The Barents Sea state, drivers and pressure

ICES WGIBAR's co-chair
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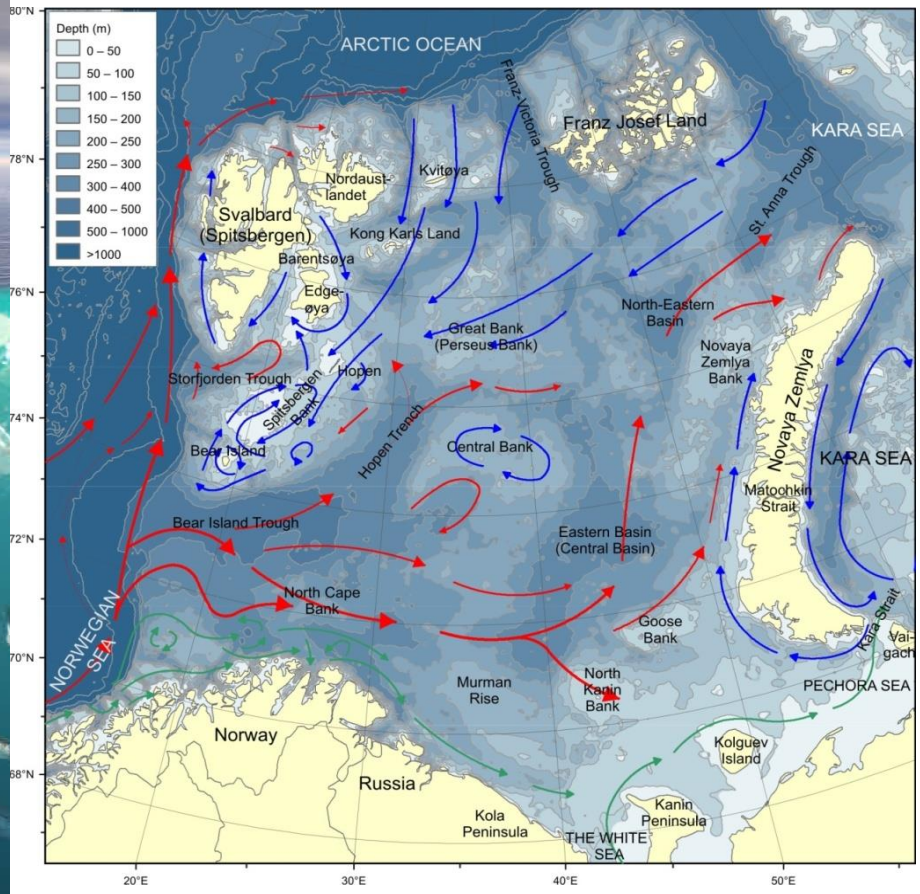
The Global Fishery Forum,
14–15 September 2017, St. Petersburg, Russia

The Barents Sea



The Barents Sea is a shelf sea (~ 1.6 million km^2) and a transition zone between Atlantic and Arctic conditions

A productive area, with more than 200 species of fish, thousands of benthic invertebrate species and diverse communities of plankton, seabirds and marine mammals inhabiting or visiting the area

The Barents Sea ecosystem has been strongly influenced by fishing and the hunting of marine mammals. More recently, human activities include transportation of goods, oil and gas, tourism, and aquaculture.

ICES WGIBAR

ICES Working Group on the Integrated Assessments of the Barents Sea (WGIBAR) was established in 2014

conducts and develops integrated ecosystem assessments

summarize and analyze up-to-date knowledge on the state of and changes for the Barents Sea ecosystem.

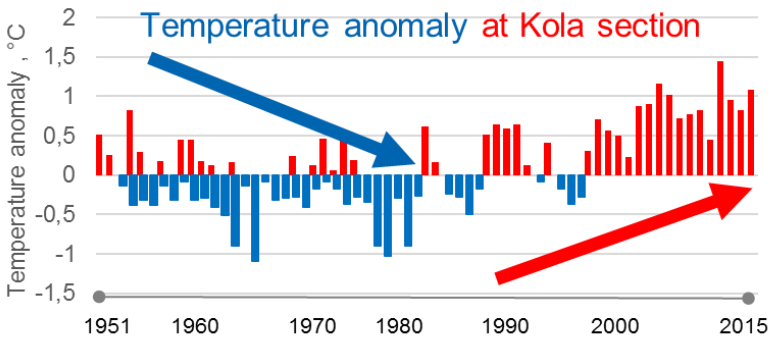
will assist adaptive management by promoting input to monitoring strategies and advice as part of holistic Barents Sea management

Norway and Soviet agreed on a special attention on conservation and sustainable use of marine living resources and coordination of research in the area (The Convention on Fishing in the North-East Atlantic, 1959)

Since 1960s, Norway and Russia conduct a large scale monitoring

Huge national effort and international cooperation resulted unique large scale monitoring and long time series

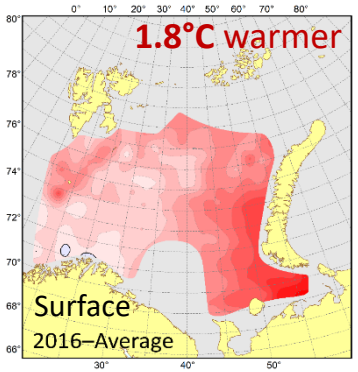
Oceanography

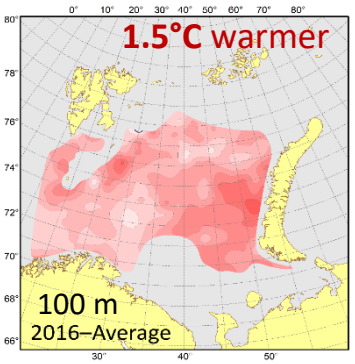


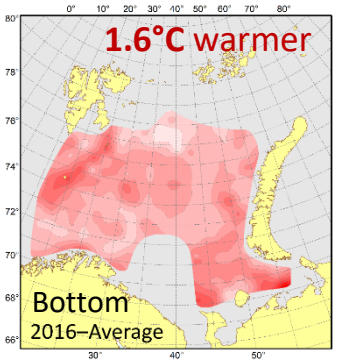
A cold period from the 1960s into the 1980s, and has since been on a warming trend

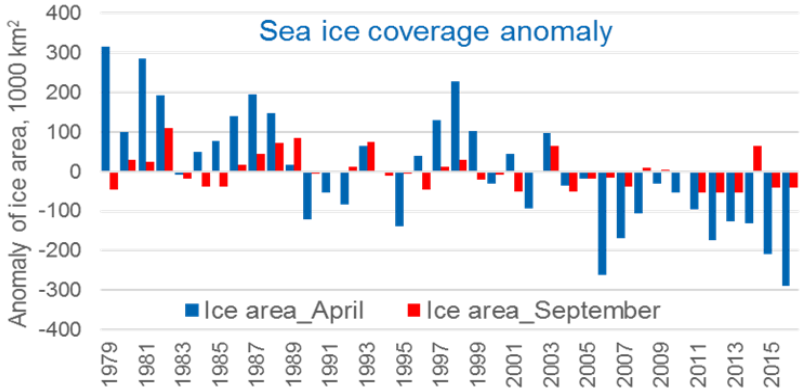
2016 is record warm

Anomalies (°C) in August–September 2016









Reduction in the winter sea ice (typically in April), with a loss of about half the area of winter sea ice during the warming

Pelagic compartment

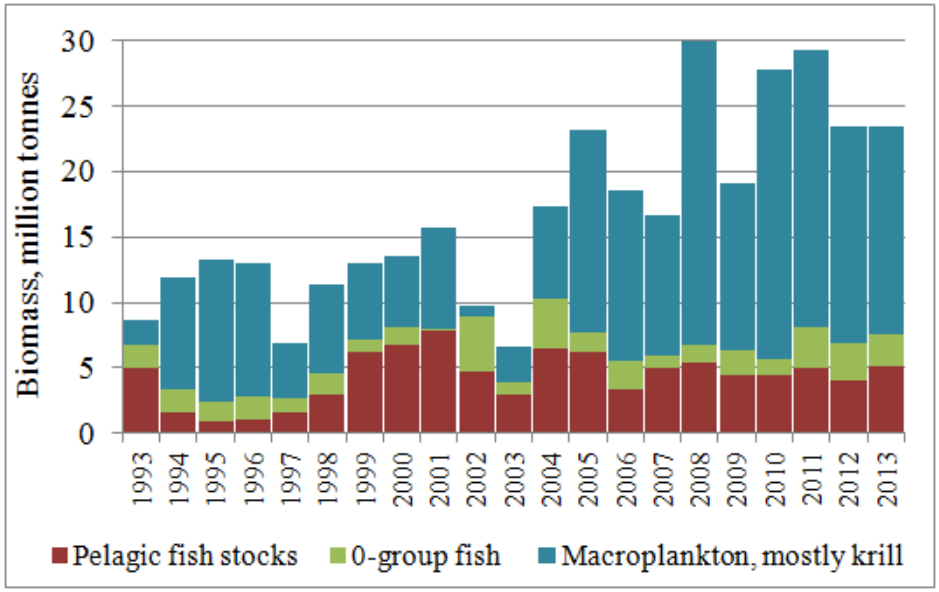


Figure shows estimated biomass (million tonnes wet weight) of the pelagic compartment in the Barents Sea from 1993 to 2013

The ongoing warming, associated with higher temperature and larger area of relative warm Atlantic water masses influenced the pelagic compartment by

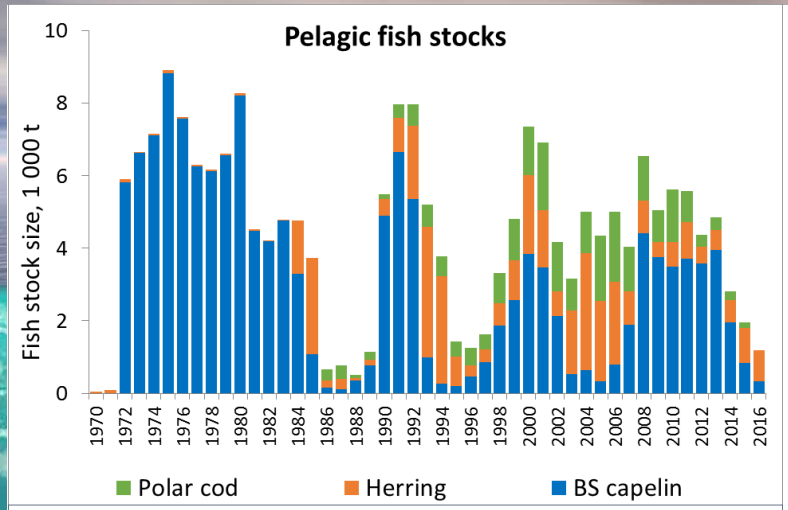
- increase of biomass
- larger distribution of macroplankton and 0-group fish
- distribution shift

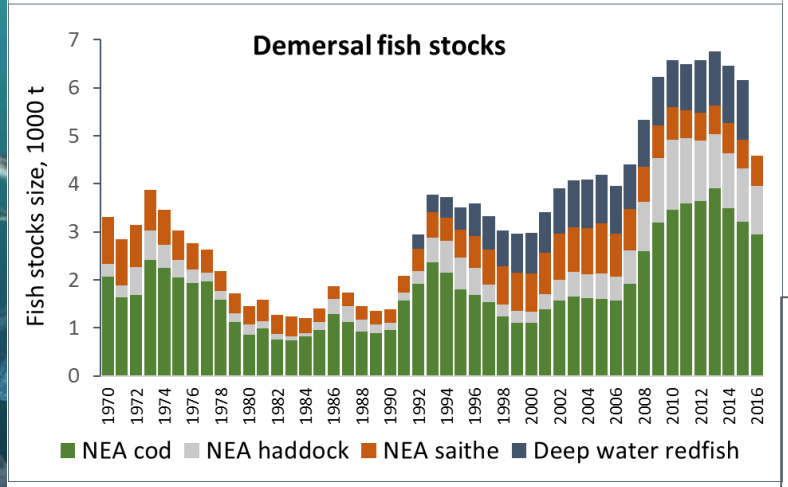
Determine the effects of the recent warming on the pelagic compartment

The pelagic compartment becomes more productive during the 2000s

- more food for predators
- secure development of fish stocks

Fish stocks



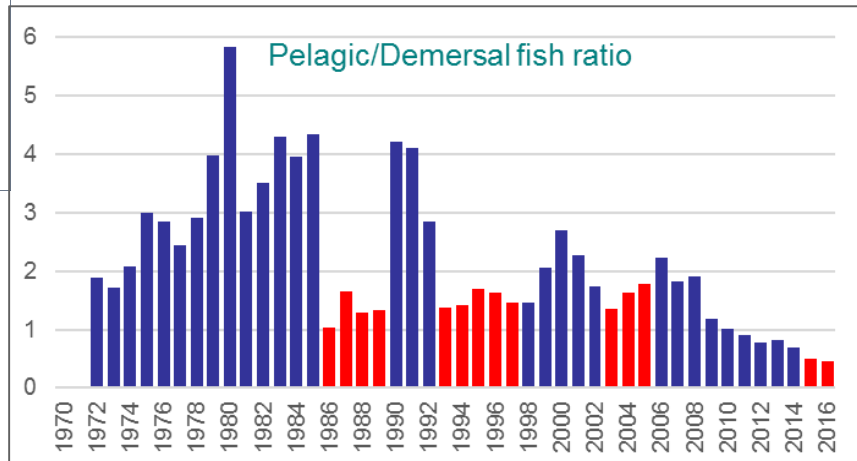


Total biomass of pelagic fish stocks was generally high in 2000s.

Decrease of pelagic fish stocks since 2009

The cumulative biomass of demersal fish was highest in 2012-2013, and now tends to decrease

More predators in the system than forage fish



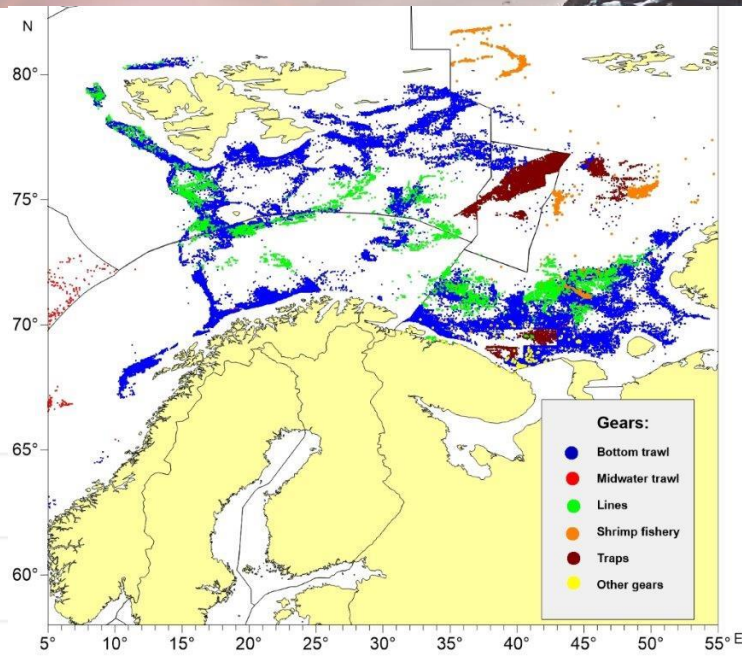
Pelagic to demersal biomass ratio.
Capelin collapse shown in red.

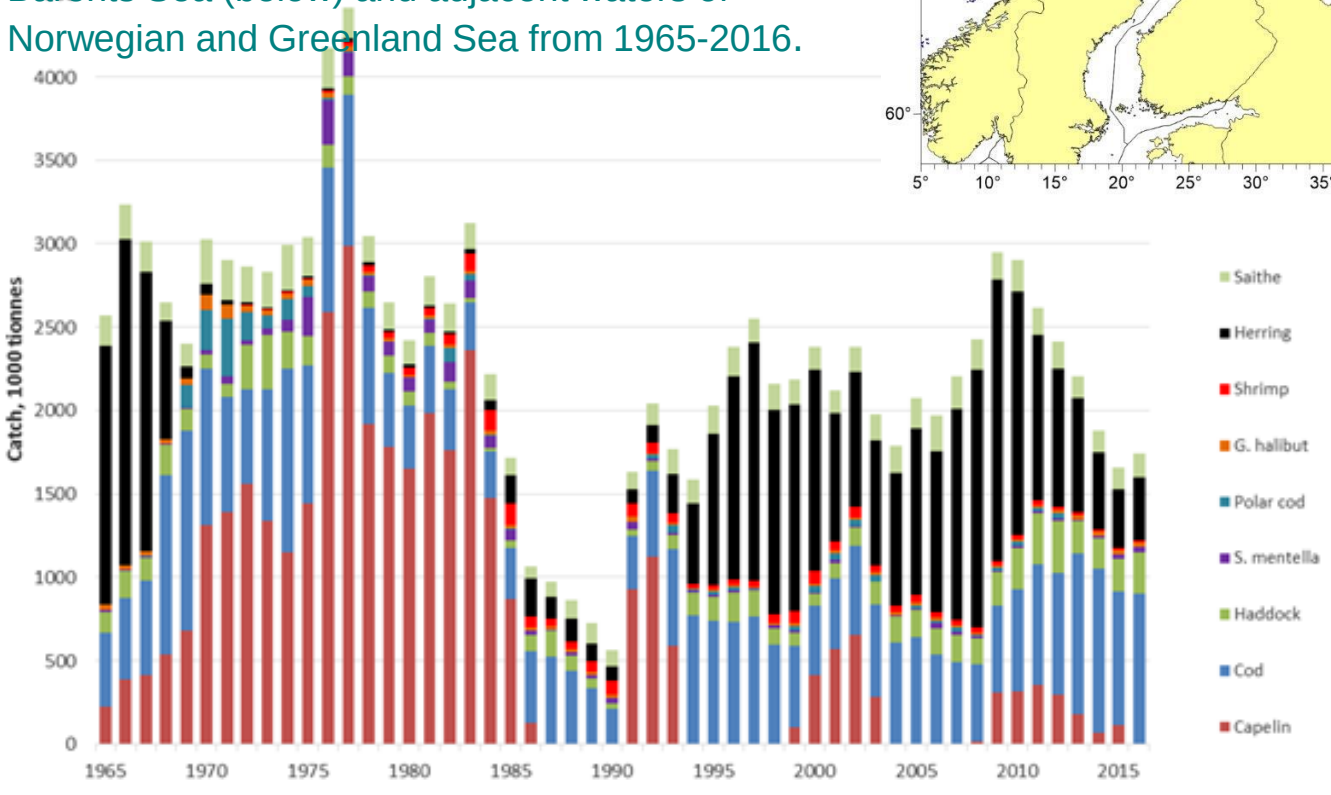
Fishing activity

Fishing is the largest human impact on the fish stocks in the Barents Sea, and thereby on the functioning of the whole ecosystem

The most widespread gear used in the Barents Sea is bottom trawl. The pelagic fisheries use purse seine and pelagic trawl.

Total catches of the most important stocks in the Barents Sea (below) and adjacent waters of Norwegian and Greenland Sea from 1965-2016.



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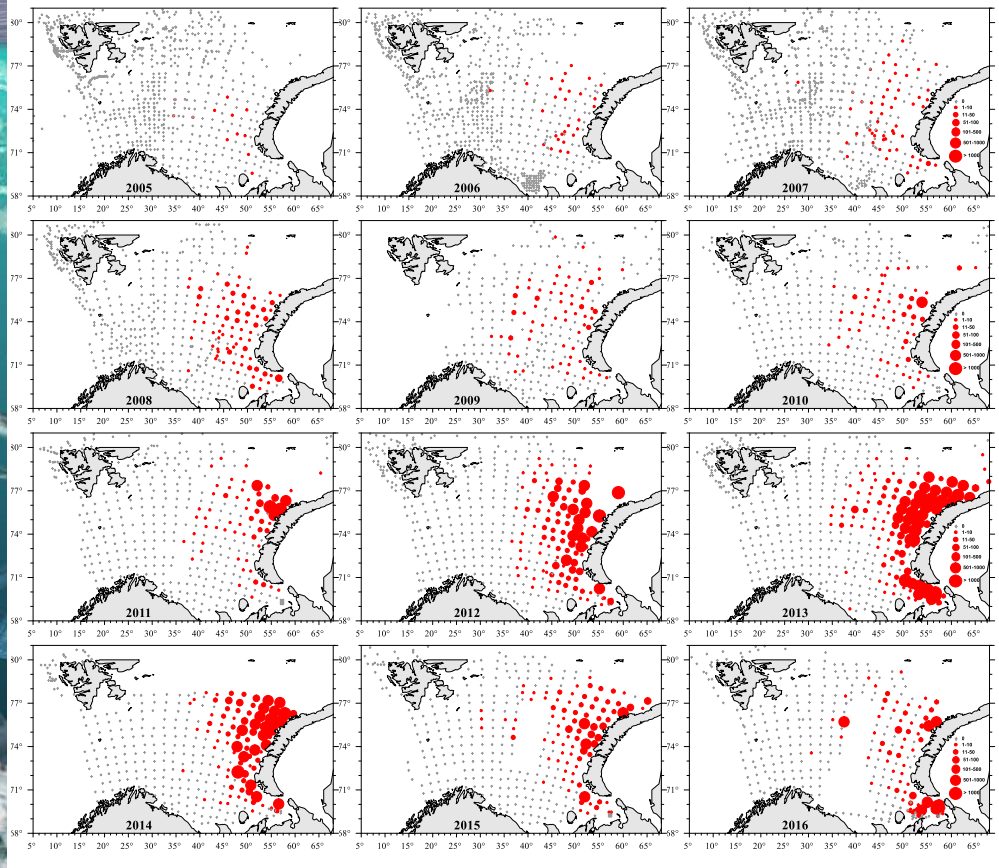
Thanks for your attention
ICES WGIBAR, Murmansk, Russia, March 2017

New species in the Barents Sea

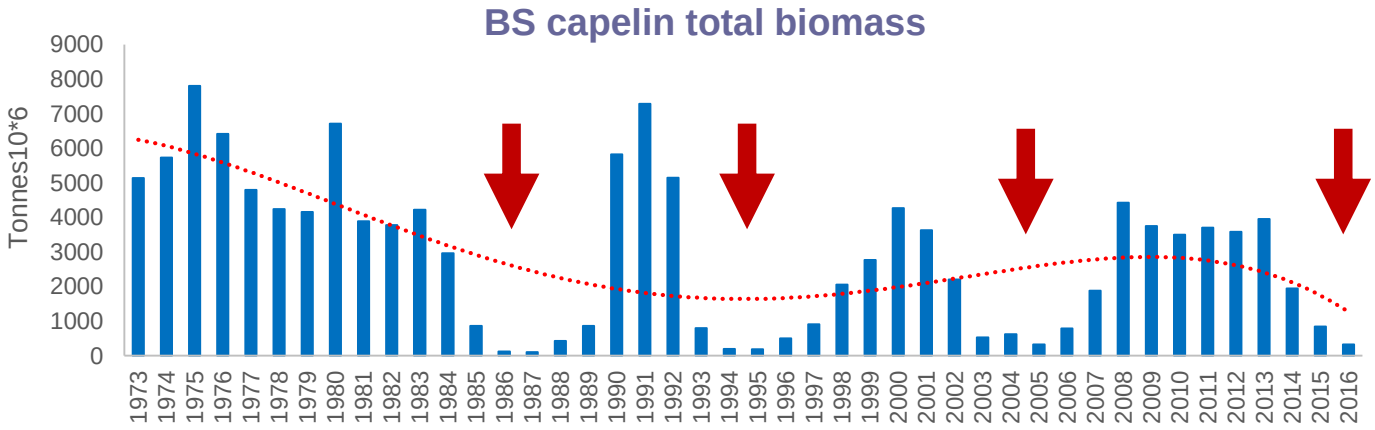
The snow crab population reached 4346 million individuals in 2012



The temperature is the strongest factor limiting the spread of the snow crab to the south and western part of the Barents Sea

Snow crab became a rather important prey items for cod, especially in eastern Barents Sea alongside Novaya Zemlya

Trophic interactions



The capelin stock tolerated a high grazing pressure from large cod stock in years between 3. and 4. collapse due to good recruitment at 0-group and occurrence of other prey items

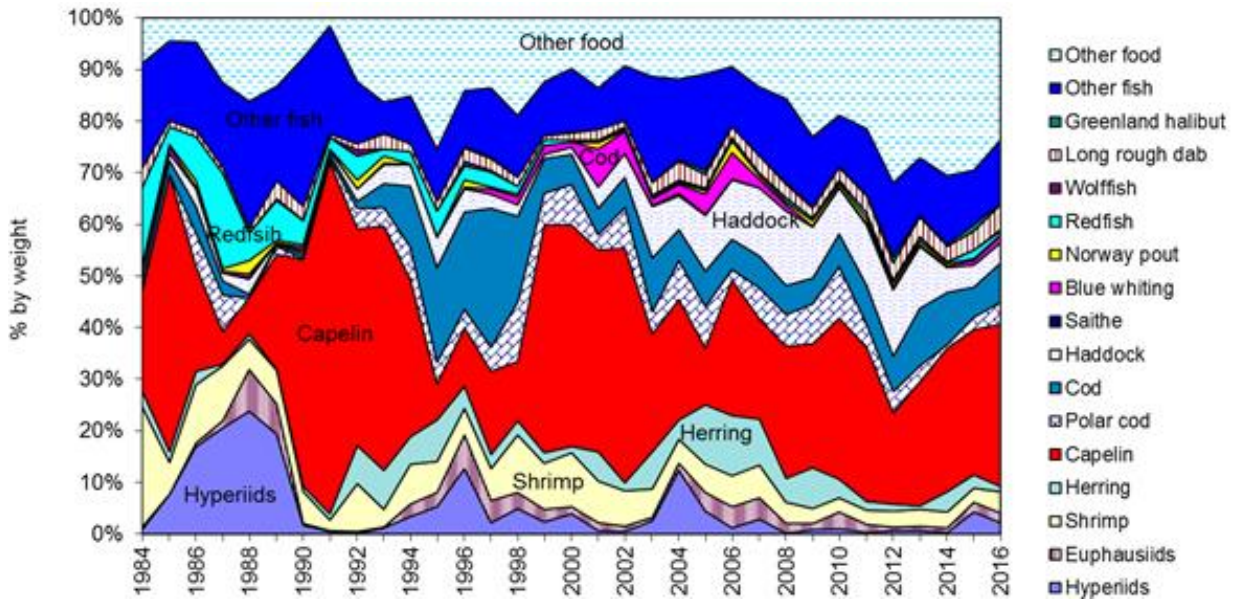
- ✓ decrease in individual growth rate and condition of capelin observed until 2014 for the large capelin stock caused by reduced food availability
- ✓ larger overlap with cod
- ✓ still high predation pressure from cod
- ✓ increased mortality both from age 0-1 and on older capelin

Led to capelin collapse in 2014 and still low level two years after

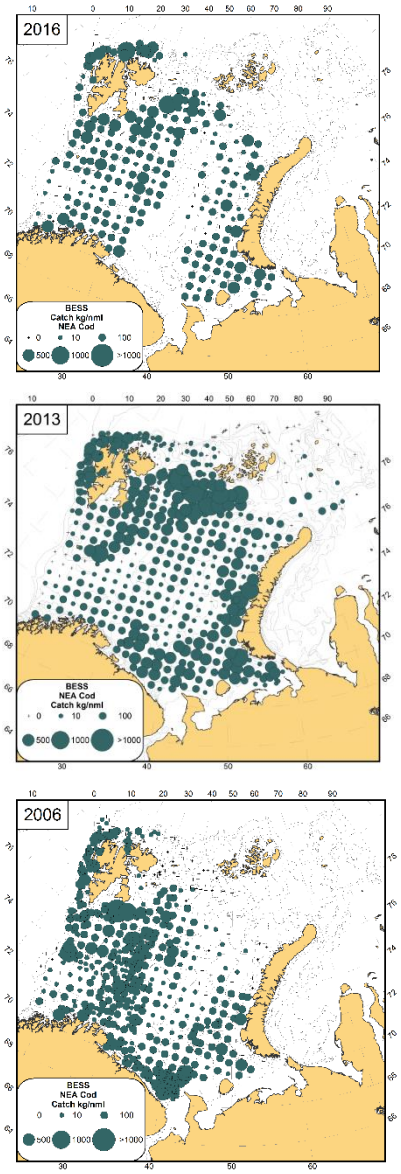
Trophic interactions

Consequences of the forth collapse of capelin stock (2015-2016) on cod conditions were so far minor compared to previous collapses.

A combination of using new areas in the northern Barents Sea available for cod feeding as well as switch on new prey item allowed to cod compensate for decrease of traditional prey like capelin and polar cod under recent warming period.

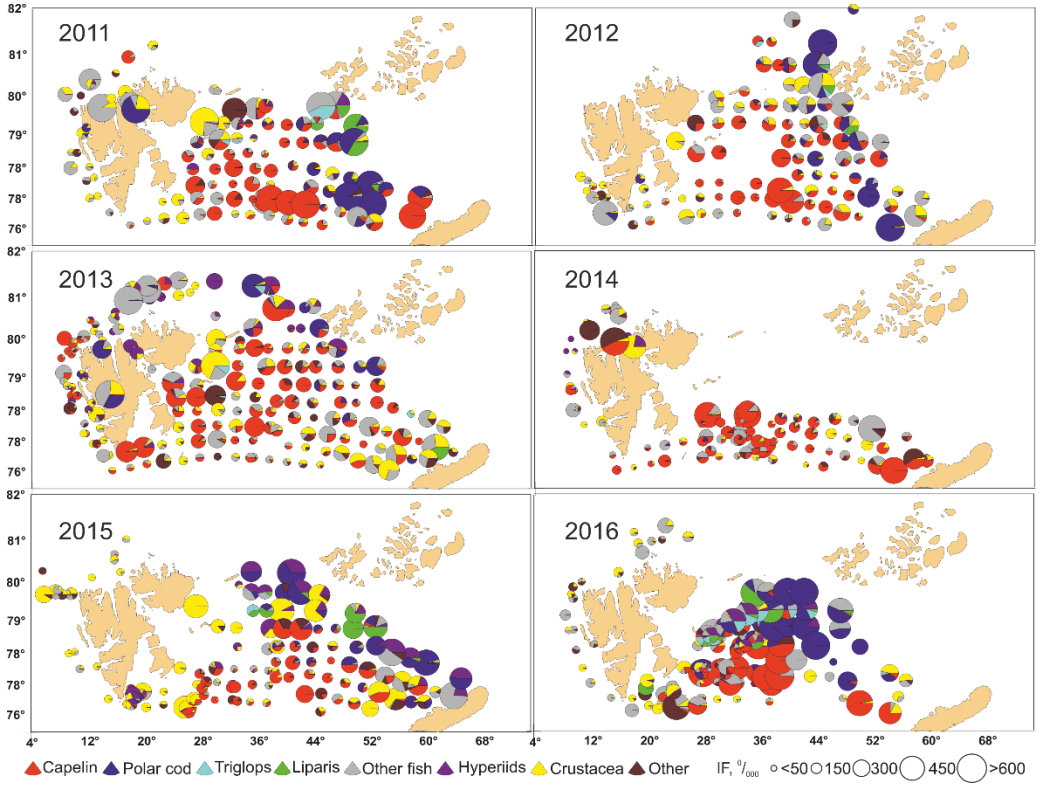


Trophic interactions



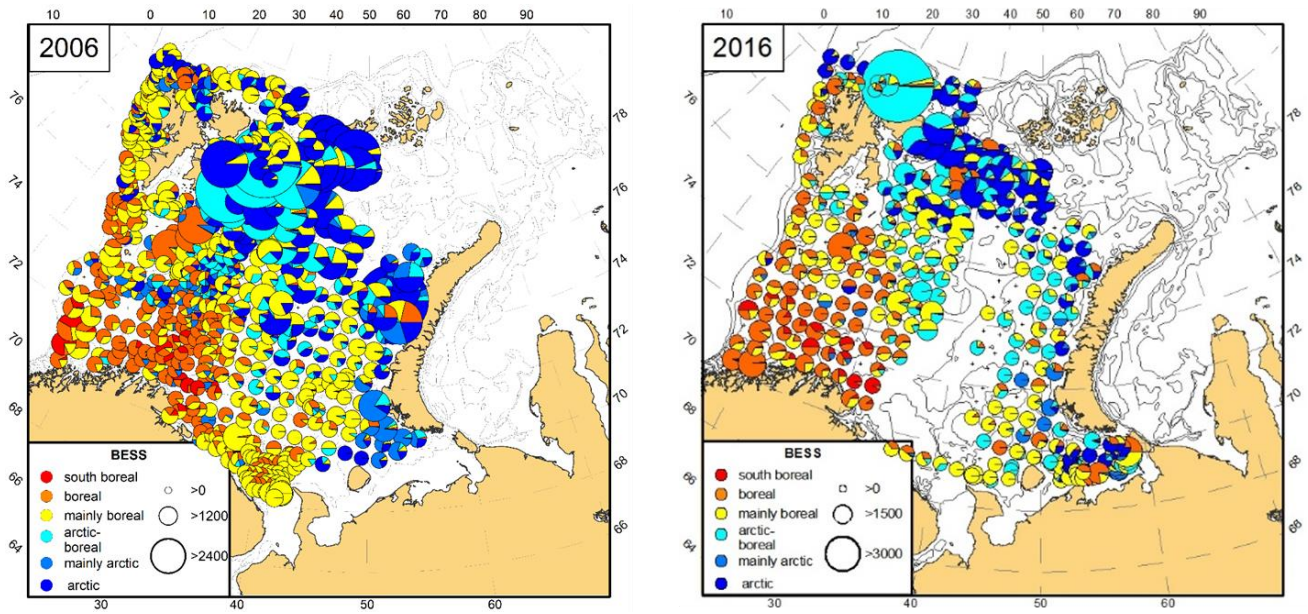
Consequences of the third collapse of capelin stock (2015-2016) on cod conditions were so far minor compared to previous collapses.

It can be related to northward expansion of cod to the northern Barents Sea with available food resources not used by cod earlier.



Restructuring of fish and benthos community

The most rapid and substantial climate driven changes are expected in regions within, or bordering, the Arctic, where rates of warming are double the global average



Reduced average catches of mainly arctic and arctic fish species

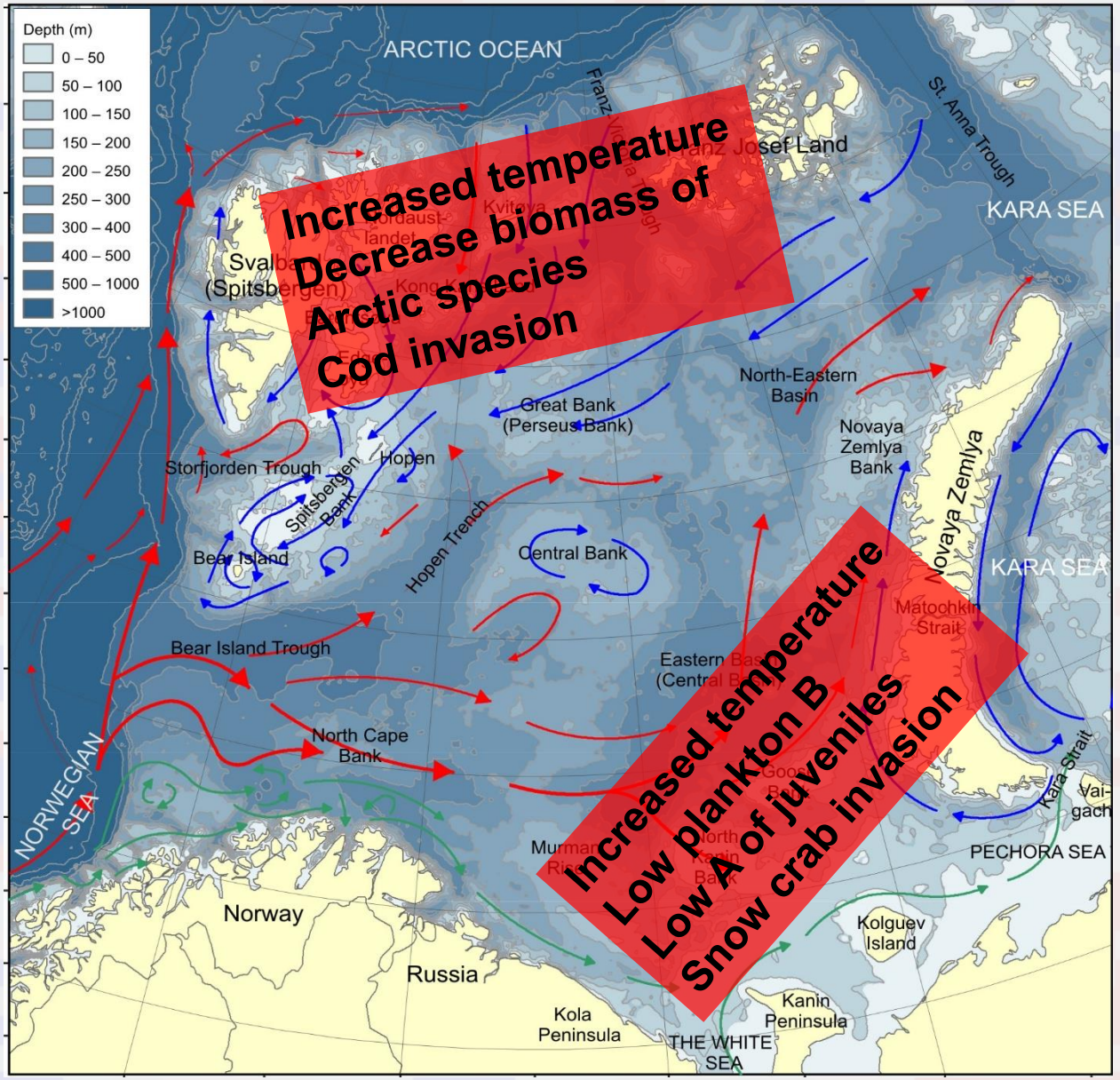
Reduced distribution of arctic fish community in the eastern Barents sea and west of Svalbard

Consequences

Restructuring of fish and benthos community

Worse feeding conditions for seasonally migrating predators

Warning


Depth (m)
0 – 50
50 – 100
100 – 150
150 – 200
200 – 250
250 – 300
300 – 400
400 – 500
500 – 1000
>1000
ARCTIC OCEAN
Franz Josef Land
St. Anna Trough
KARA SEA
Svalbard (Spitsbergen)
Increased temperature
Decrease biomass of
Arctic species
Cod invasion
North-Eastern Basin
Great Bank (Perseus Bank)
Novaya Zemlya Bank
Novaya Zemlya
Storfjorden Trough
Hopen
Spitsbergen Bank
Hopen Trench
Central Bank
Bear Island
KARA SEA
Matochkin Strait
Bear Island Trough
Eastern Basin (Central Basin)
Increased temperature
Low plankton B
Low A of juveniles
Snow crab invasion
North Cape Bank
NORWEGIAN SEA
Kara Strait
Vai-gach
PECHORA SEA
Norway
Russia
Kolguev Island
Kola Peninsula
Kanin Peninsula
THE WHITE SEA