

Ecological importance of Calanus in Faroese Waters and potential for sustainable harvesting

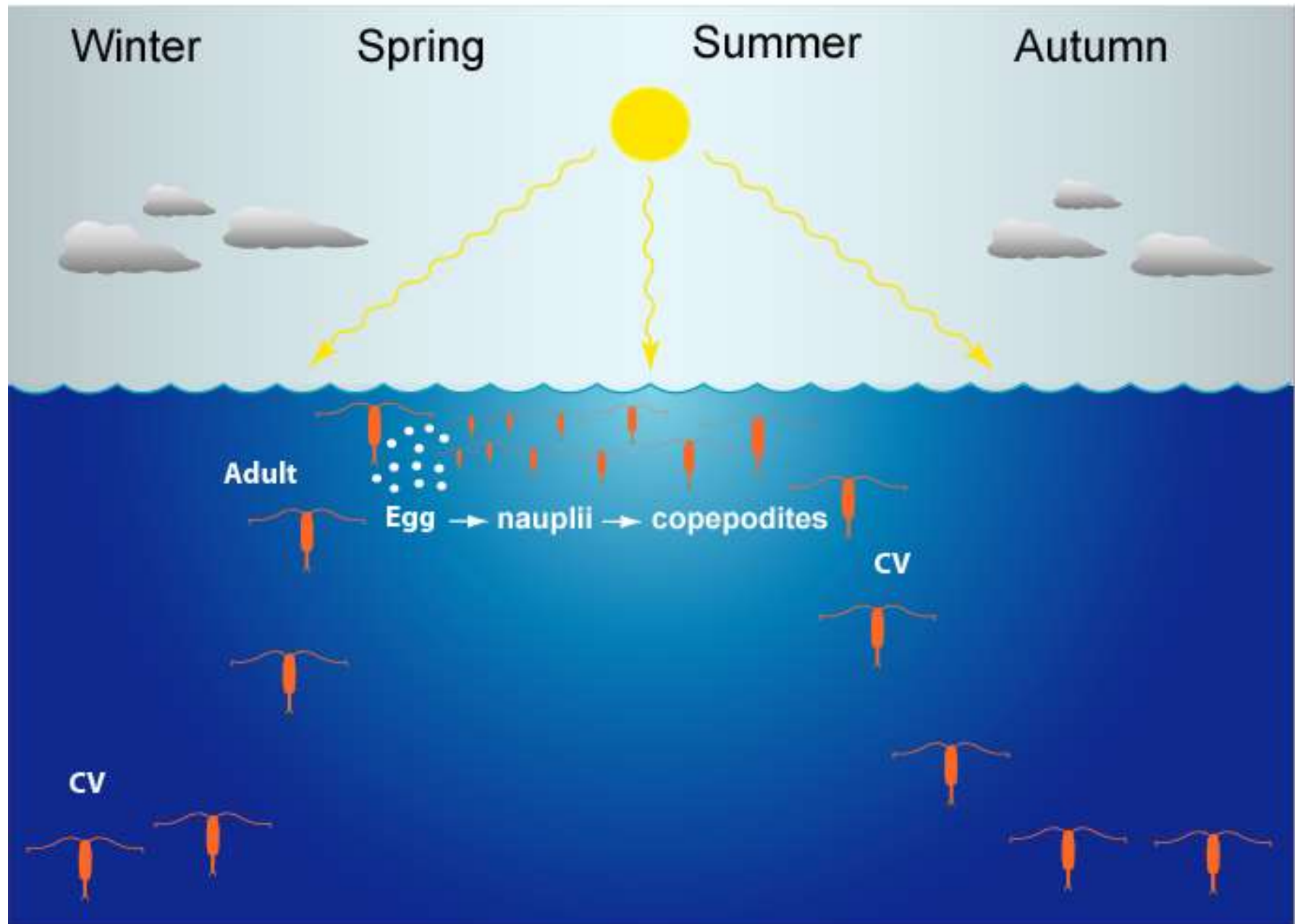


Eilif Gaard

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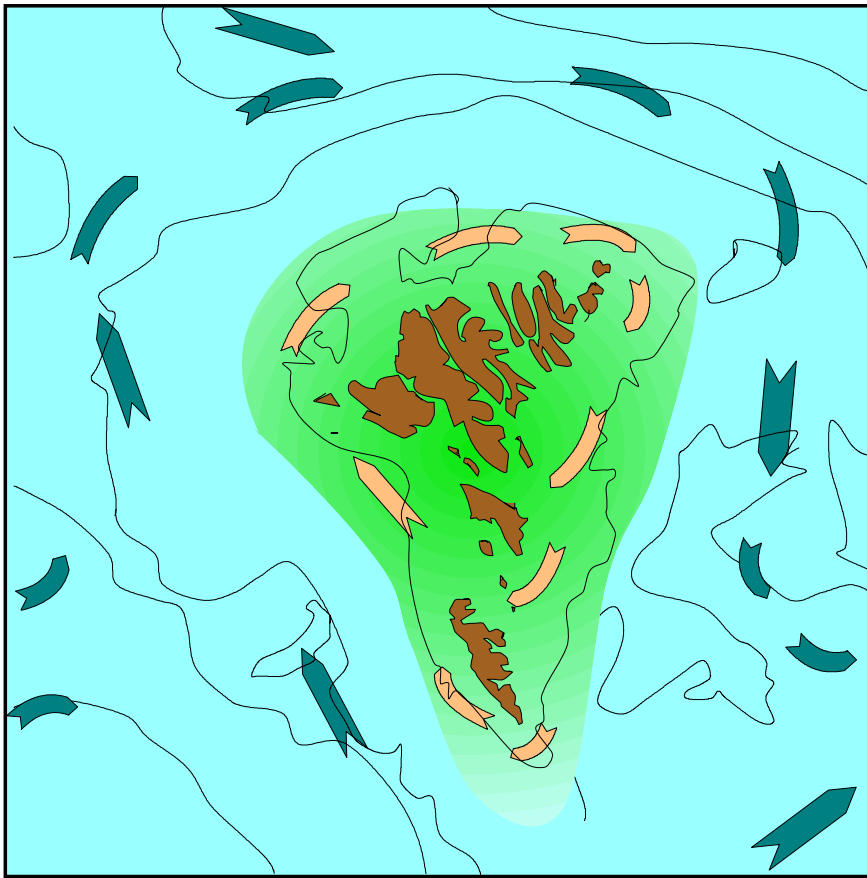
Calanus workshop, Copenhagen, 15 May 2024

Seasonal cycle of *Calanus finmarchicus*



***Calanus* during spring and summer**

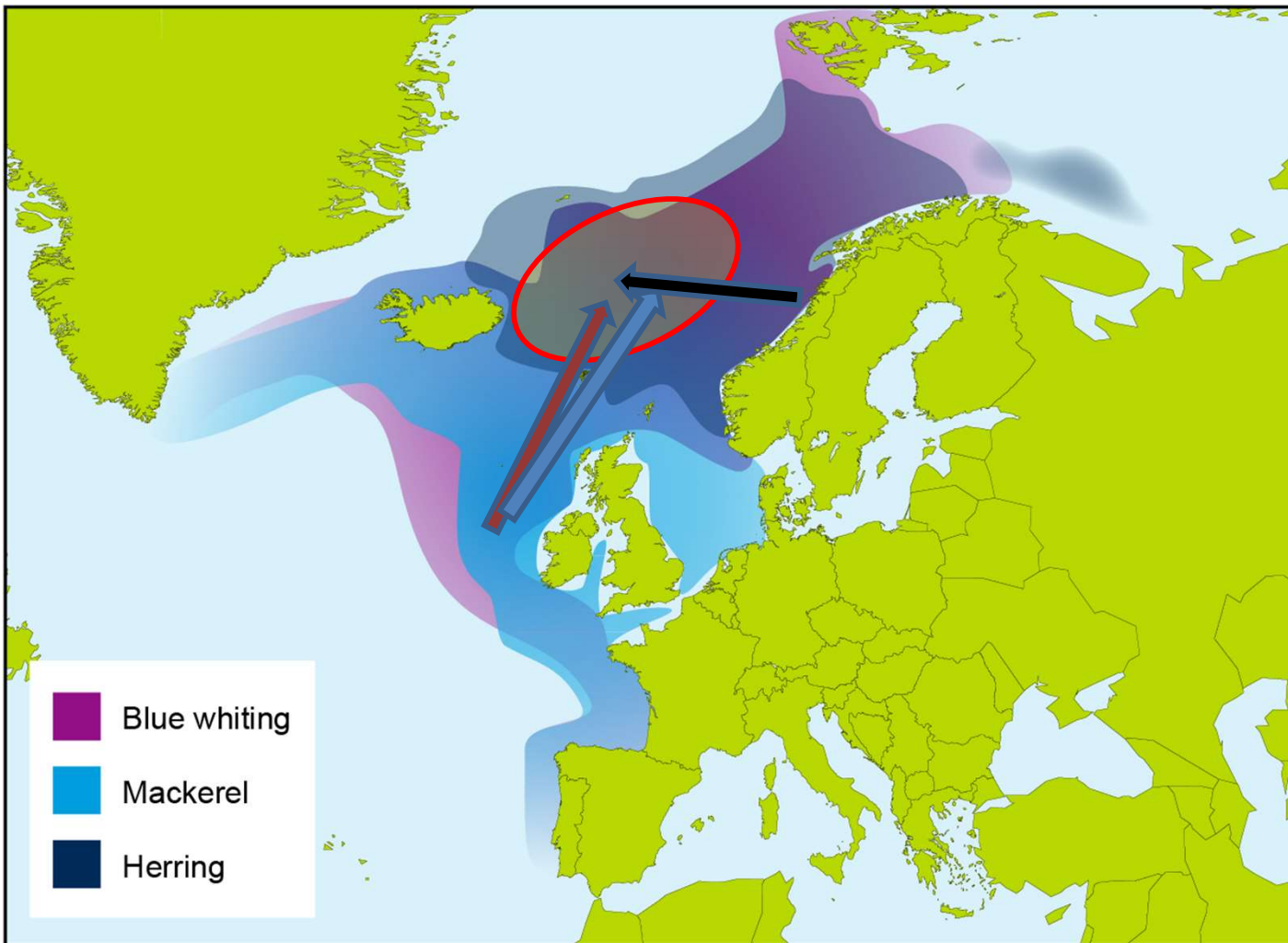
Faroe Shelf ecosystem



- Zooplankton: Mixture of neritic and oceanic species
- Food for fish larvae and pelagic juveniles in spring and summer
- In late spring and summer, *Calanus* is preferred food for fish larvae, pelagic fish juveniles and planktivorous fish

Oceanic environment

Distribution & main feeding area of the large straddling pelagic fish stocks



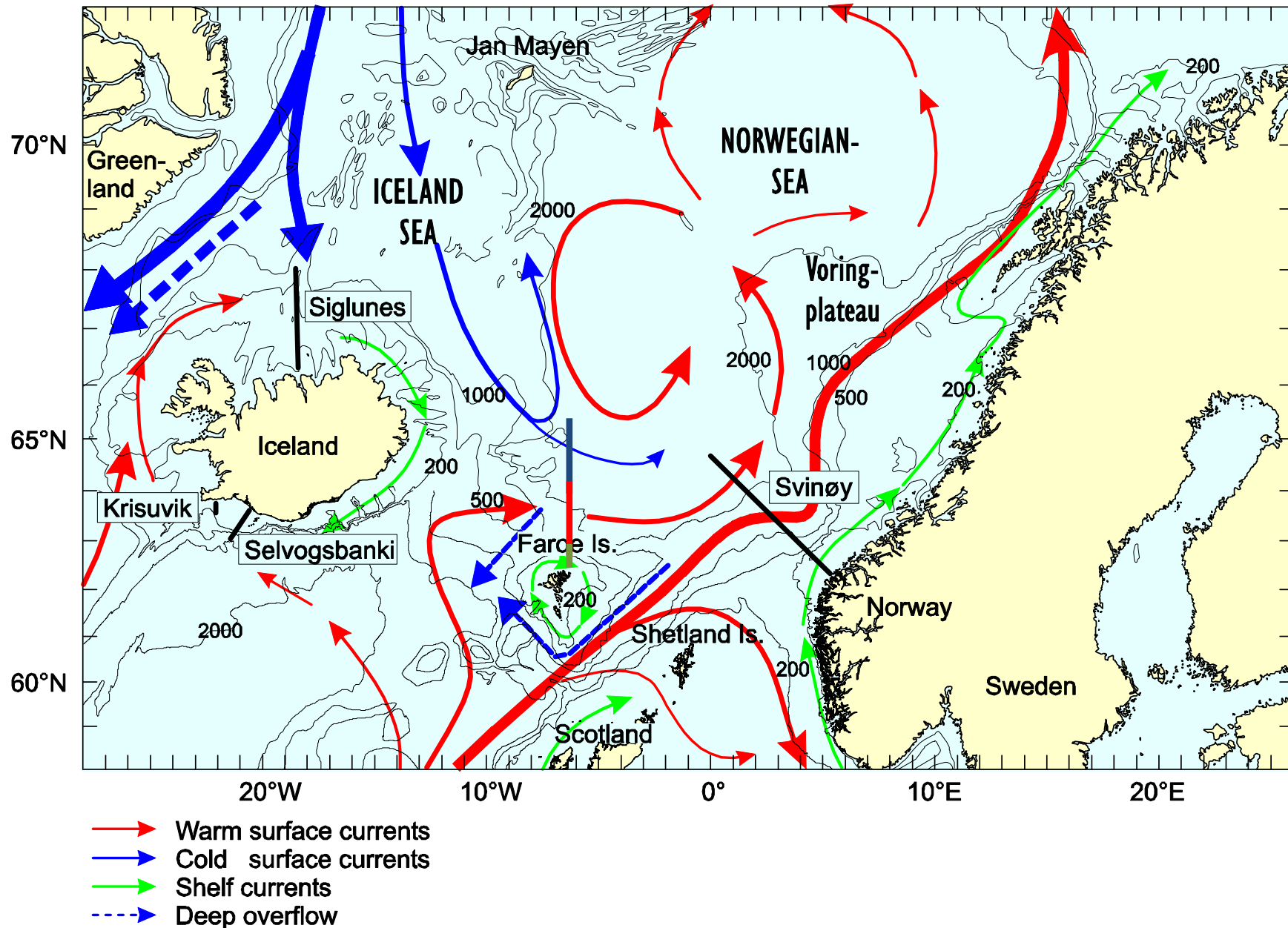
SSB (tonnes)

Blue whiting ~ 6 millions

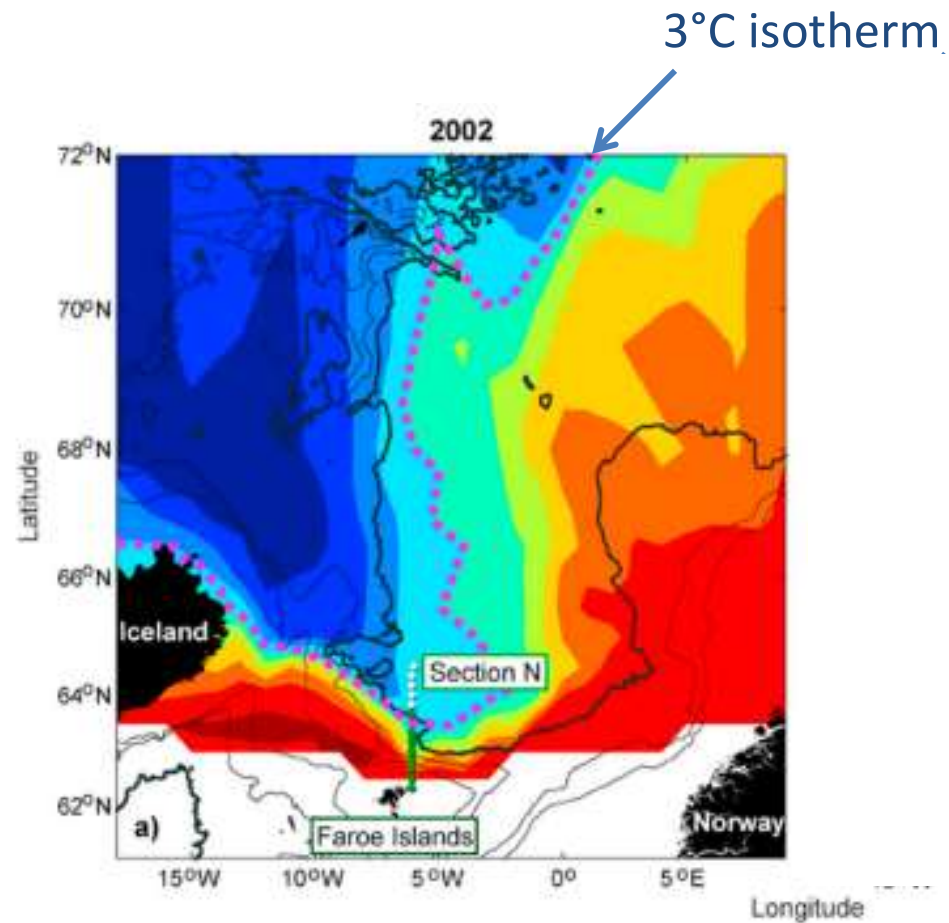
Mackerel ~ 4 millions

Herring ~ 4 millions

Iceland Sea and Norwegian Sea



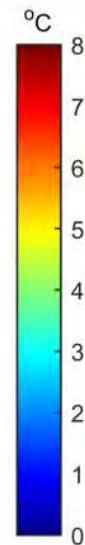
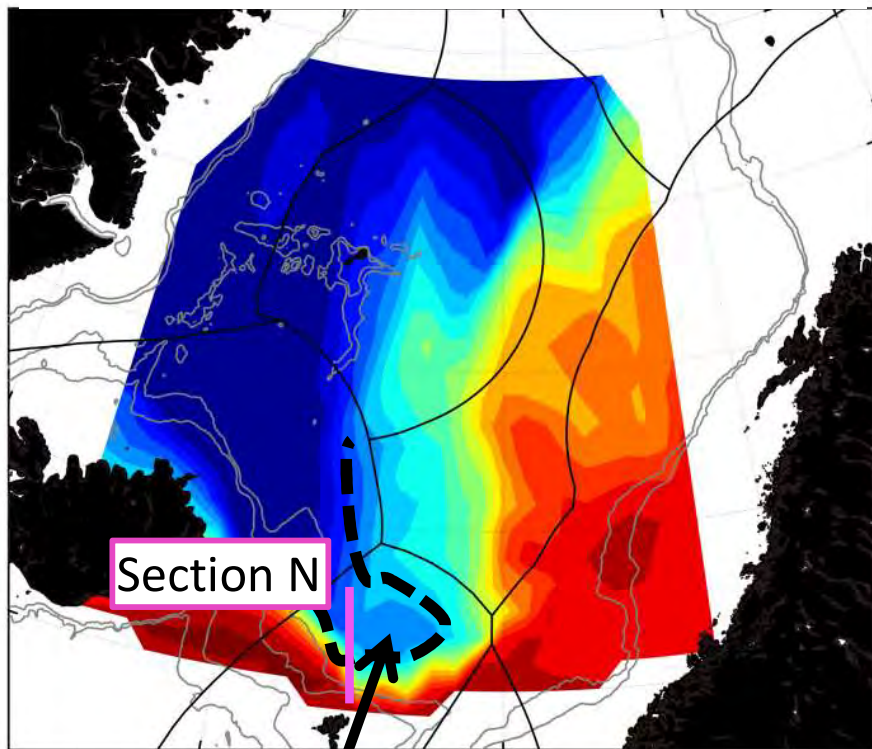
The Eastwards extension of SAW 2002 and 2003



Variability of East Icelandic Water

Temp at 100 m

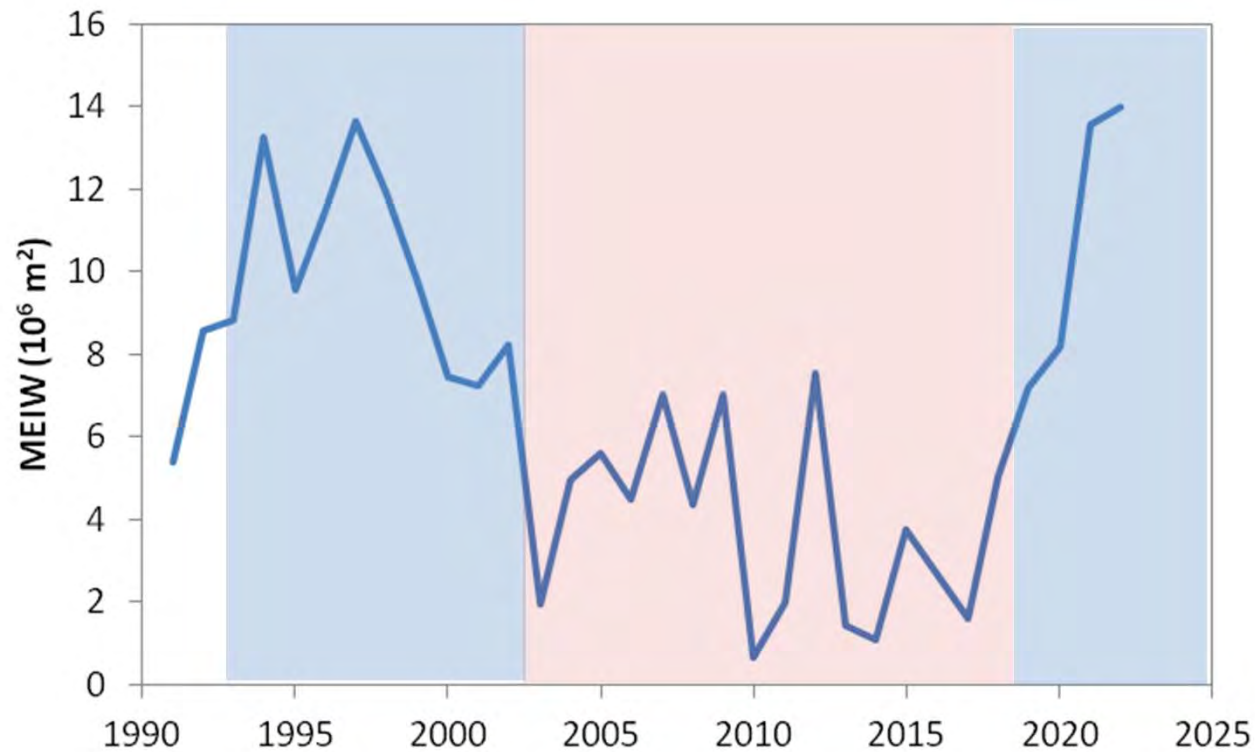
2002



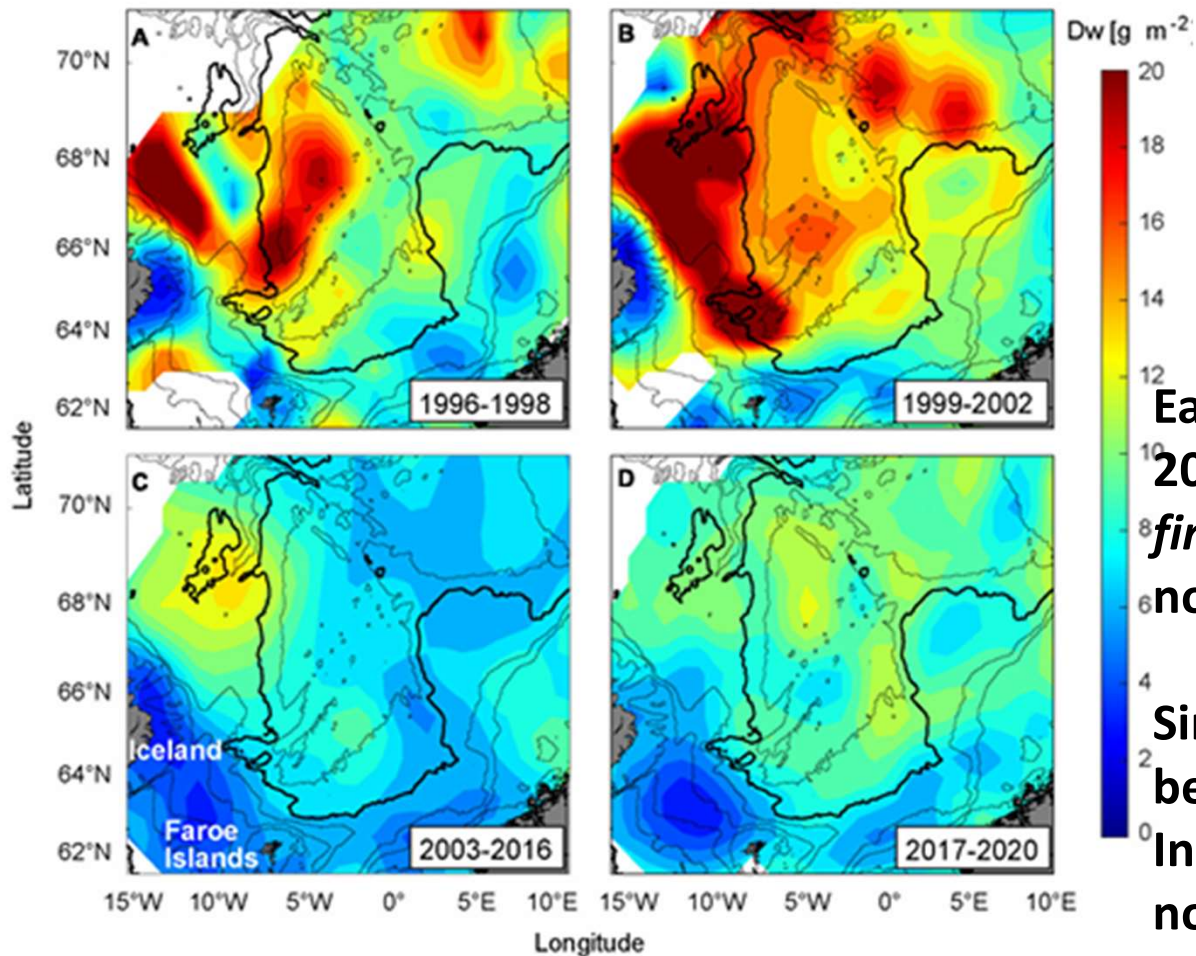
Modified East Icelandic Water

Modified East Icelandic Water

Transect area, annual mean



Zooplankton dry weight (0-200 m) in May: Variable strengt and advection with the East Icelanic current



East Icelandic current weak from 2003 to 2017. Reduced transport of *C. finmarchicus* and *C. hyperboreus* from north.

Since 2018 the East Icelandic current has been increasing → Increased transport of *Calanus* from north

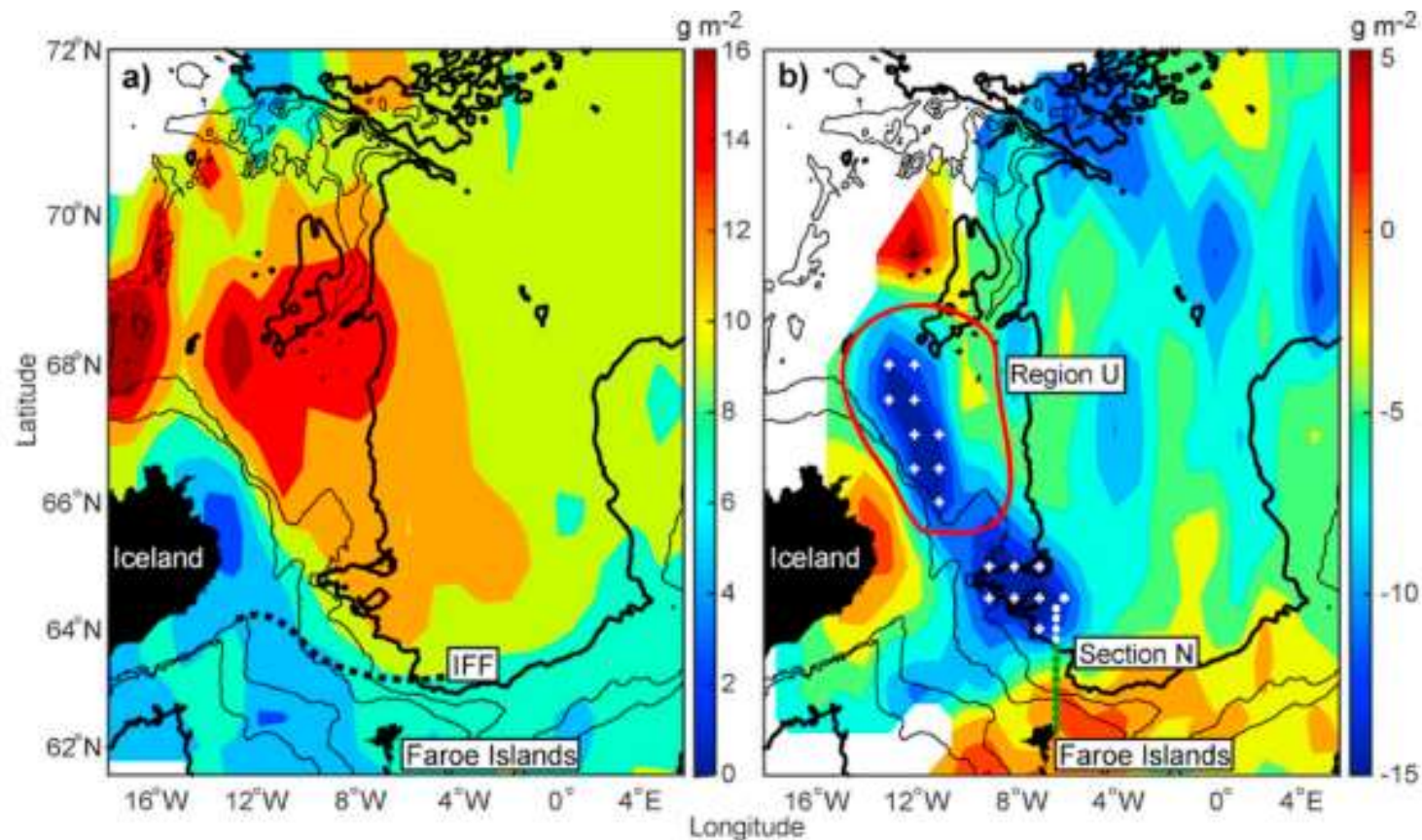
Zooplankton biomass (May)

DW (0-200 m)

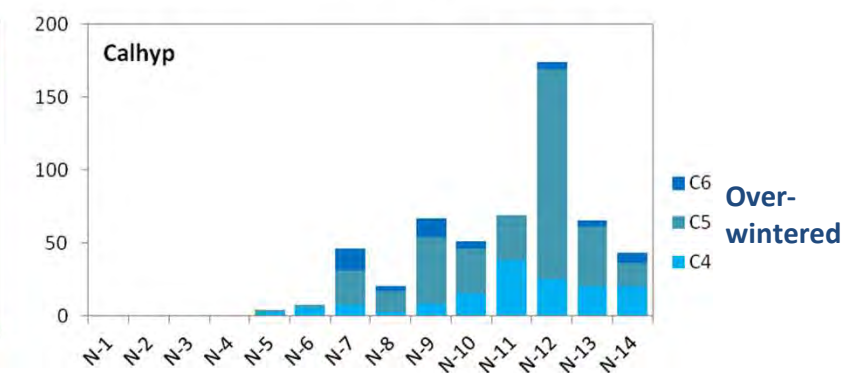
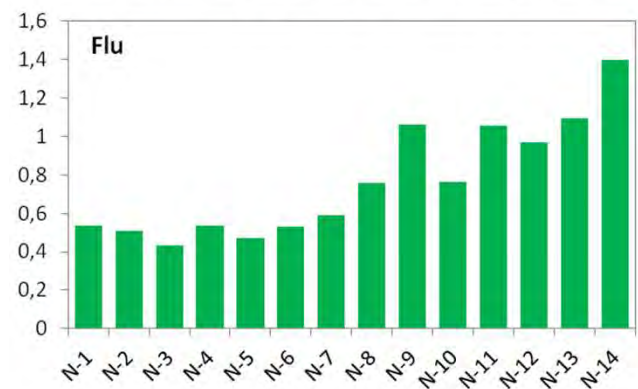
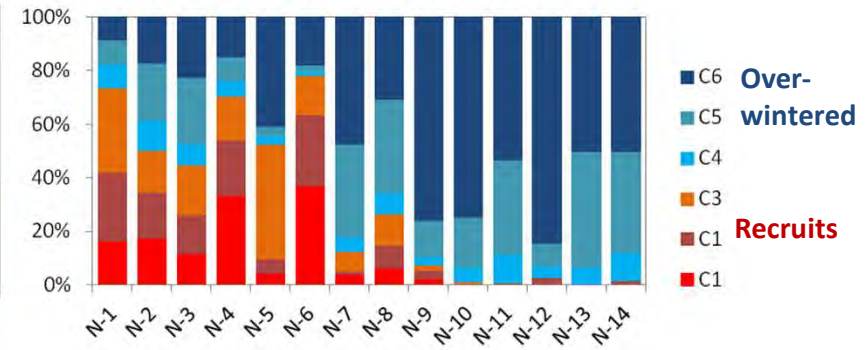
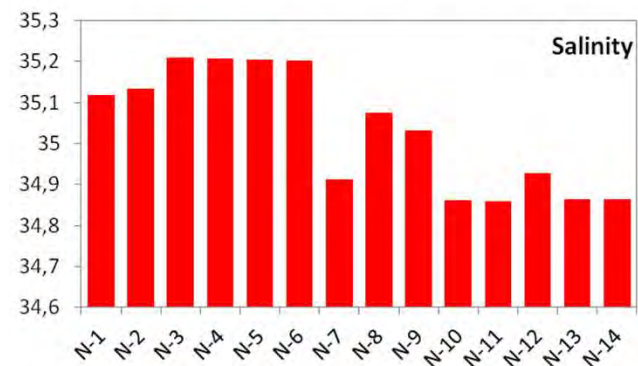
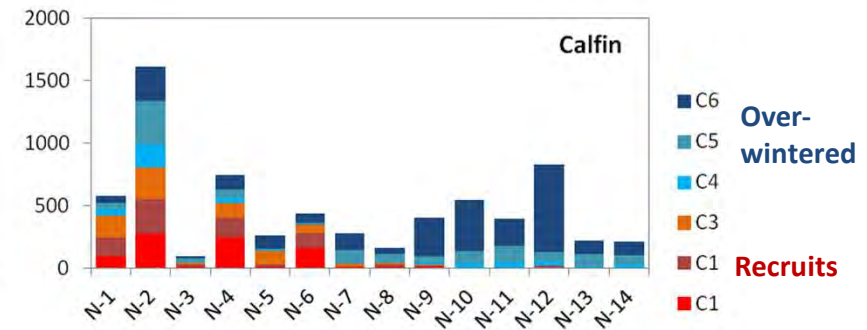
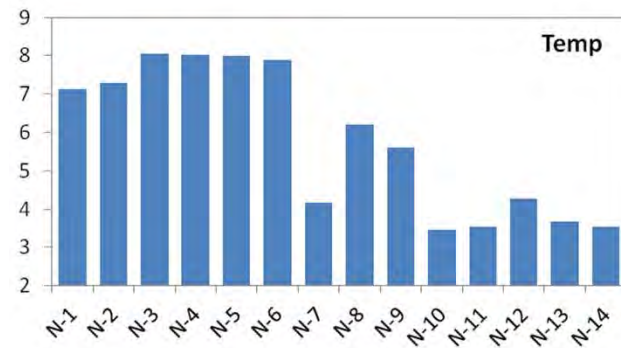
International Ecosystem Survey in the Norwegian Sea

Mean, 1998-2016

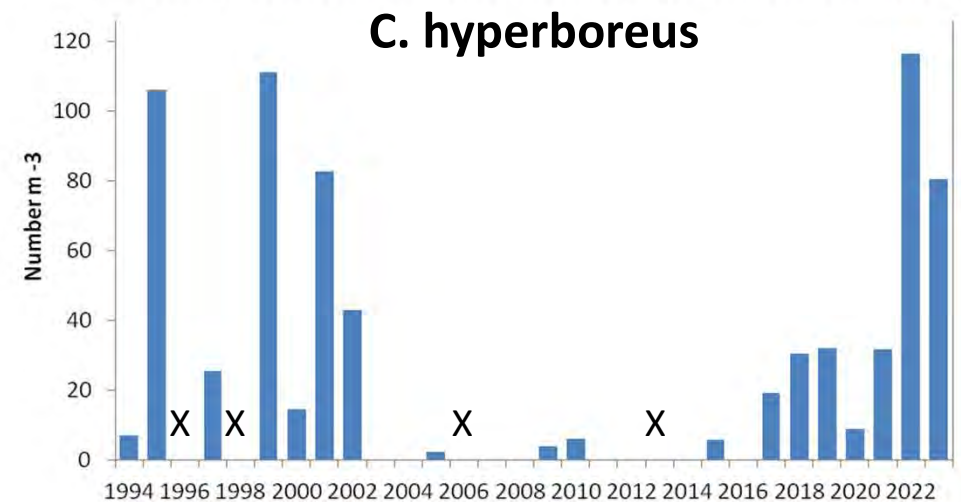
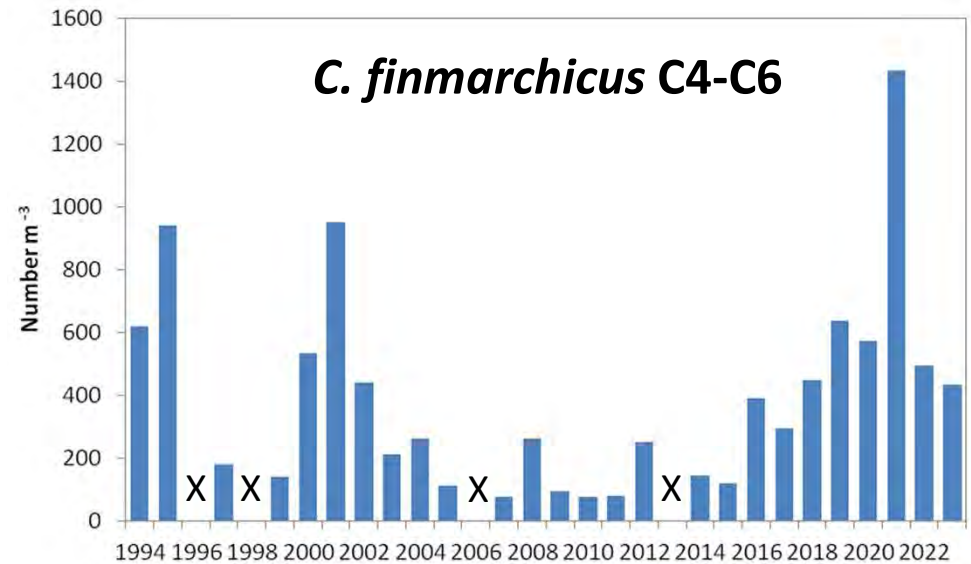
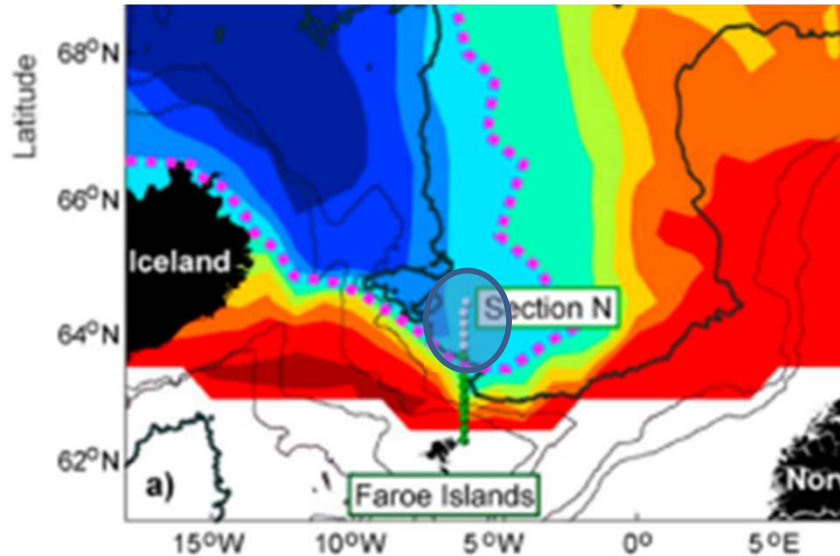
Difference (mean 2003-2016 minus 1998-2002)



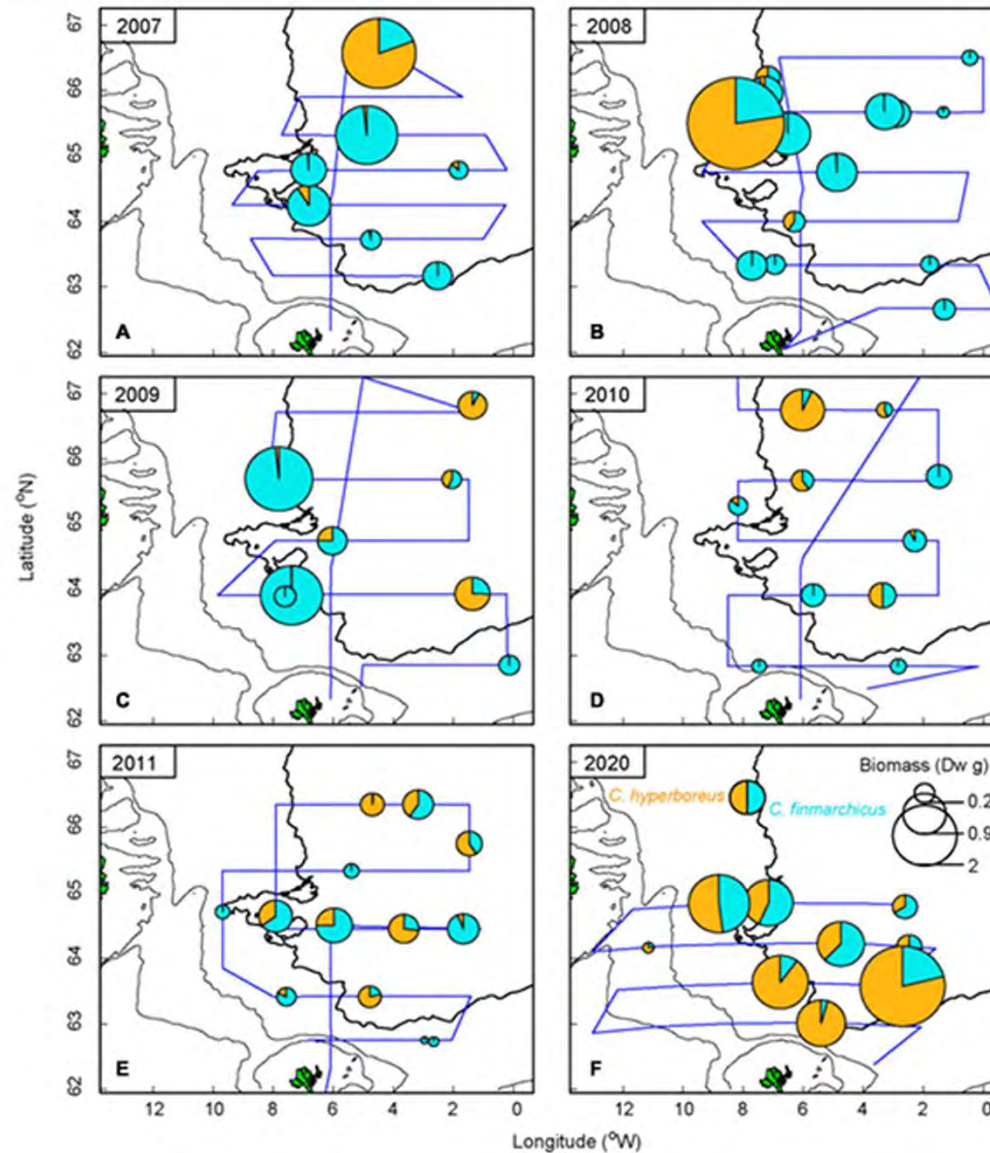
Section N, May 2023



May 1994-2023



Herring stomach content (g DW) of *Calanus finmarchicus* and *Calanus hyperboreus* in May

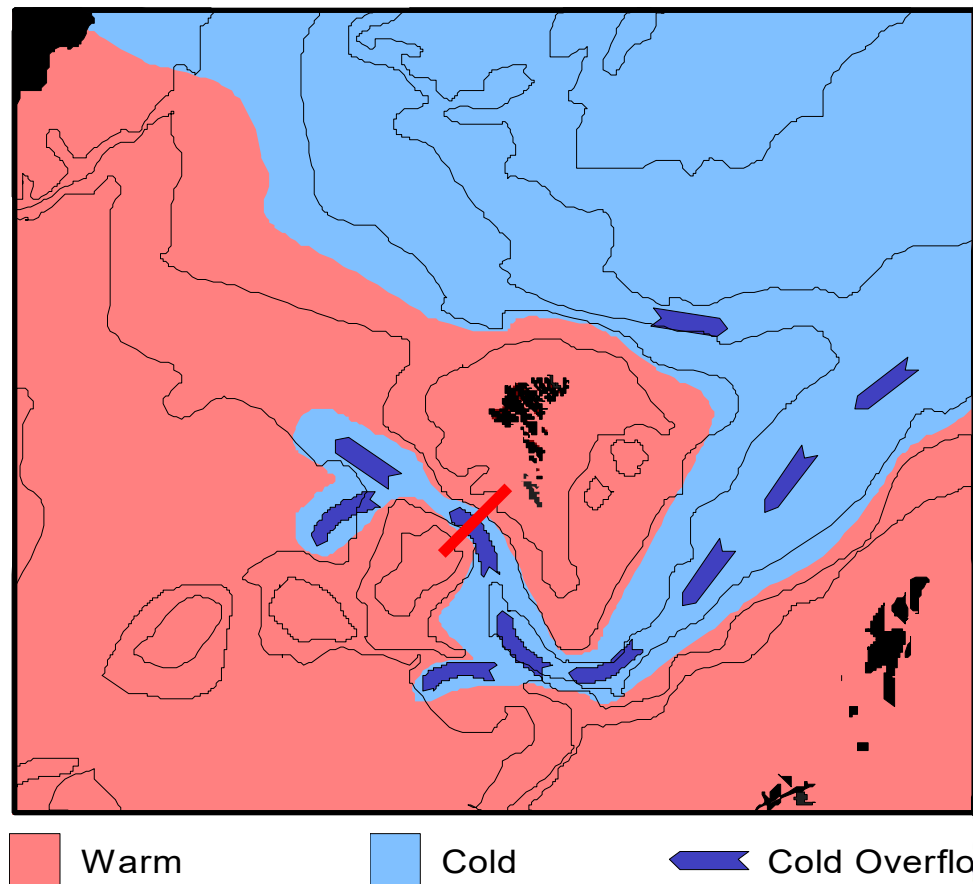


Kristiansen et al., 2022

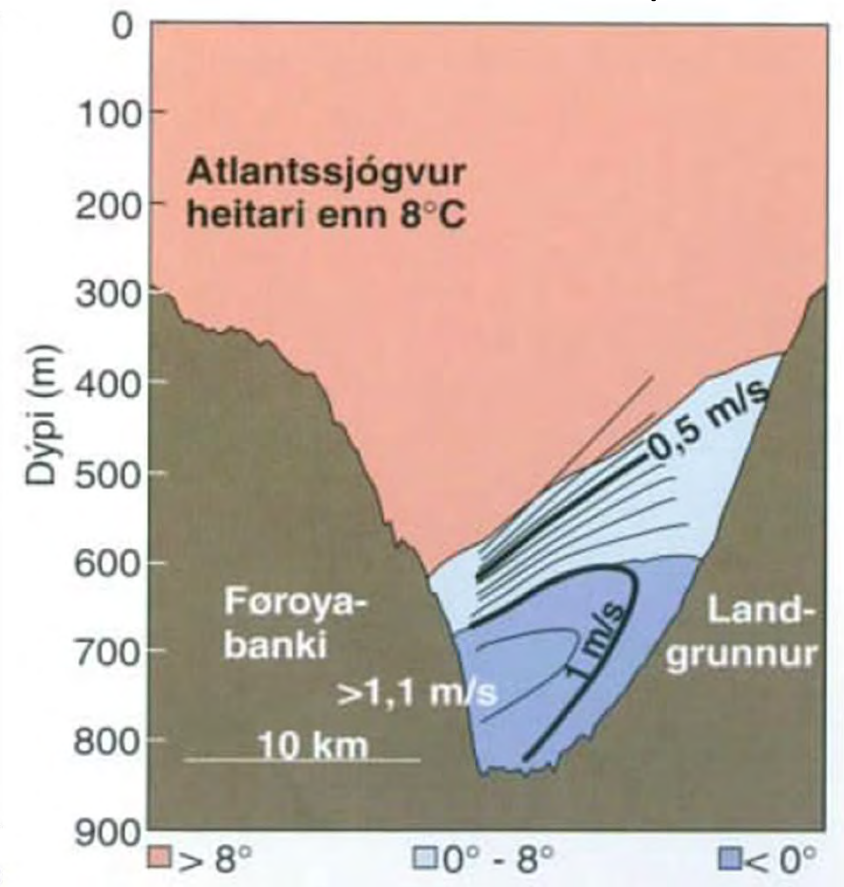
Advection of overwintering *Calanus finmarchicus* through Faroe-Shetland Channel and Faroe Bank Channel

Potential for sustainable harvesting

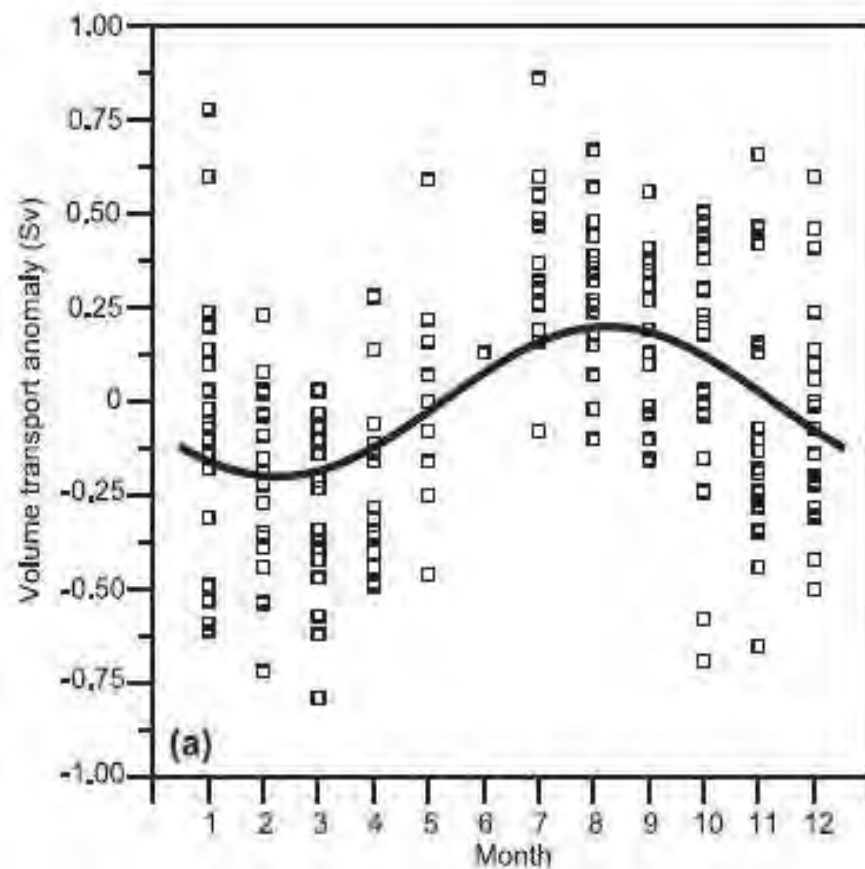
Deep overflow through the Faroe-Shetland and Faroe Bank Channels



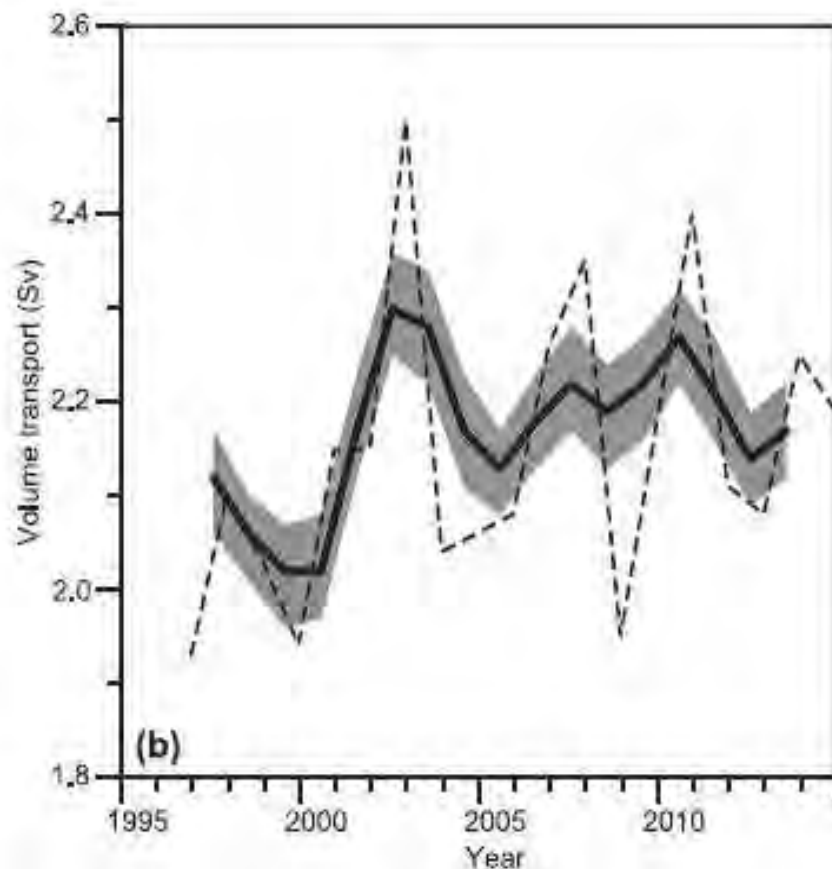
FBC currents and temperature



Deep overflow in the Faroe Bank Channel



1 SV = 1 mill. m³/sec



(From Hansen et al., 2016)

Deep overflow through the FB-Channel

~2,2 Sv

Norwegian Sea

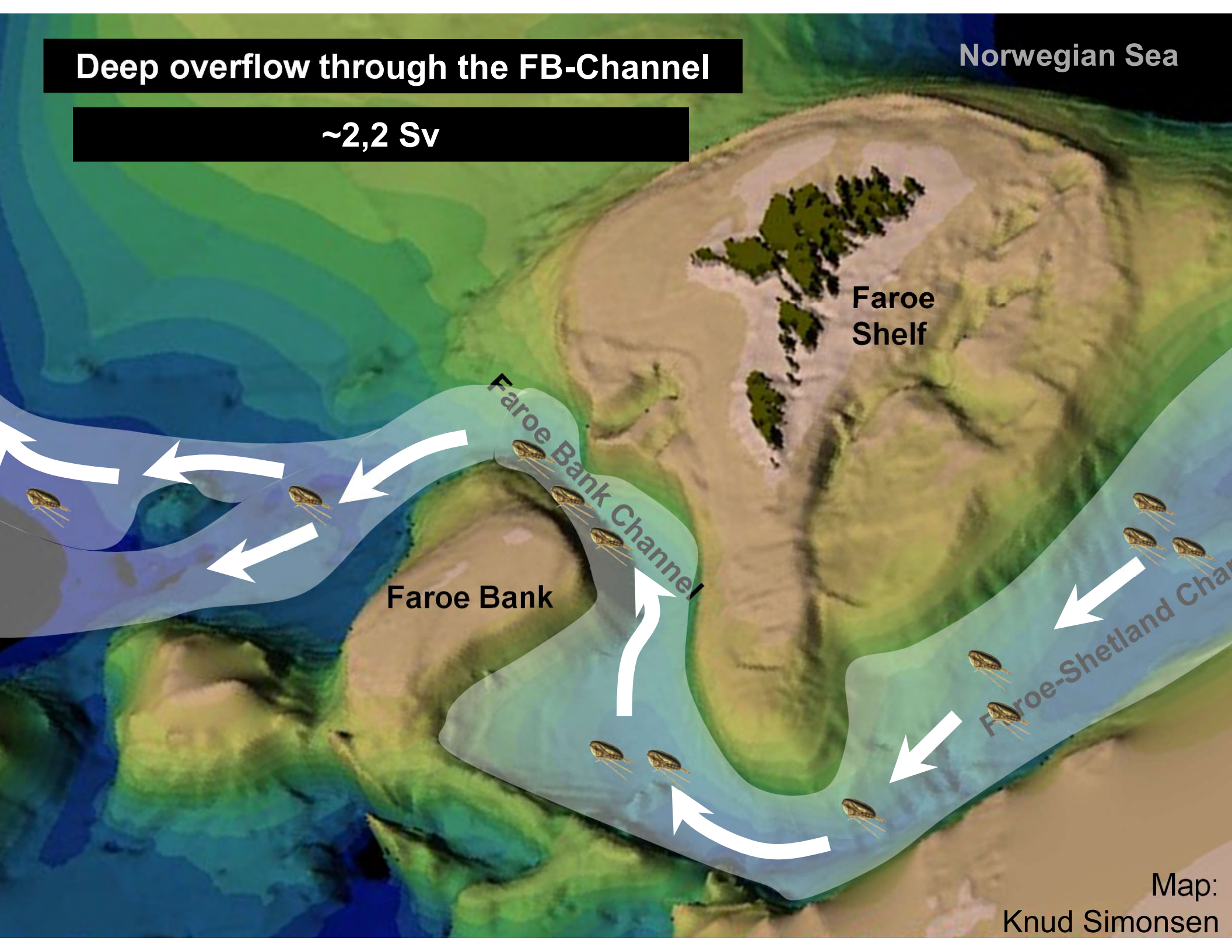
Faroe Shelf

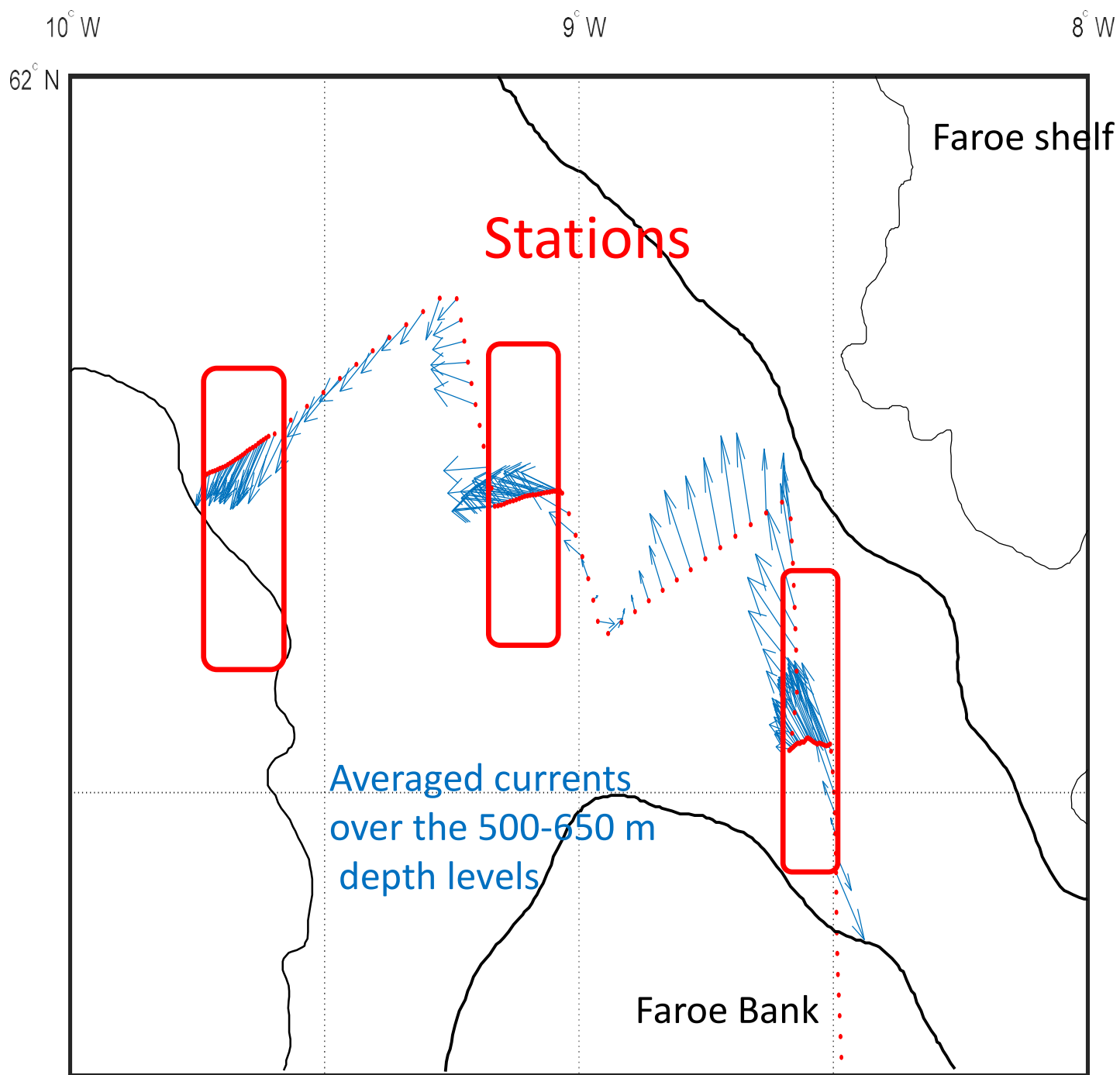
Faroe Bank

Faroe Bank Channel

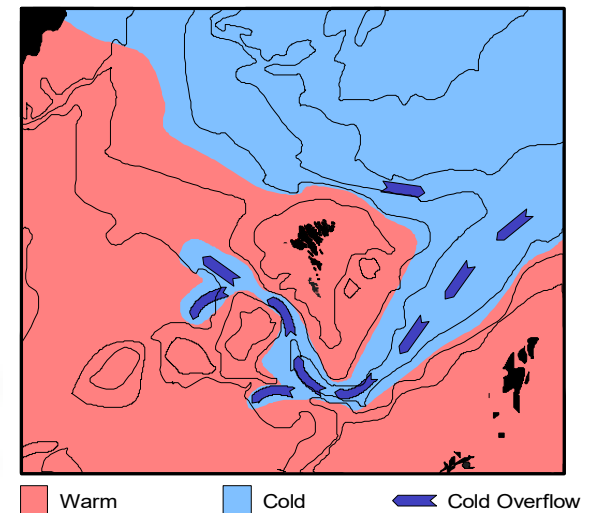
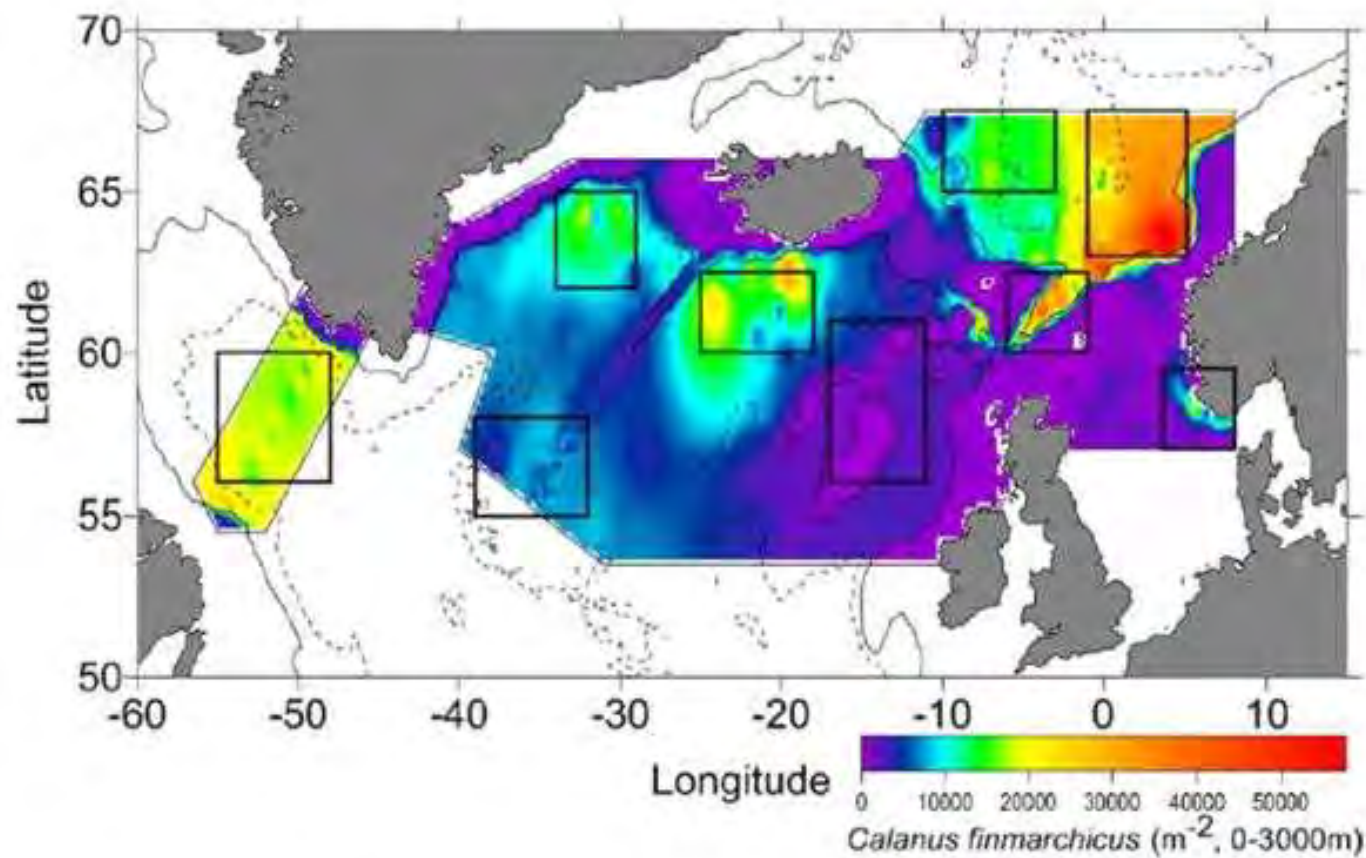
Faroe-Shetland Channel

Map:
Knud Simonsen



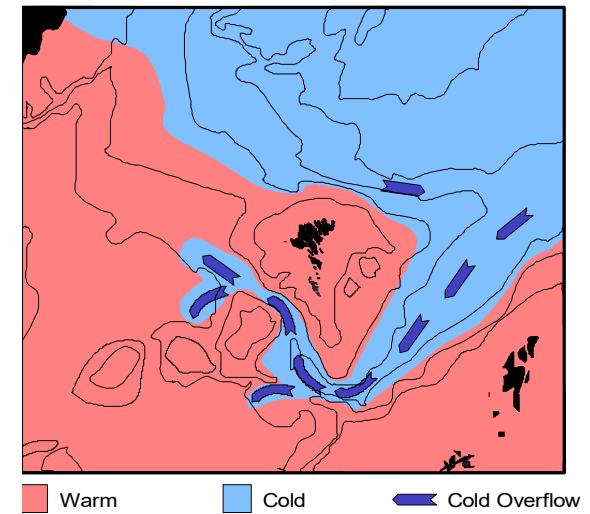
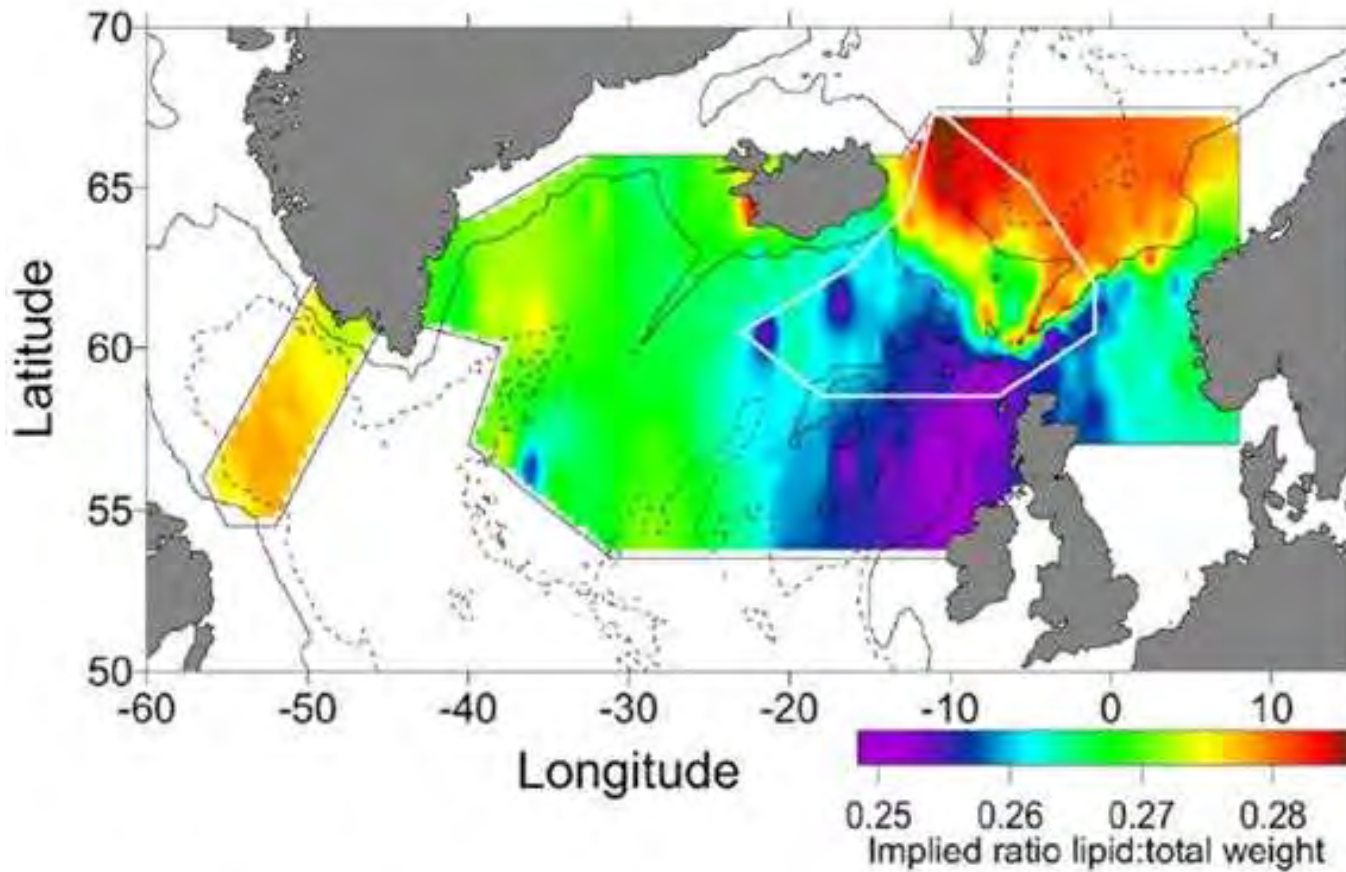


Over-wintering *Calanus* Abundance



Heath et al, 2004)

Over-wintering *Calanus* Ration lipid:total weight



Heath et al, 2004)

Estimated biomass and production (wet weight) of *C. finmarchicus* in the Norwegian Sea

- Biomass in NS: Estimates between 33 and 50 mill. tonnes
- Production NS: Some 100 mill. tonnes/year (uncertain)
- (+ Iceland-, Greenland- and Barents Sea)
- Large production, compared to the biomass

Estimated transport of overwintering *C. finmarchicus* through the Faroe Bank Channel

- Abundance estimates (preliminary): $\sim 130\text{-}280 \text{ indi/m}^3$
- Biomass (WW): $\sim 130\text{-}280 \text{ mg/m}^3$
- Flow: $\sim 2.2 \text{ mill. m}^3/\text{sek}$

Estimated transport of *Calanus*:

Between $\sim 25\,000$ and $\sim 53\,000$ tonnes WW/day

Between ~ 3.7 mill. and ~ 8 mill tonnes WW/winter

Potential fishery of over-wintering *C. finmarchicus* in the Faroe Bank Channel overflow

- Horizontal flow of *Calanus*: $\sim 0.5\text{-}1 \text{ kg/m}^2$ transect/hour
- Test trawlings have confirmed this.
- Apparently too high costs of commercial trawling
- Next step: “Passive” gear, using the strong horizontal flow.



Future Research

- Distribution after leaving the Faroe Bank Channel during winter.
- Importance for potential predators during winter.
- The survival rate is unknown although it seems to be small.

- Preliminary results indicate that after leaving the FBC
 - most individuals are advected along the southern slope of the Faroe-Iceland Ridge.
 - An apparently smaller amount seems to be transported close to the seabed in southwestern direction