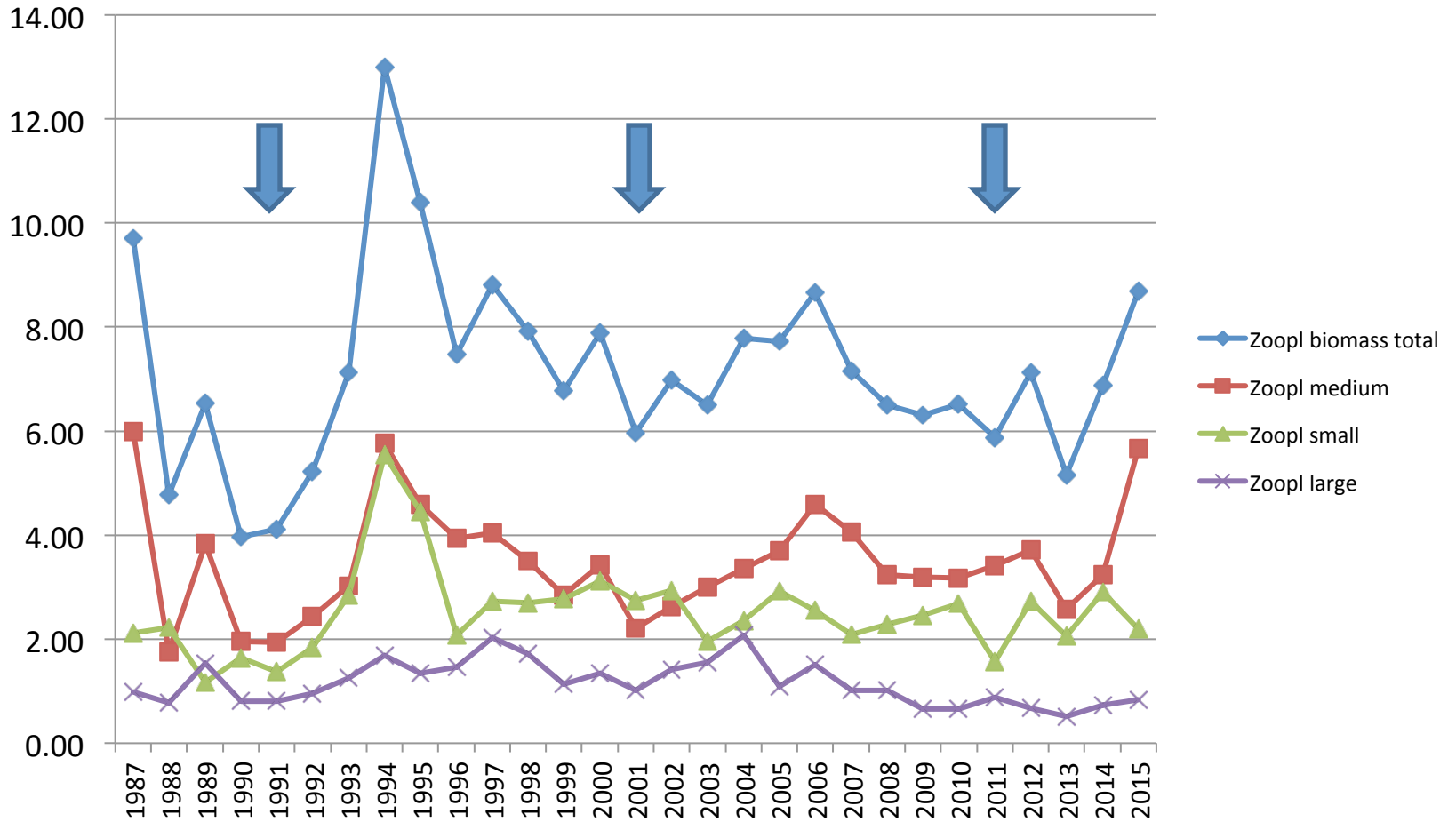


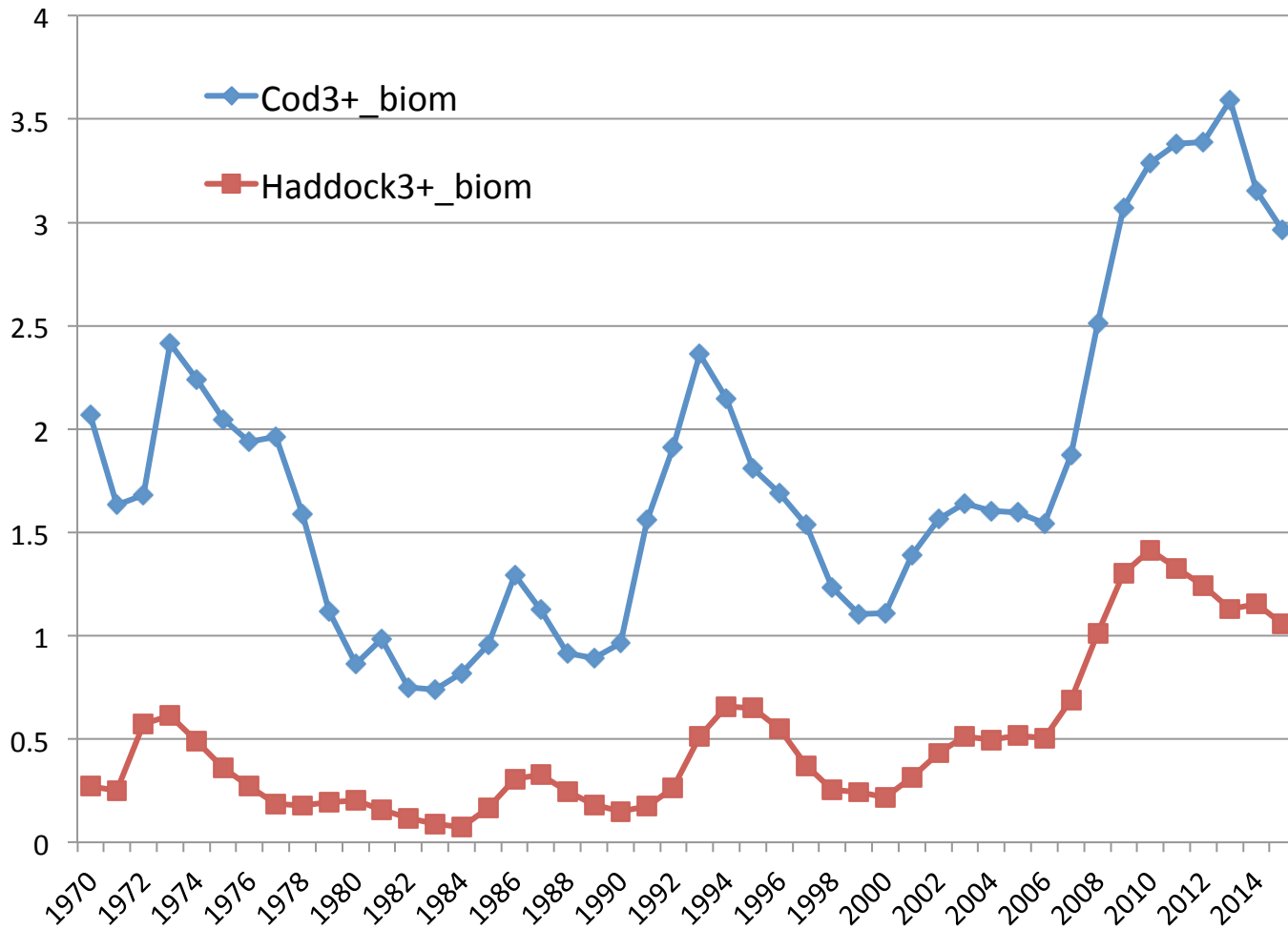






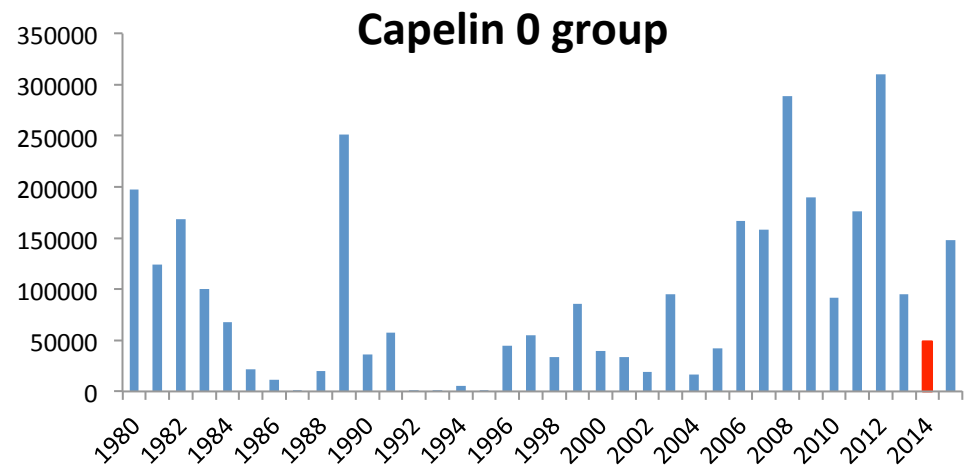
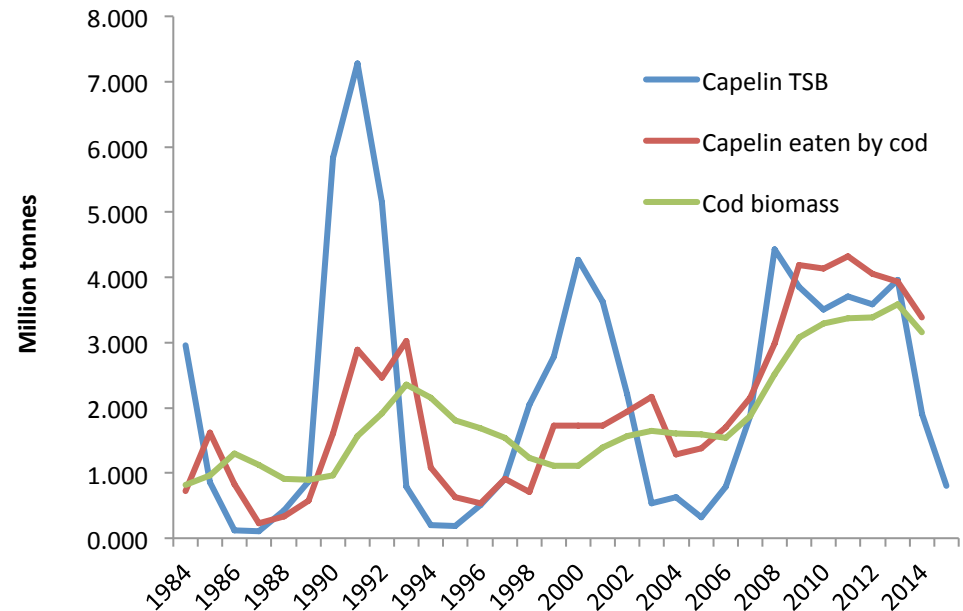
# Zooplankton biomass – g dw m<sup>-2</sup>



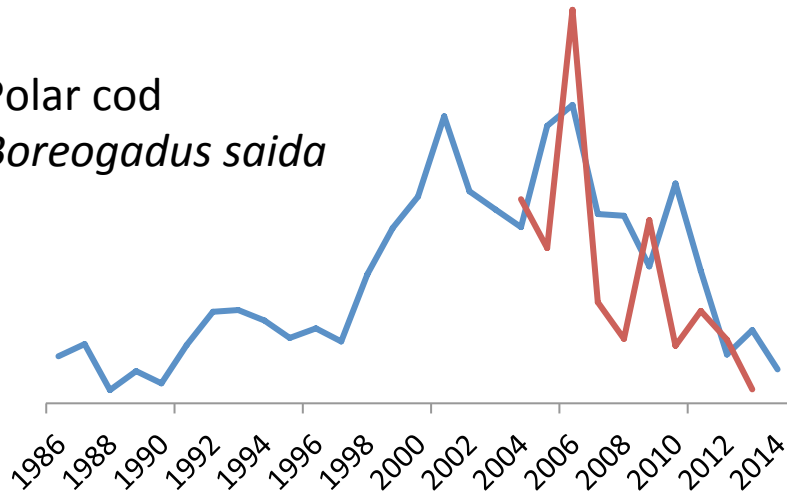


•Causes of capelin decline are high consumption by cod combined with low individual growth,

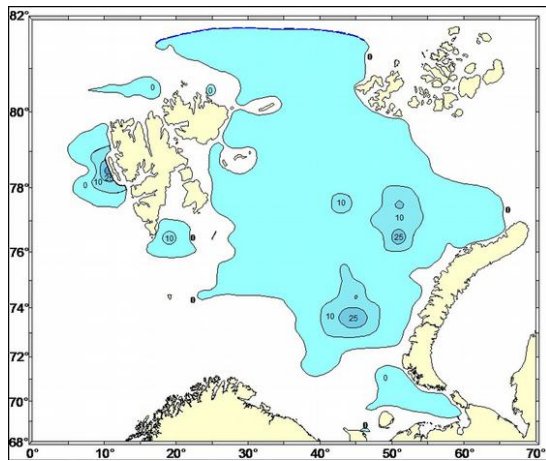
In addition to relatively low recruitment (low 0 group index in 2014).



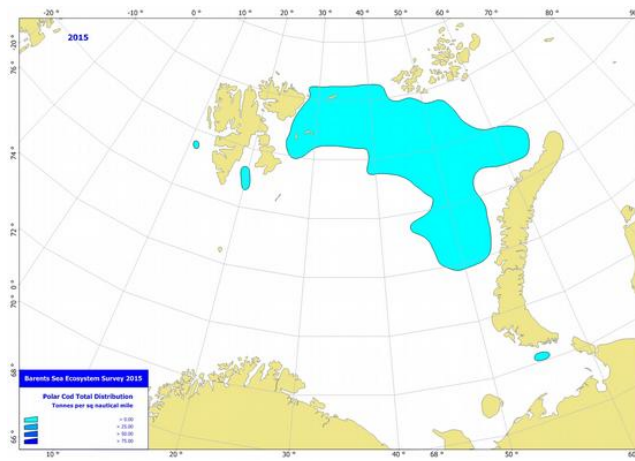
Polar cod  
*Boreogadus saida*



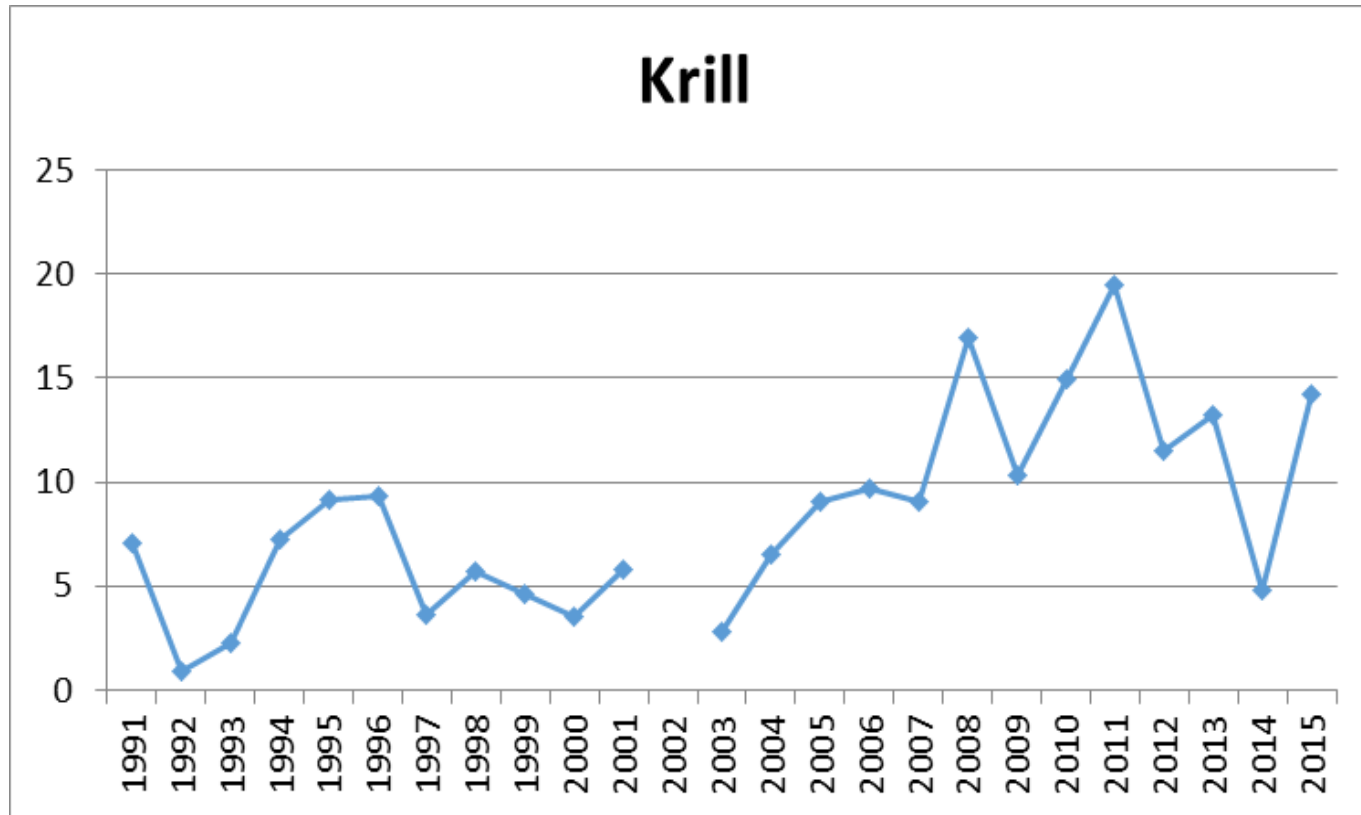
2004



2015



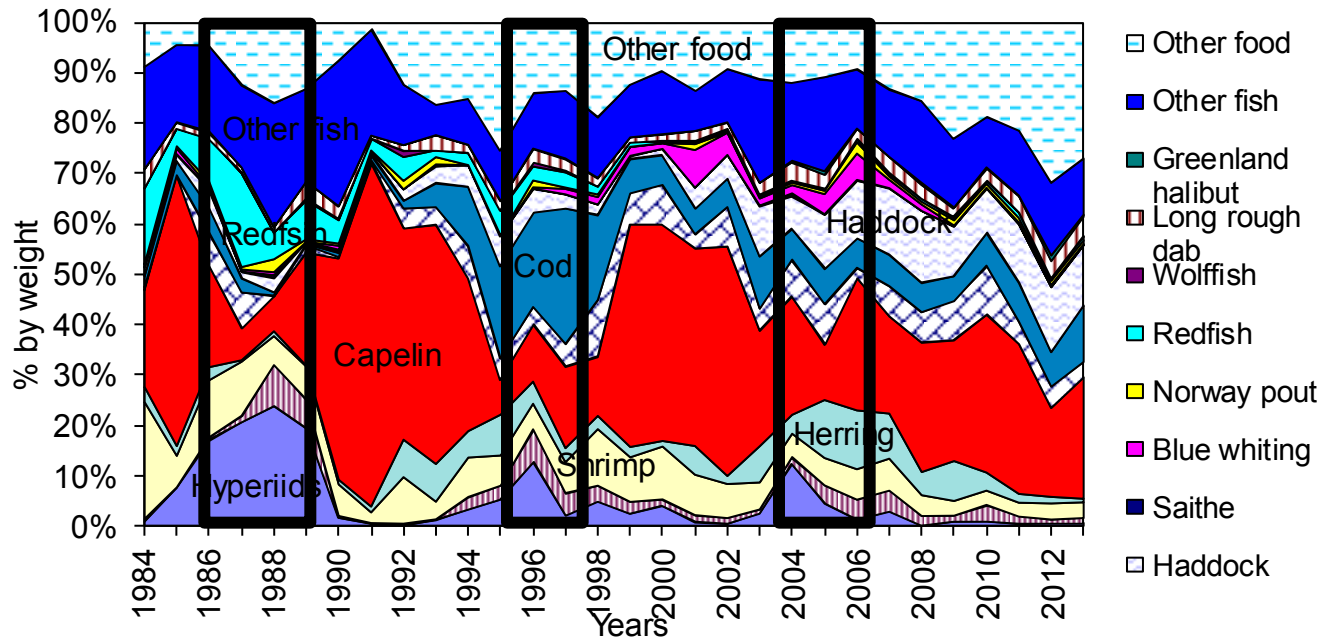
# Krill



Krill biomass – million tonnes

- Both capelin and polar cod stocks are at very low levels with negative impact on the piscivores in the Barents Sea
- Since polar cod is a key species in the Arctic food web, consequences here will be substantial
- Cod has to compensate the loss of capelin by feeding on alternative prey

### COD DIET



- Since the cod stock is large the consequences for the Barents Sea food web are potentially large

# Barents Sea abiotic 1986-2015

