

 **MARINE & FRESHWATER
RESEARCH INSTITUTE**
Iceland



Climate change effects on the linkages between environmental factors, zooplankton and pelagic fish in the Norwegian Sea



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ICELAND



Reason for study & aim

Changes in the past two decades in:

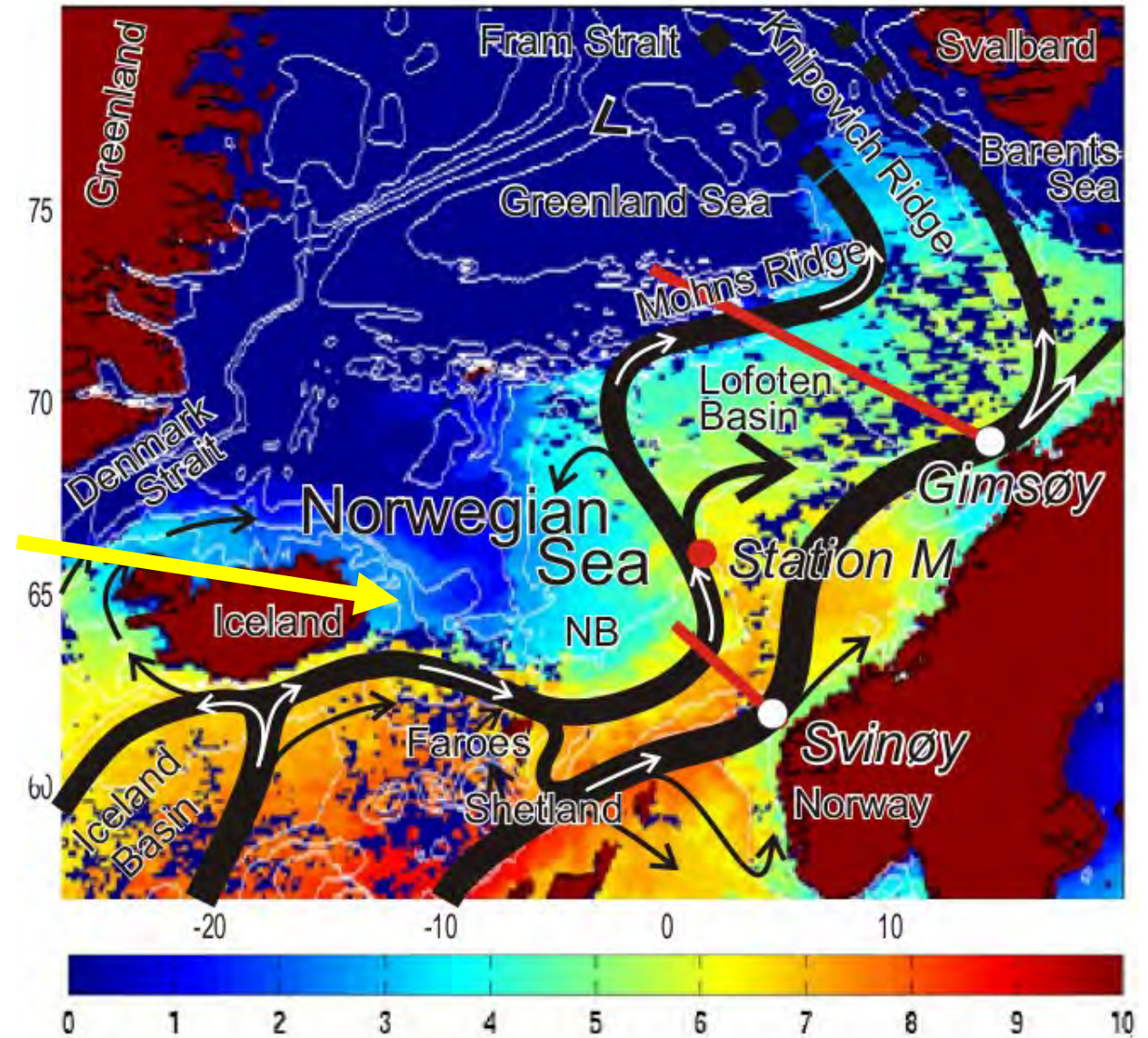
- Environmental factors in the Norwegian Sea Ecosystem
- Zooplankton biomass
- The migration route of pelagic fish

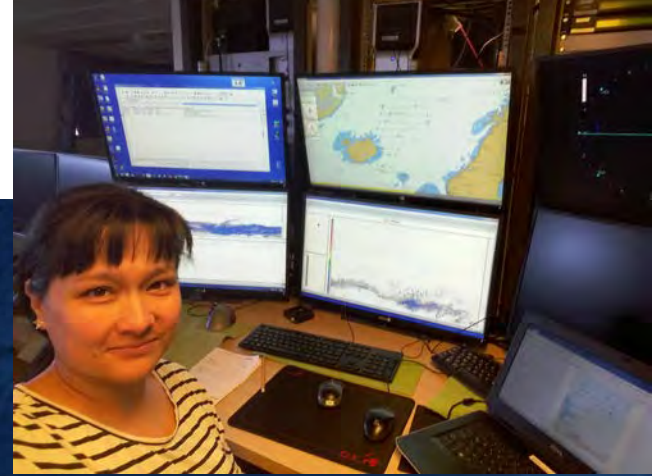
Aim

- Identify longterm shifts and changes in species composition and abundance in relation to environmental factors using samples and data collected 1995-2017
- Fundamental players: Pelagic fish stocks, zooplankton, phytoplankton

Research area

- The oceanic ecosystem east of Iceland is characterized by dramatic conditions
- Cold and low saline polar currents (EIC) from the north meet warm and saline currents from the south (IC)
- Compare a northern area (66.1°N-68°N) to southern area (63-66°N)





Samples from a herring survey

- Cruise in May, ~20 days, since 1995
- Transects, acoustics
- Ocean samples (CTD), phytoplankton, zooplankton and pelagic fish



Acoustics to find fish, trawls

WP2 net – Zooplankton, 200, 0-50 m & 0-200 m

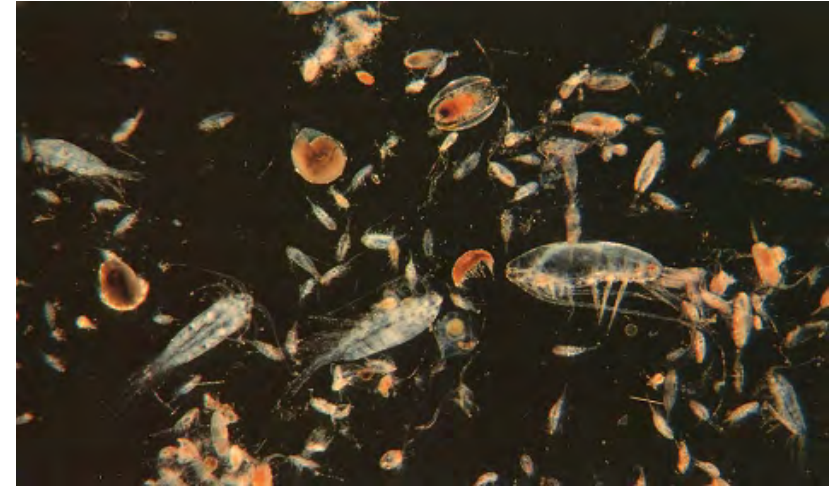
Krill net – 1000 m

CTD – temperature, salinity, phytoplankton

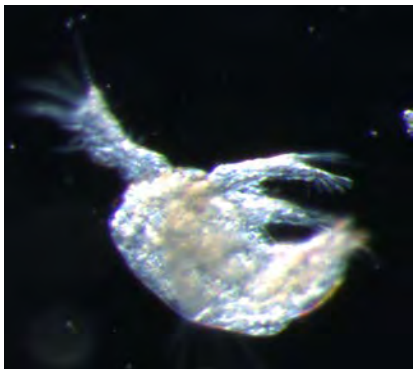


Zooplankton

- Zooplankton samples 1995-2017
- Compare north (66.1°N-68°N) to south (63-66°N) in the ocean region east of Iceland



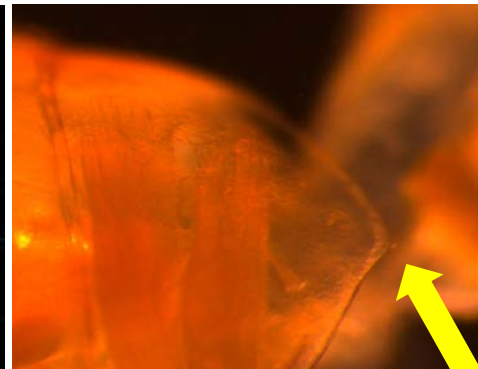
→ Currently in analysis: species identification and developmental stages



Copepoda nauplii



Calanus hyperboreus



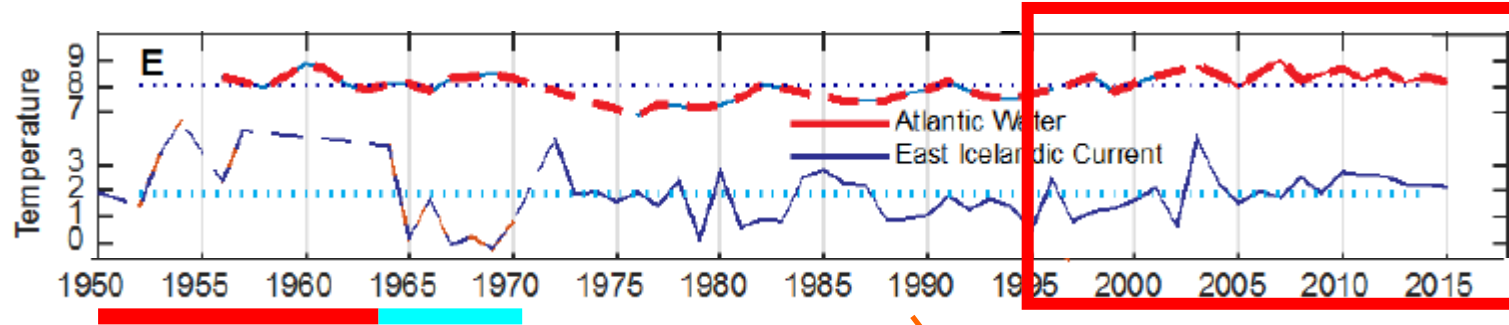
Calanus finmarchicus



Oil sac (lipids)

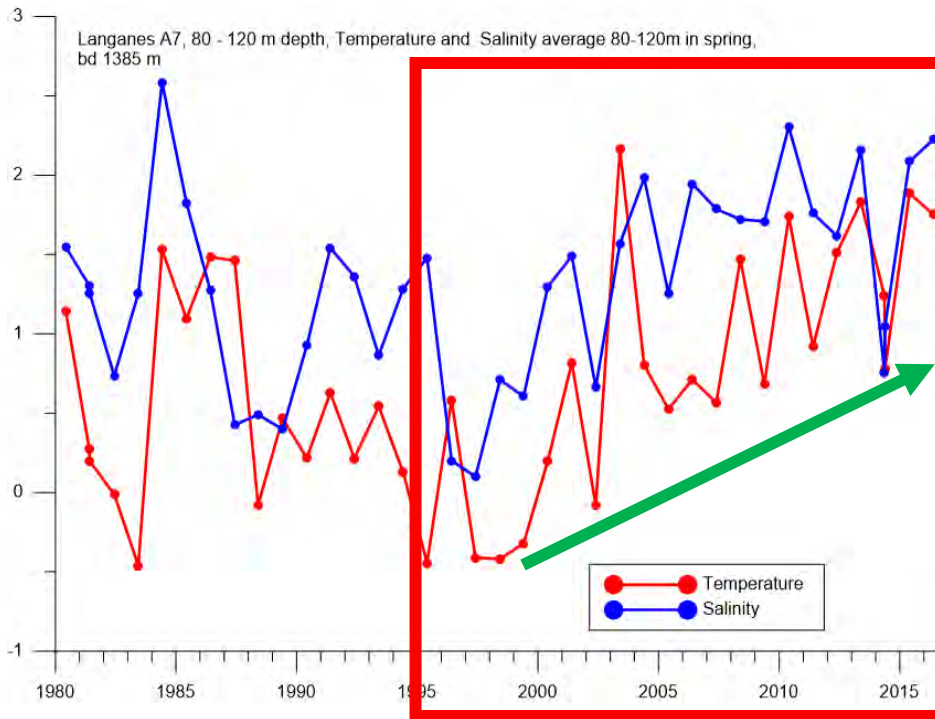
Changes in the Norwegian Sea ecosystem

Temperature in the Norwegian Sea

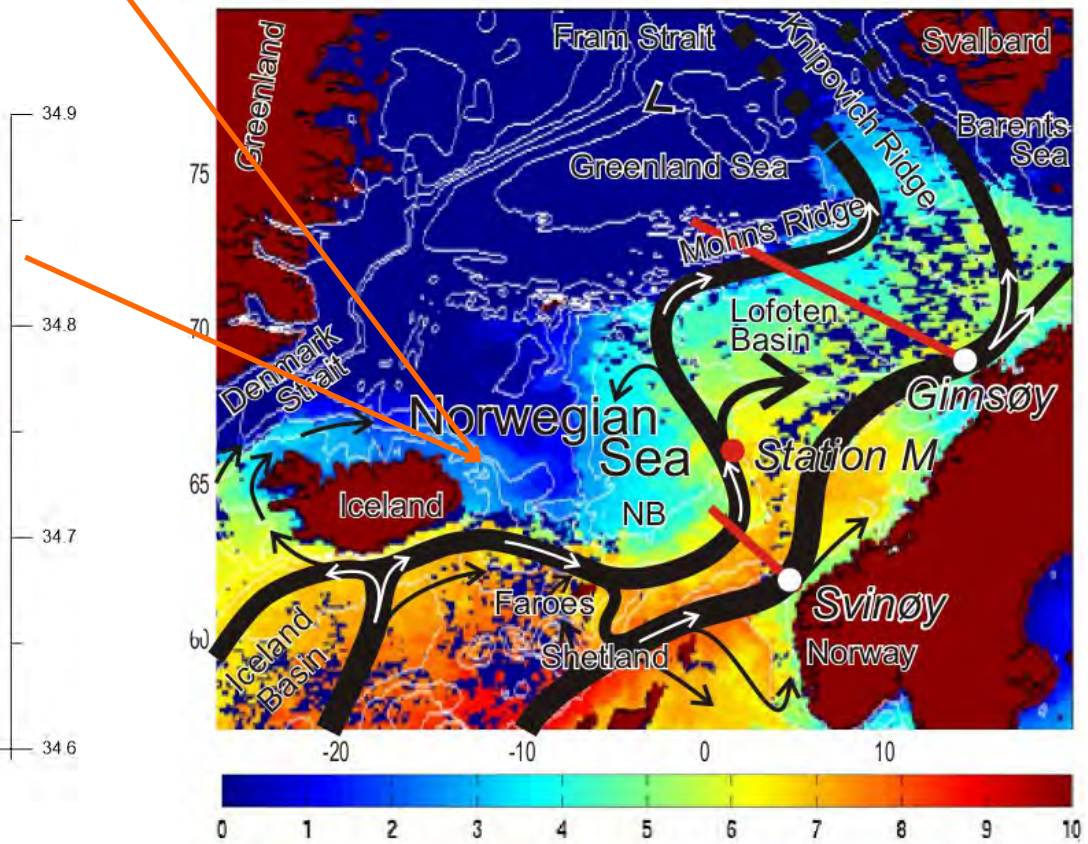


Longtime series (from ICES: International Exploration of the Sea, WGINOR 2015)

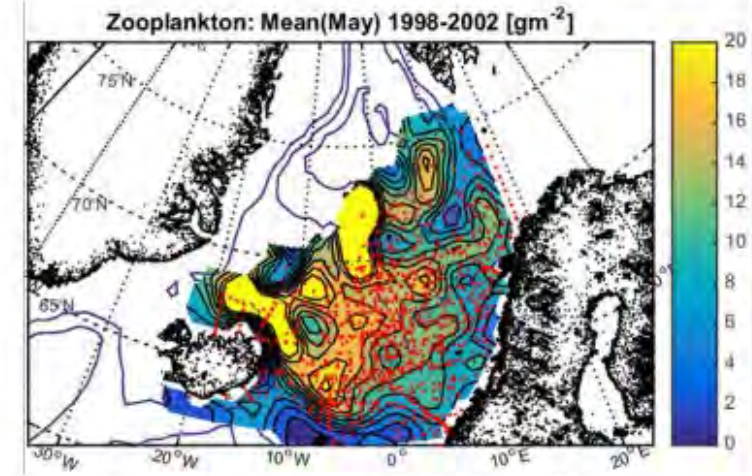
Temperature and salinity in Langesnes



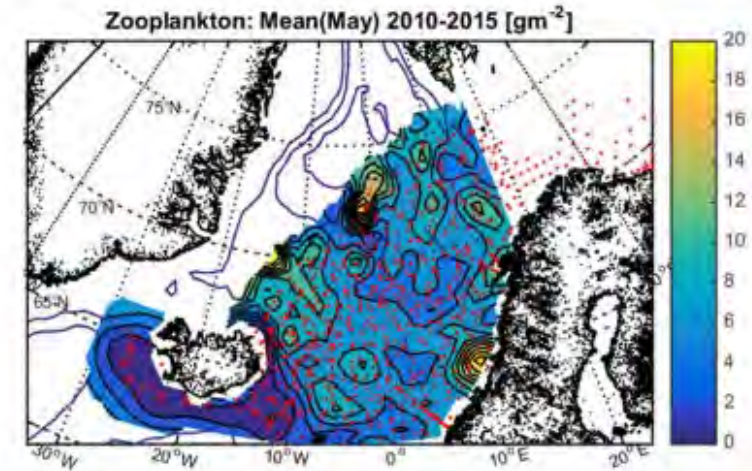
Sea temperature is higher during the latter half of the study period



Changes in zooplankton biomass 1998-2002 vs 2010-2015



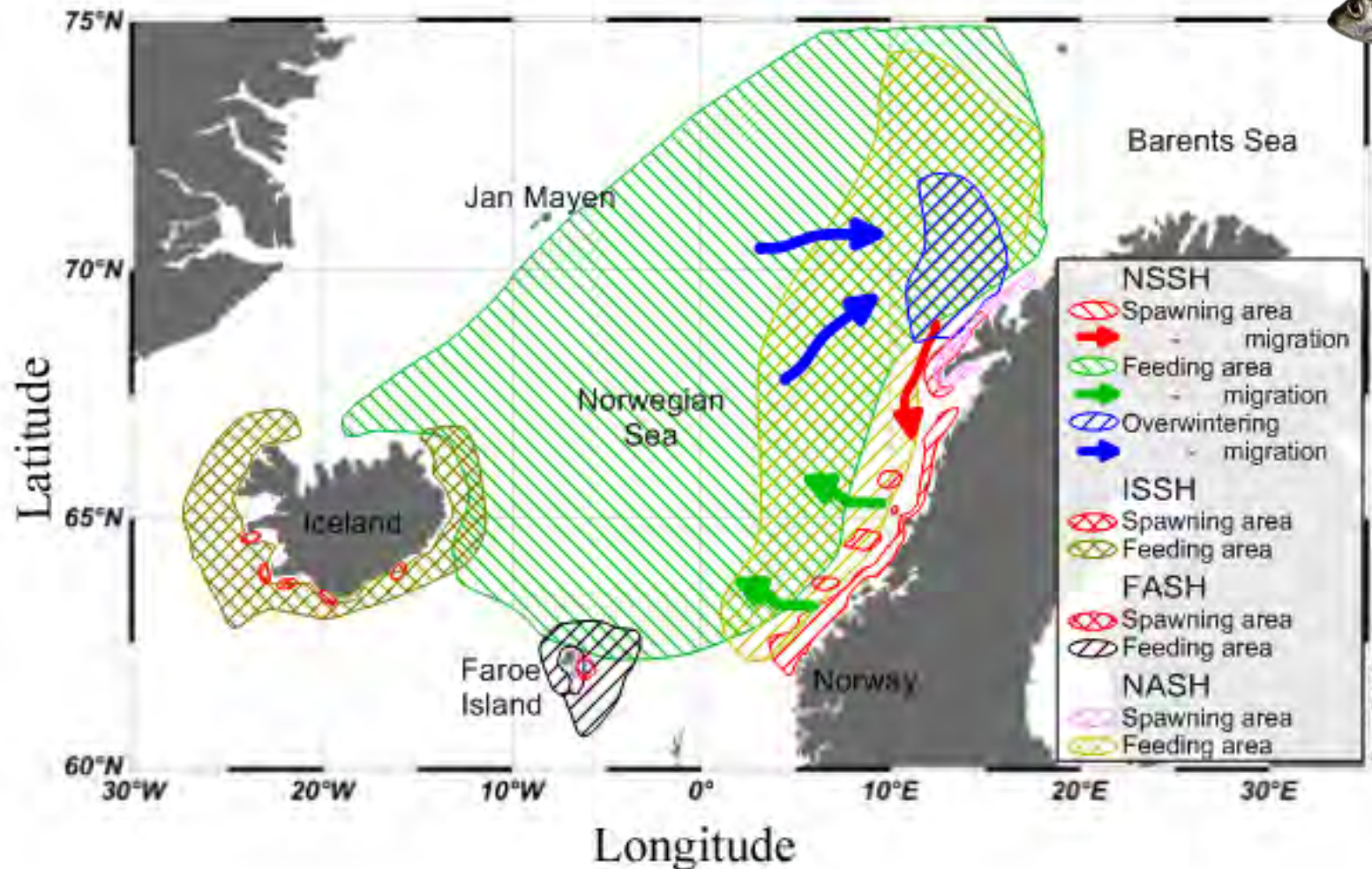
Higher
biomass
1998-2002



Figures 6.4.4 a and b. Means of zooplankton biomass (g dw m^{-2} ; WP2, 200-0 m) in the Norwegian Sea and surrounding waters. Figure representative for a) higher amounts of zooplankton biomass (1998-2002) and figure representative for b) lower amounts of zooplankton biomass (2010-2015).

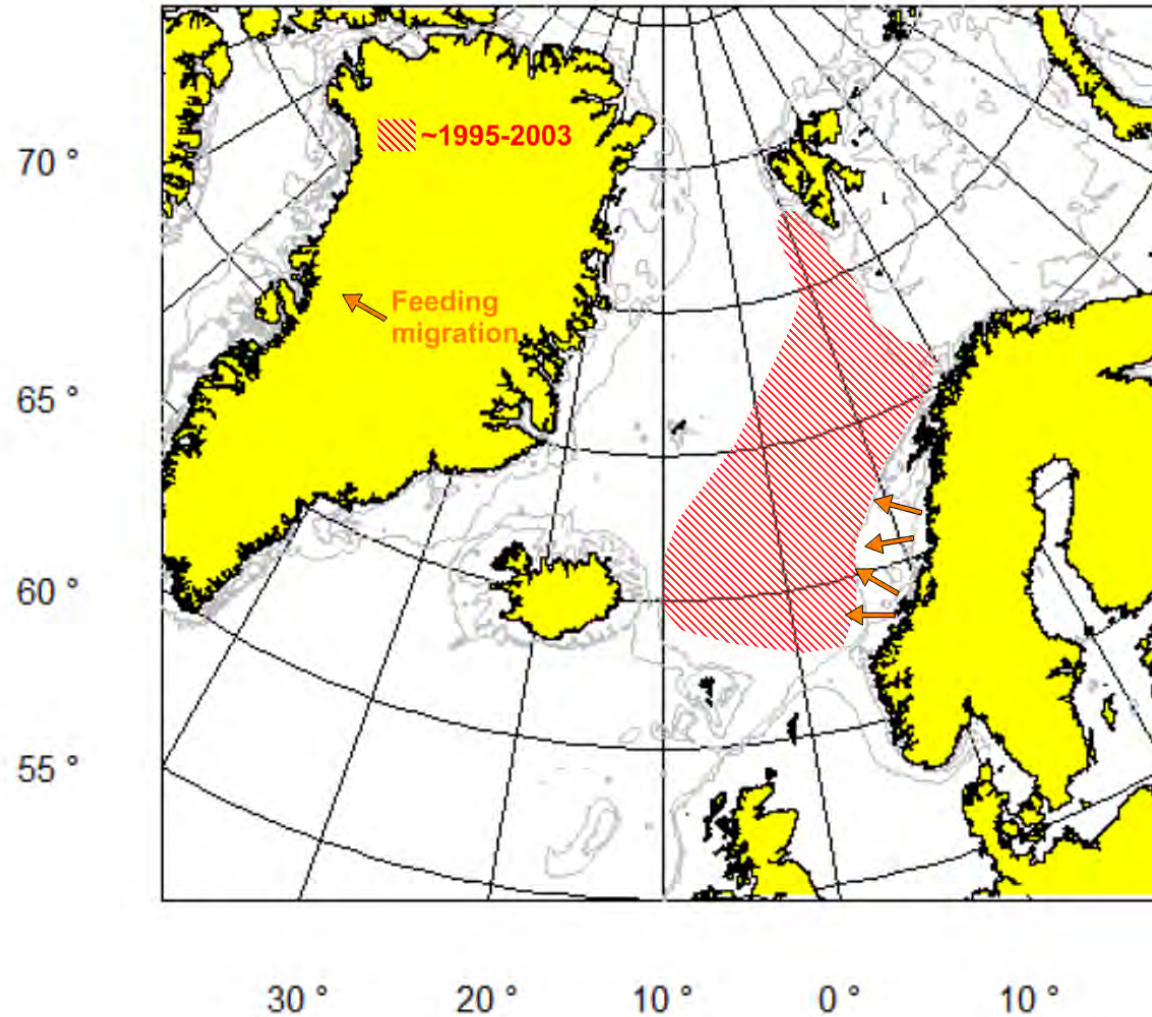
Migration route of a highly migratory pelagic fish

Norwegian spring-spawning herring (*Clupea harengus*)



Shifts in the migration route of pelagic fish

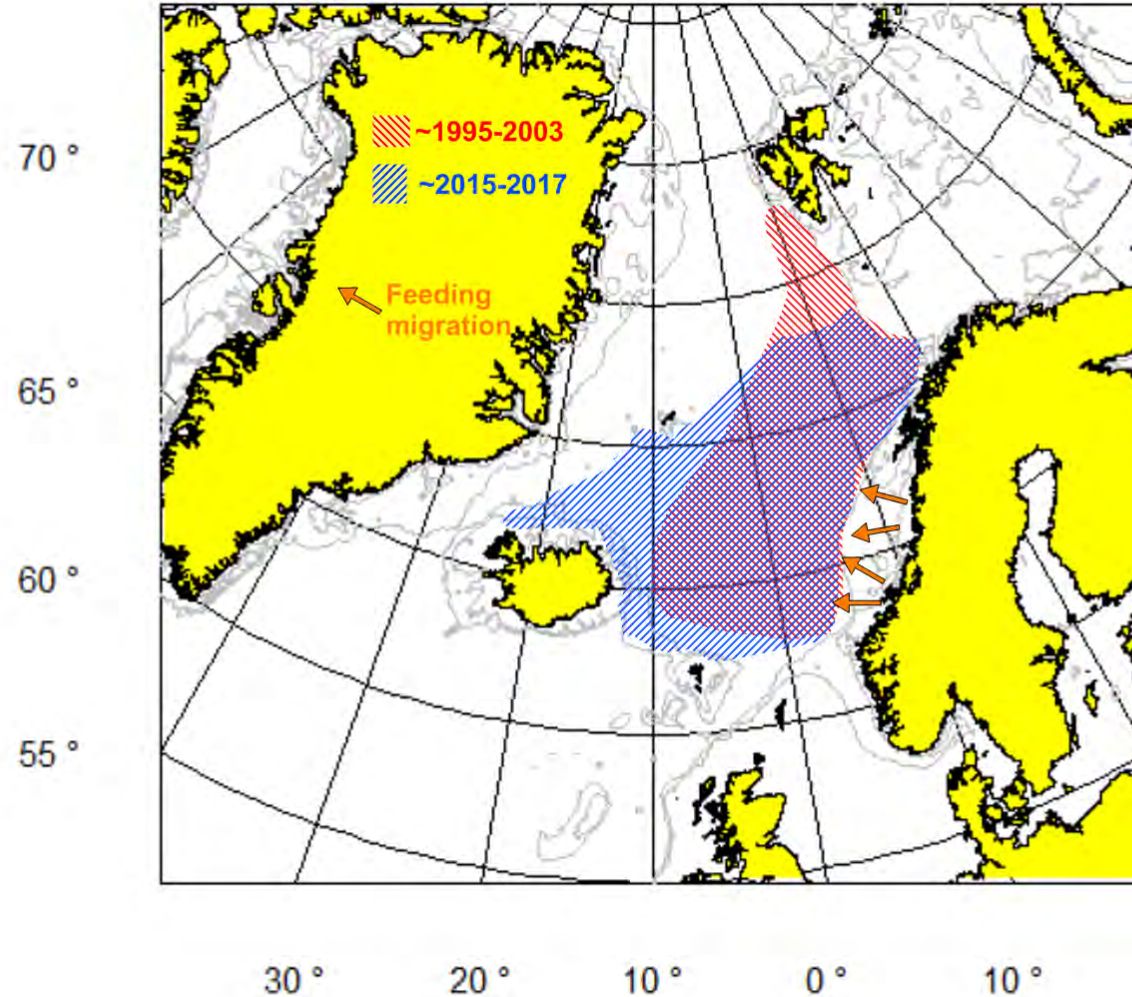
Norwegian spring-spawning herring (*Clupea harengus*)



Based on results of International research surveys (e.g. IESNS and IESSNS)

Shifts in the migration route of pelagic fish

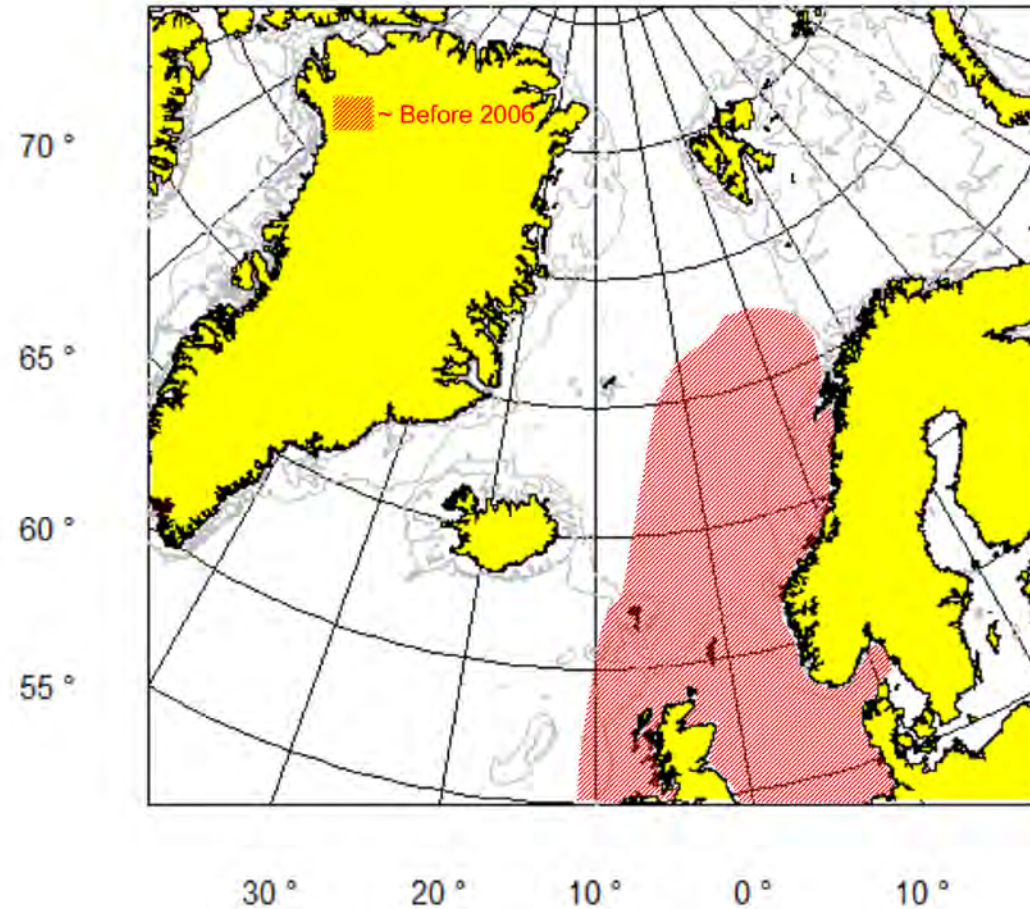
Norwegian spring-spawning herring (*Clupea harengus*)



Based on results of International research surveys (e.g. IESNS and IESSNS)

Shifts in the migration route of pelagic fish

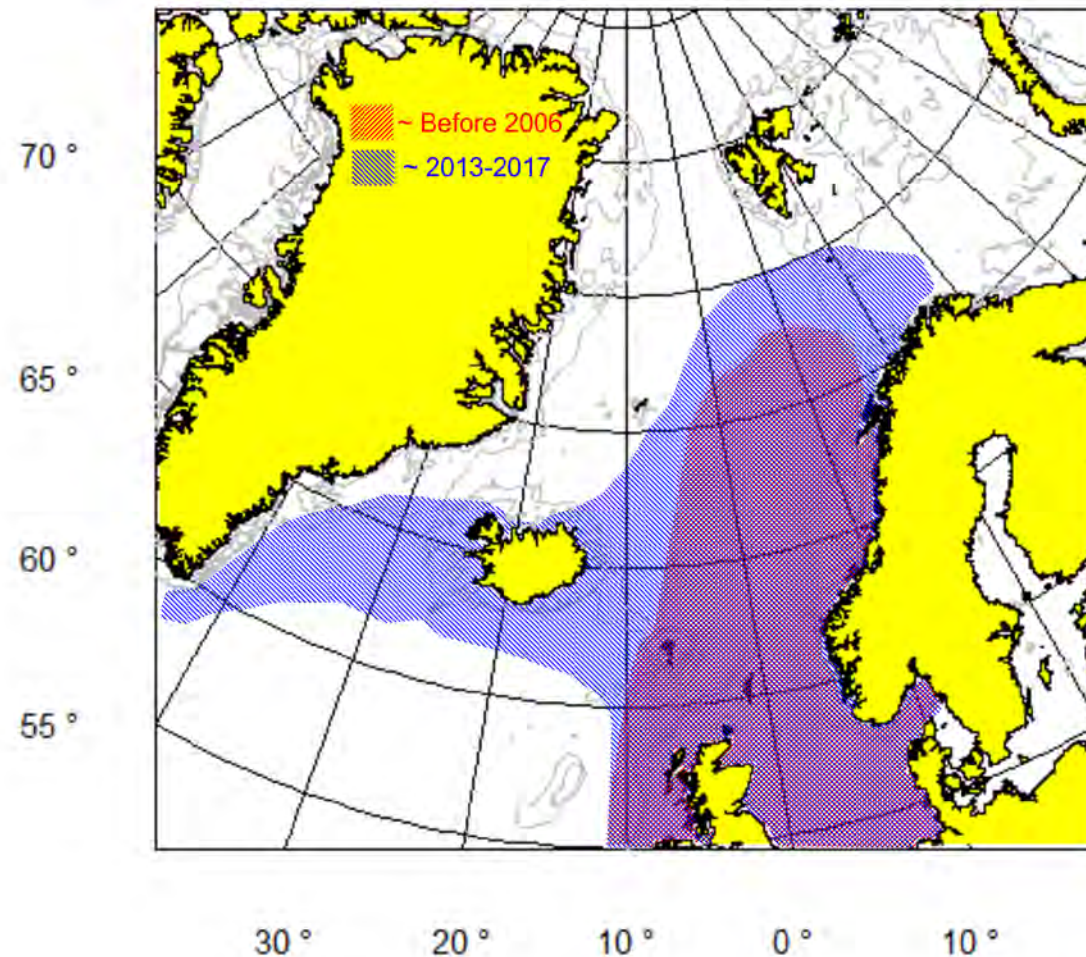
NE Atlantic mackerel (*Scomber scombrus*)



Based on results of surveys (IESSNS) and Olafsdottir et al. (2015).

Shifts in the migration route of pelagic fish

NE Atlantic mackerel (*Scomber scombrus*)

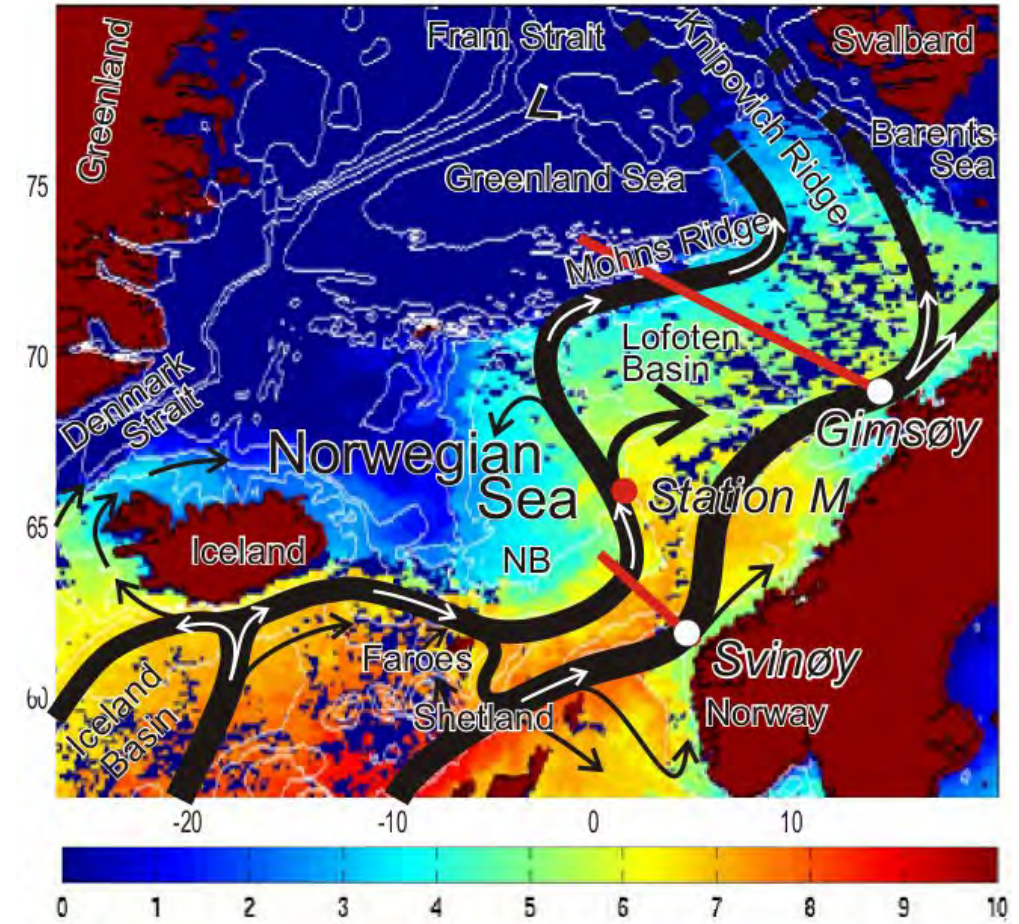


Based on results of surveys (IESSNS) and Olafsdottir et al. (2015).

First results

- Changes in zooplankton species composition
- Herring and mackerel are shifting their migration route
 - East to west of Iceland
- Temperature and salinity → variable...

→ It might get chilly in Iceland...



Orvik and Niiler, 2002



Thank you!

