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Í SJÁVARÚTVEGI

Comprehending the capelin regime shift

Breytingar á útbreiðslu loðnunnar

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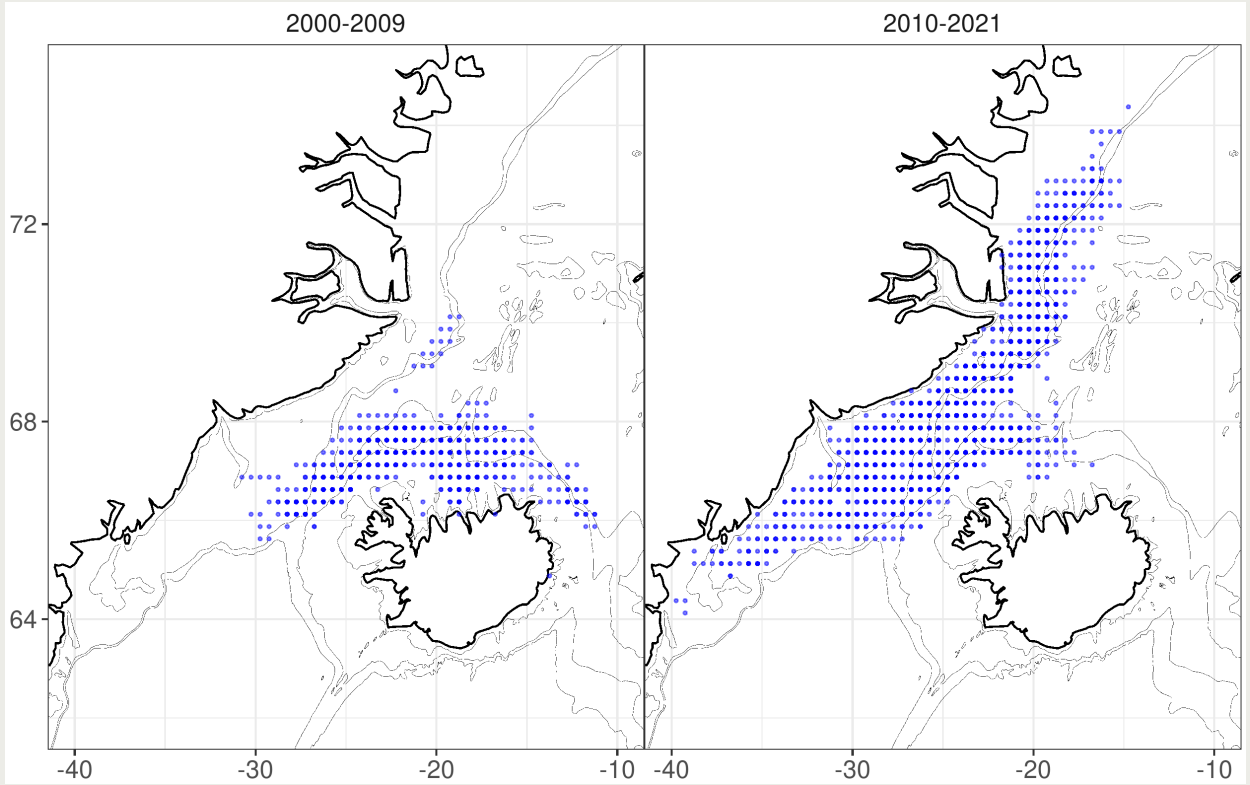
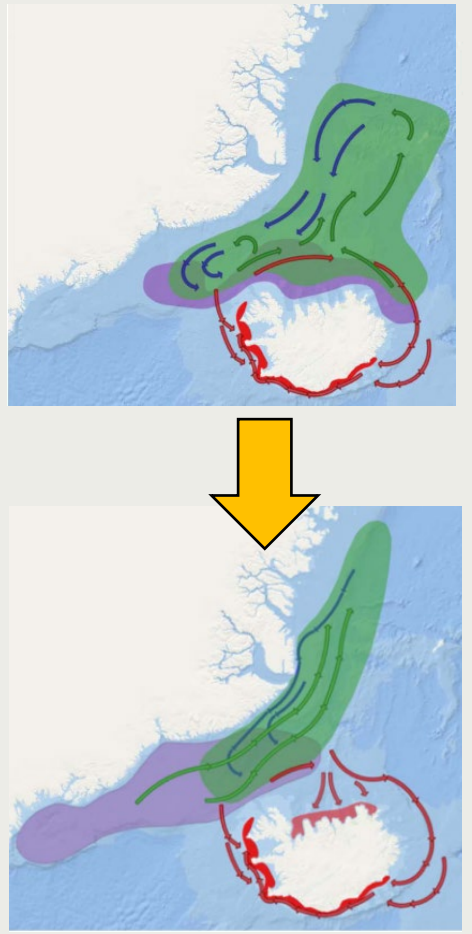
HAFRANNSÓKNASTOFNUN
Rannsókna- og ráðgjafarstofnun hafs og vatna

Regime shift in capelin distribution

- The nursery grounds of capelin shifted from north of Iceland to East coast of Greenland in 2000s (*Carscadden et al. 2013*). This is also evident from acoustic survey data.

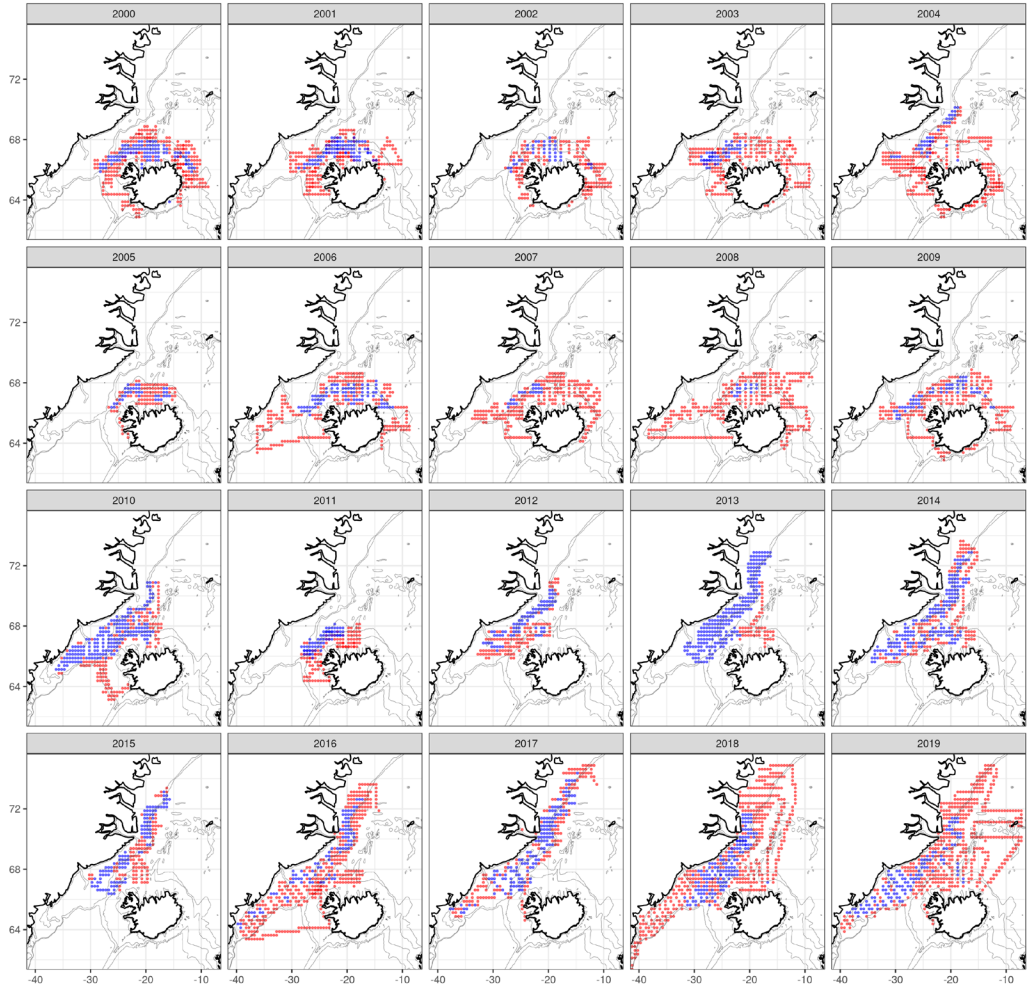




Can these changes be related to changes in the physical environment?

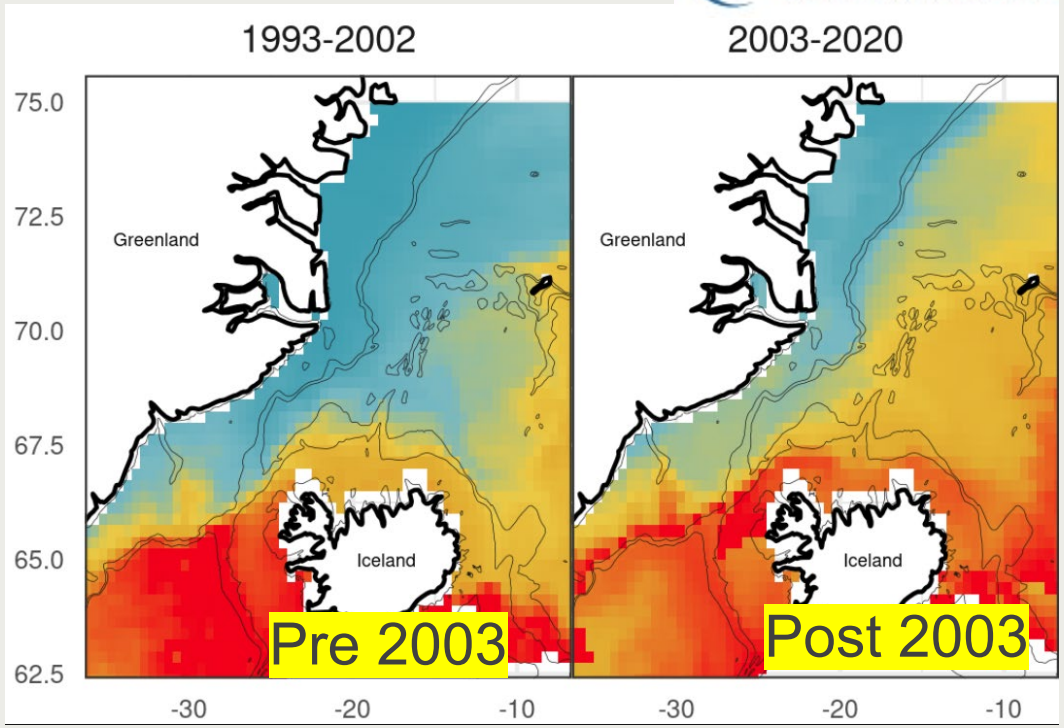
Regime shift in capelin distribution

Autumn survey time series



Environmental data

- Sea surface temperature
- Salinity
- Currents
- Bathymetry
- Net primary productivity



Species distribution models (SDM)

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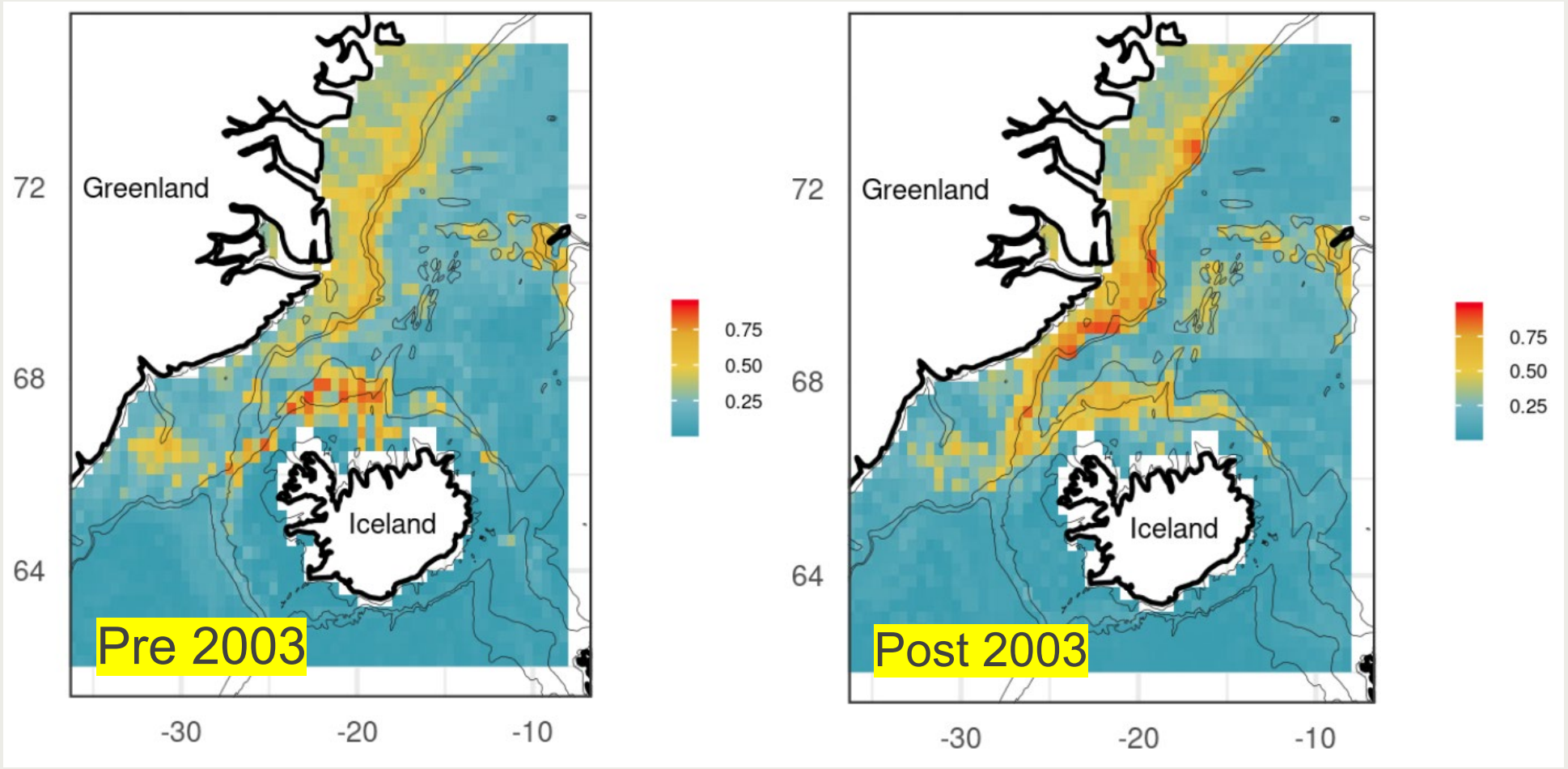
SDM

Predictions



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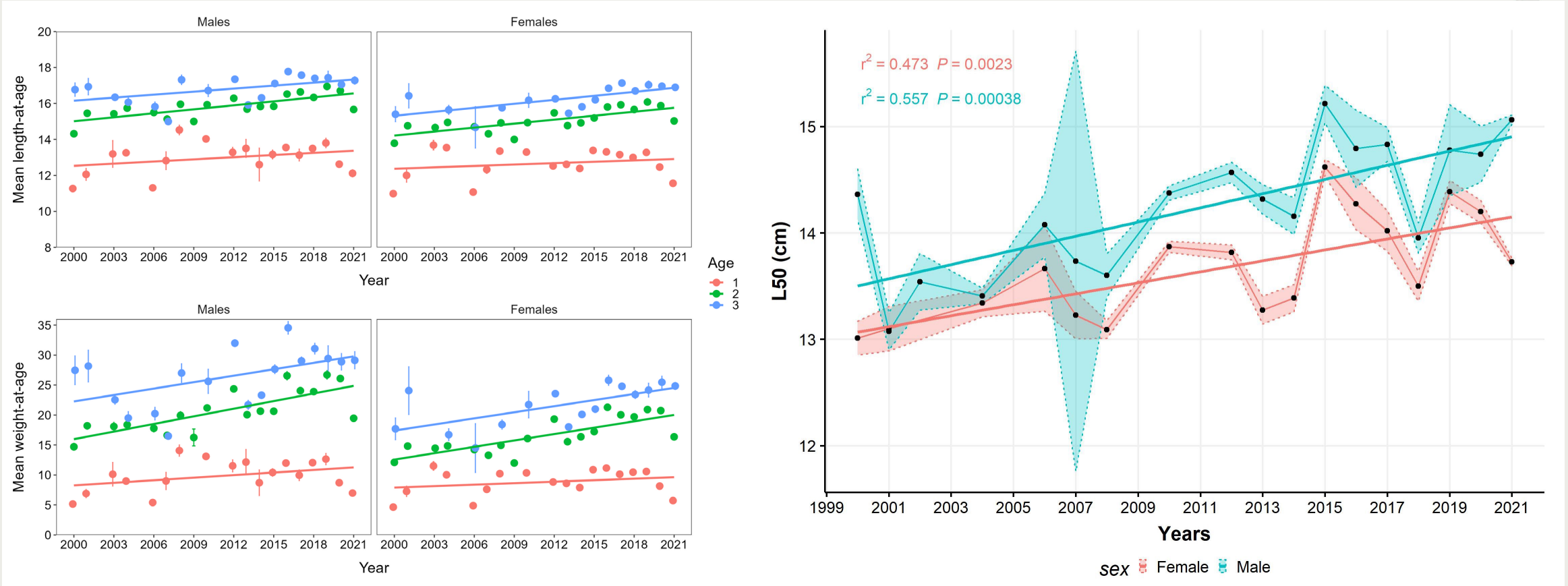
Life history traits

- Mean length- and weight- at age as well as length at maturity have increased over time in response to changes observed in the stock size indicating density-dependent effects



Capelin diet in the earlier and new feeding area

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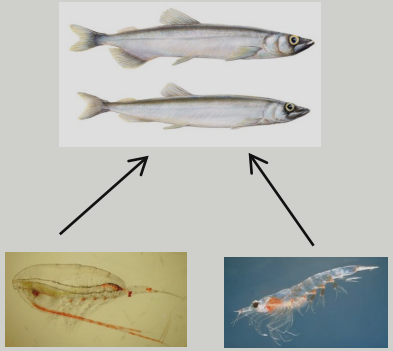
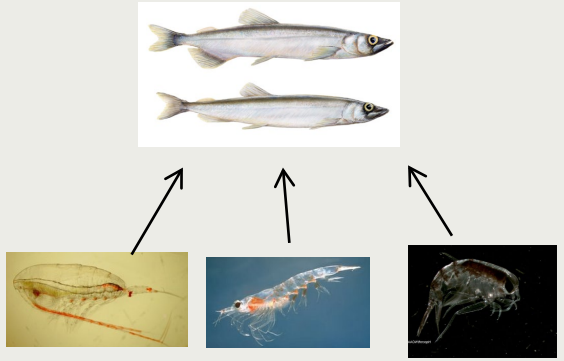
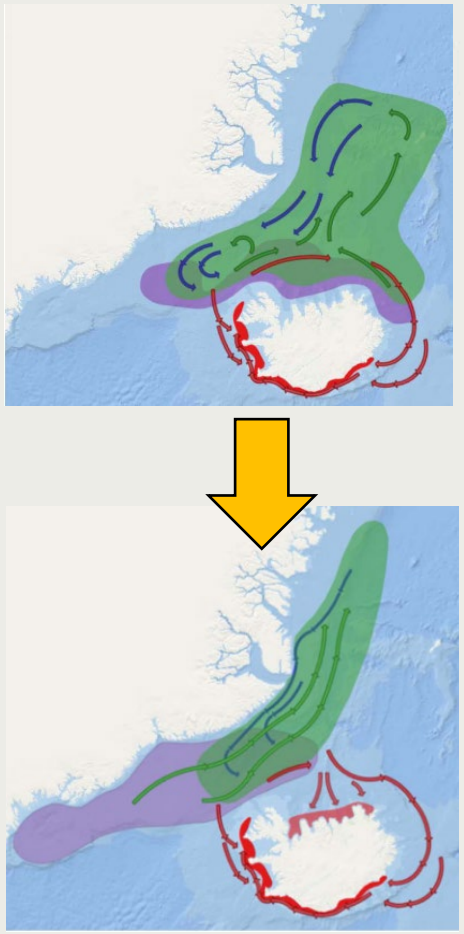
Earlier feeding area

(Sigurdsson and Astthorsson, 1991;
Astthorsson and Gislason, 1997)







- → Higher contribution of amphipods in the new feeding area
- → Reflects different prey availability but food quality is similar
- → Immature capelin feed on copepods and mature capelin feed on krill
- → A shift from old summer feeding area where copepods remained important for older fish

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Detecting spawning events and estimating connectivity

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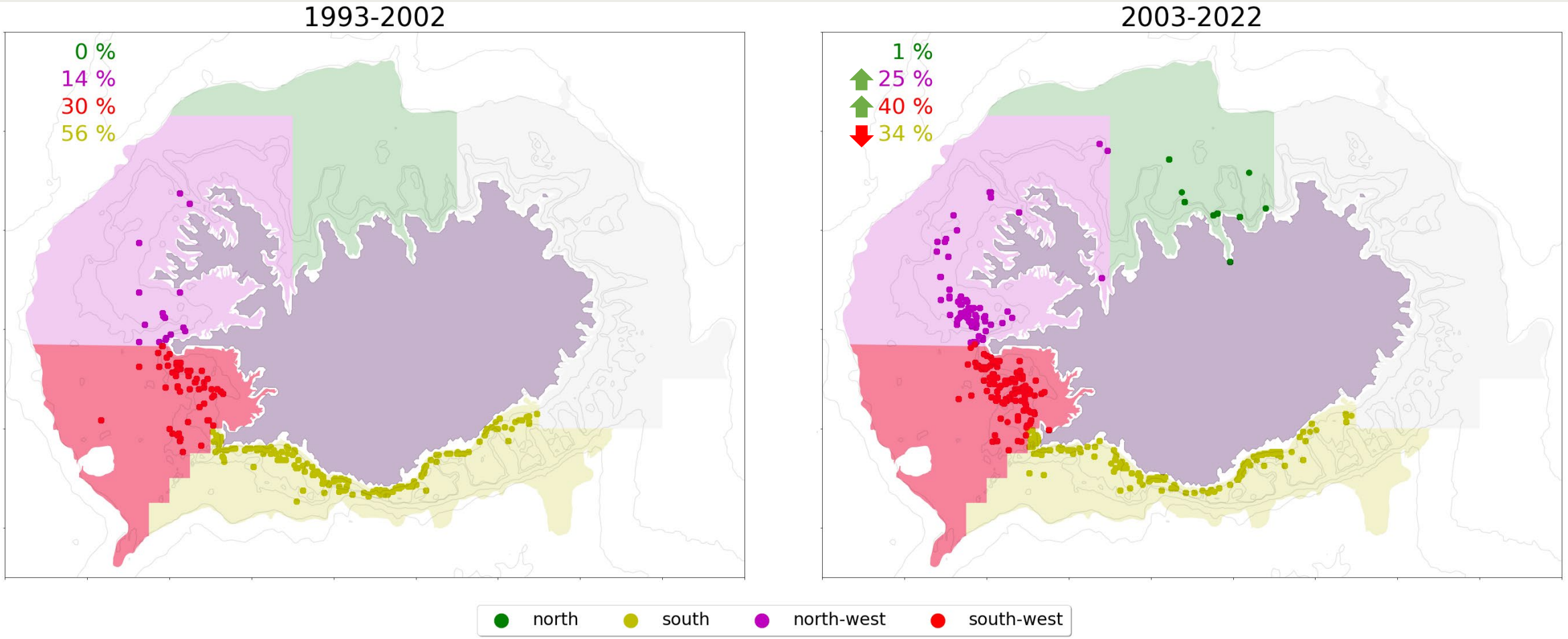
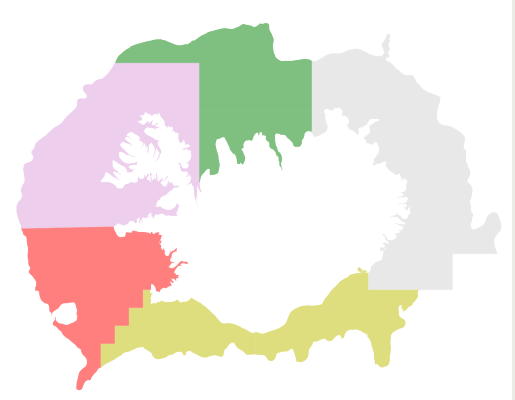
- Catches of pre-spawning capelin from commercial samples



Changes in spawning environment



- Increased temperature and reduced salinity after 2003.

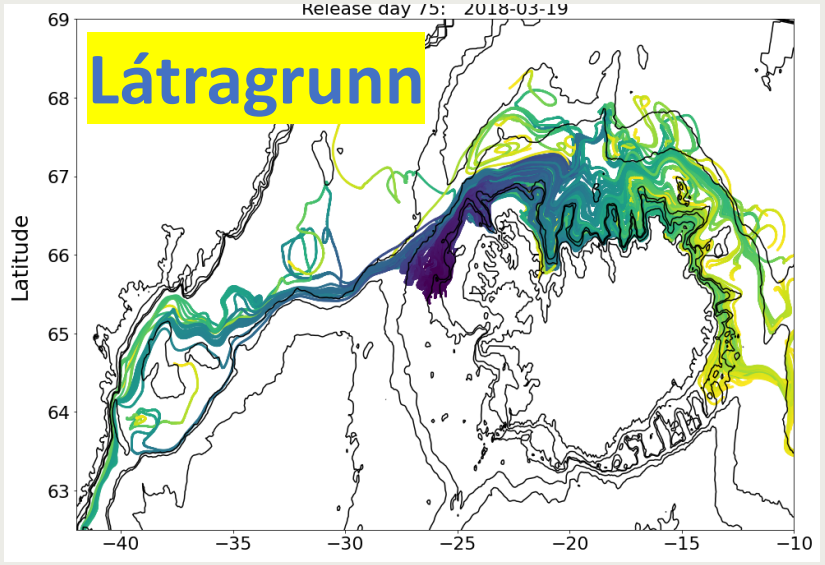
- Favourable spawning conditions: 5-7°C,

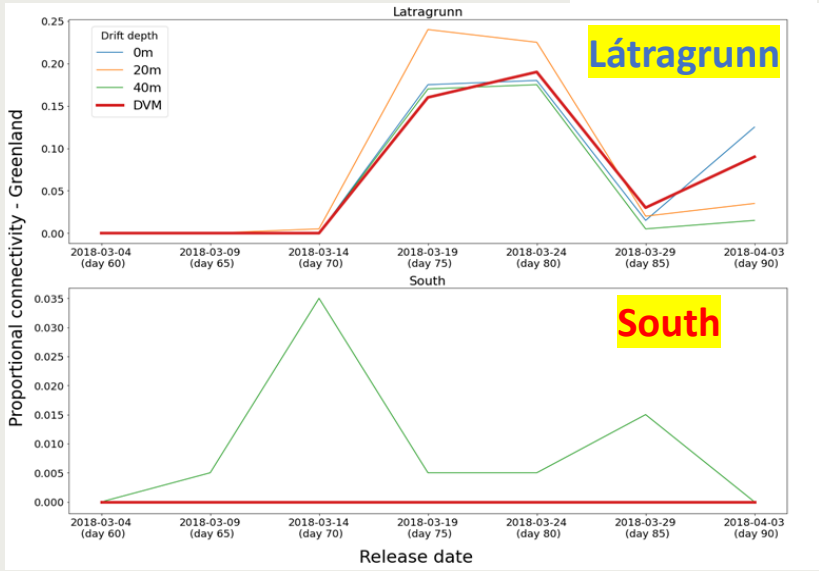
Thors (1981) Rit Fiskideildar.

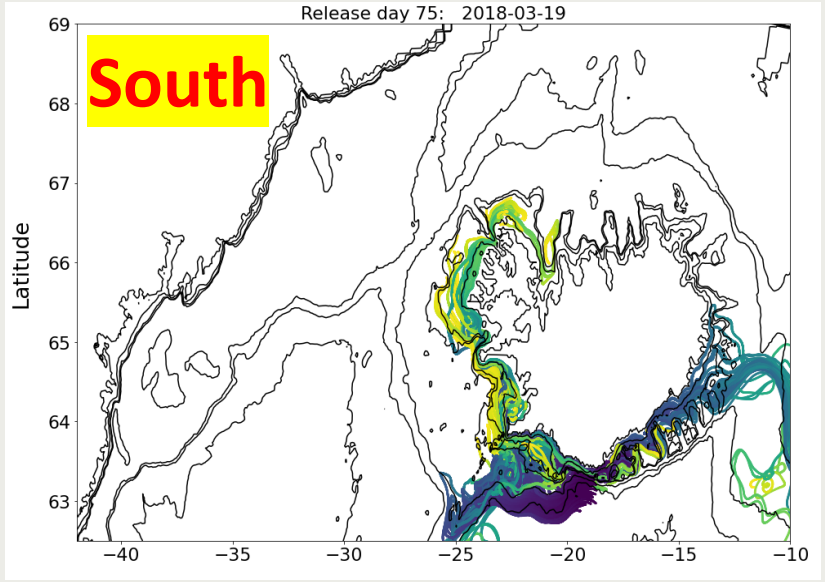
- Increased northerly spawning events linked to increase in temperatures.

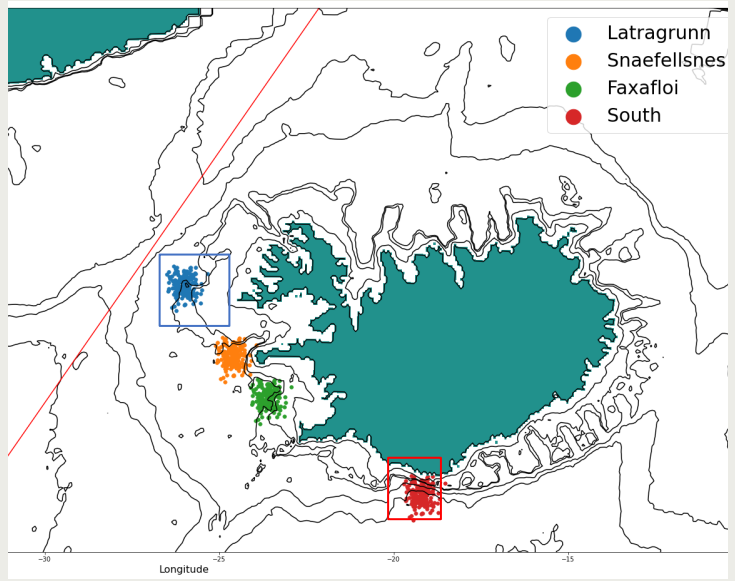
Drift trajectories from different spawning grounds

- Drift simulated at different depths, as well as with diurnal vertical migration
- Varied hatching times simulated
- Big variation in connectivity to Greenland depending on time of spawning and spawning location









Conclusion

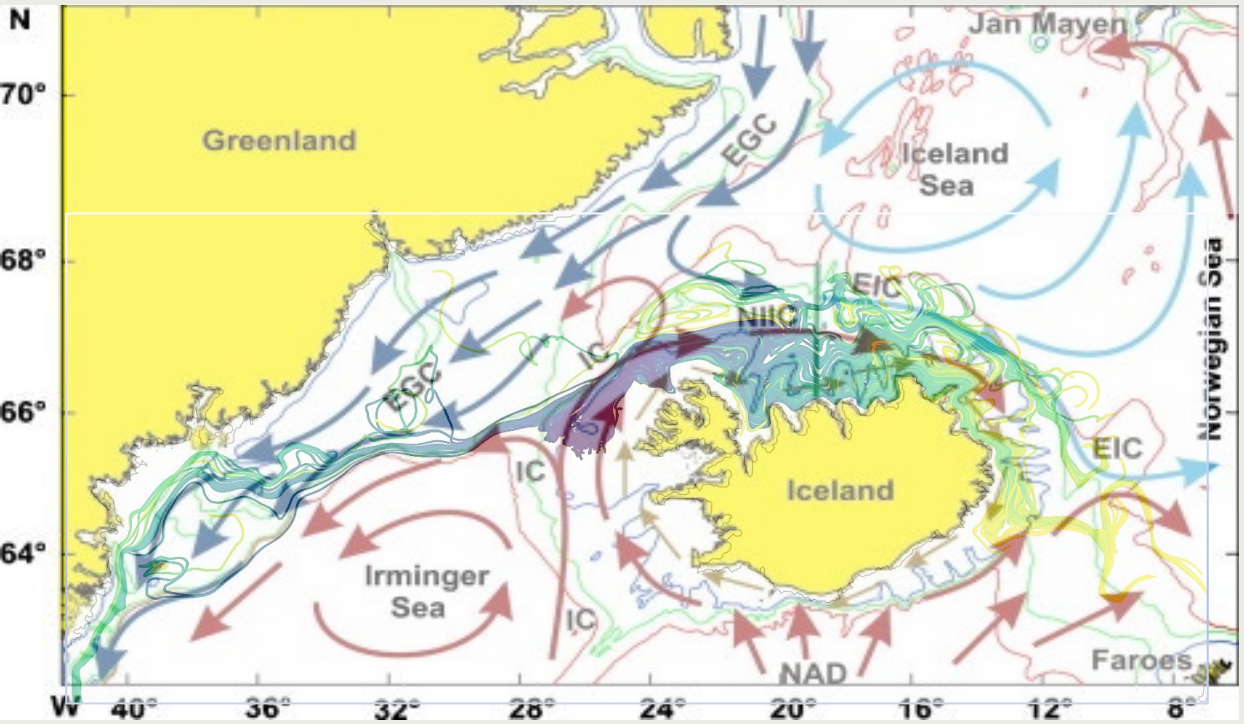
- Changes in the physical environment can explain the past and present changes in the distribution

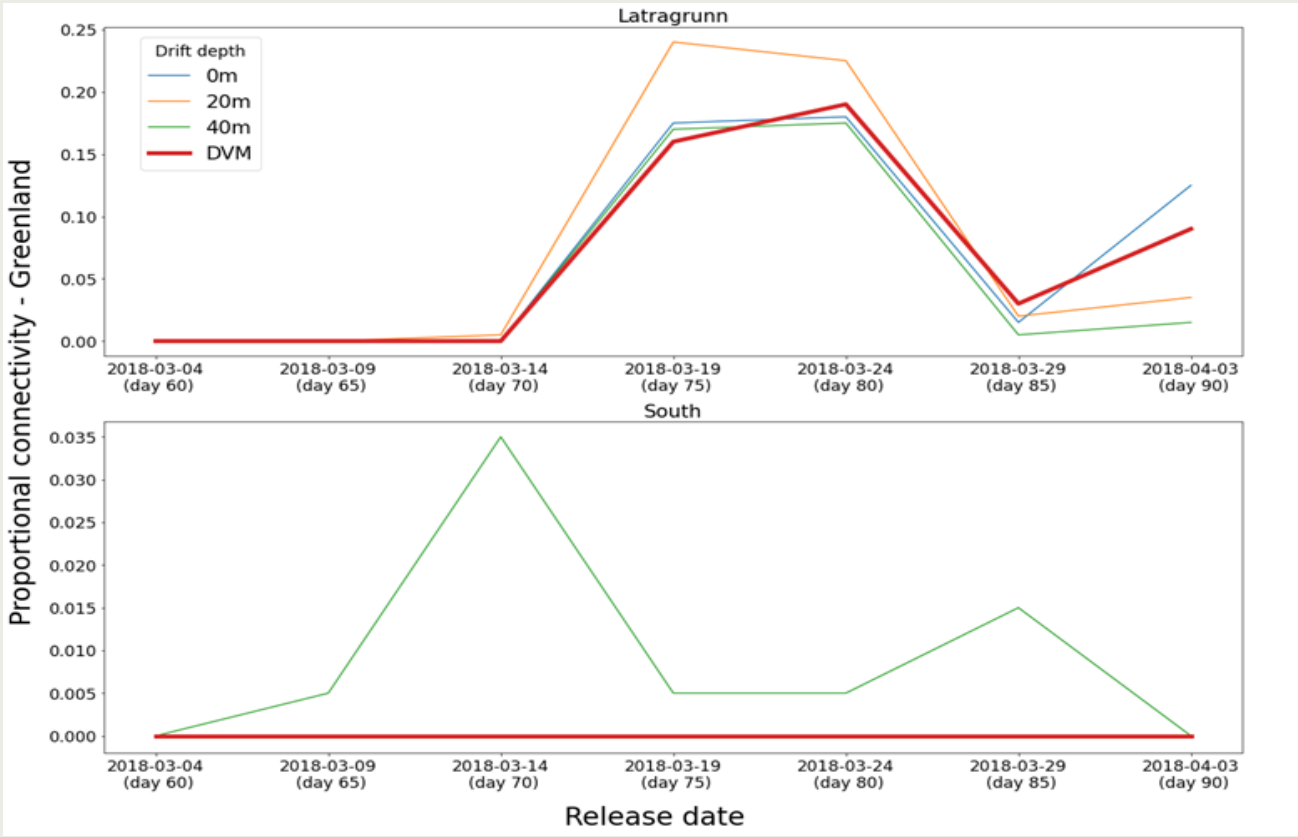
- Juvenile nursery connectivity is affected by spawning location and time of hatching

- Findings were presented at the capelin symposium in Bergen (Oct 2022)
  - https://capelin2022.imr.no/
  - Publications planned for special issue of ICES journal

- Developing a visualization tool as part of the Horizon 2020 project ECOTIP
  - https://ecotip-arctic.eu/
  - https://shiny.hafogvatn.is/31-cap-dashboard/

Currents affecting larval drift



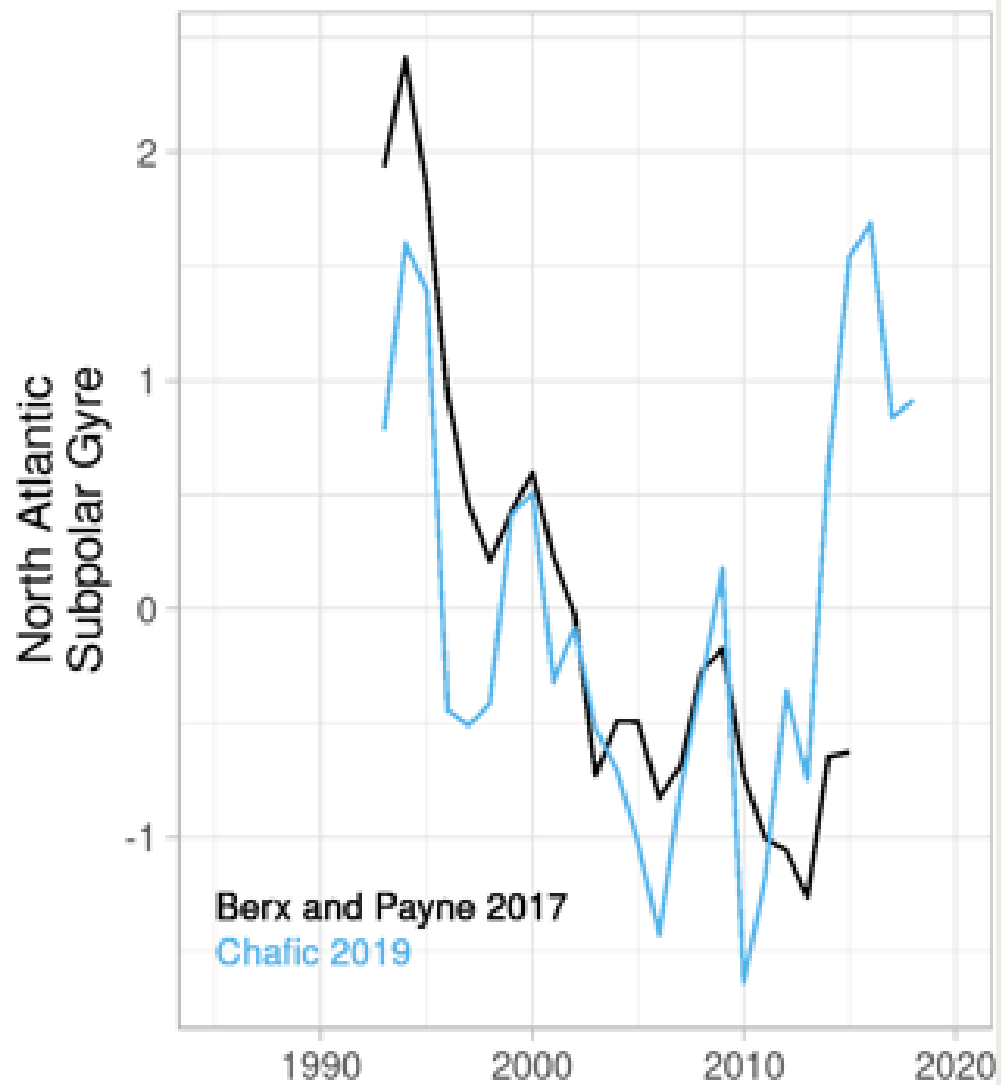


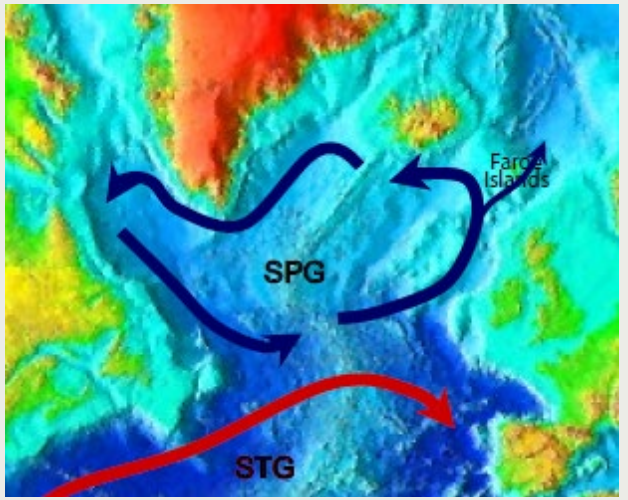
- Currents around Iceland with simulated drift from Latragrunn

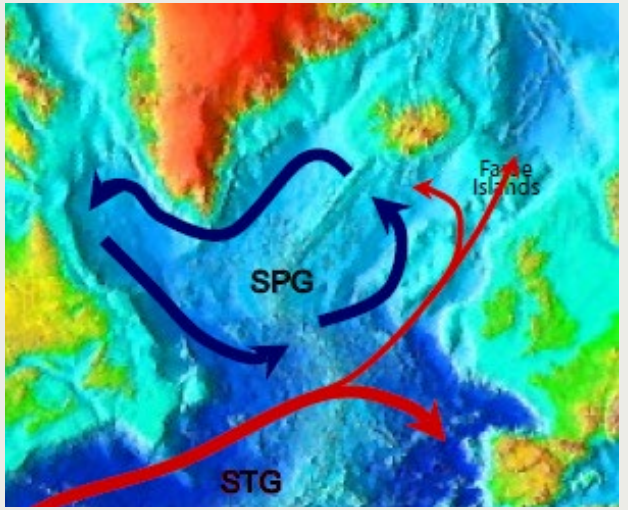
Carscadden et al. 2013
https://doi.org/10.1016/j.pocean.2013.05.005

- Time dependent connectivity to Greenland from 2 locations.

Effects of subpolar gyre





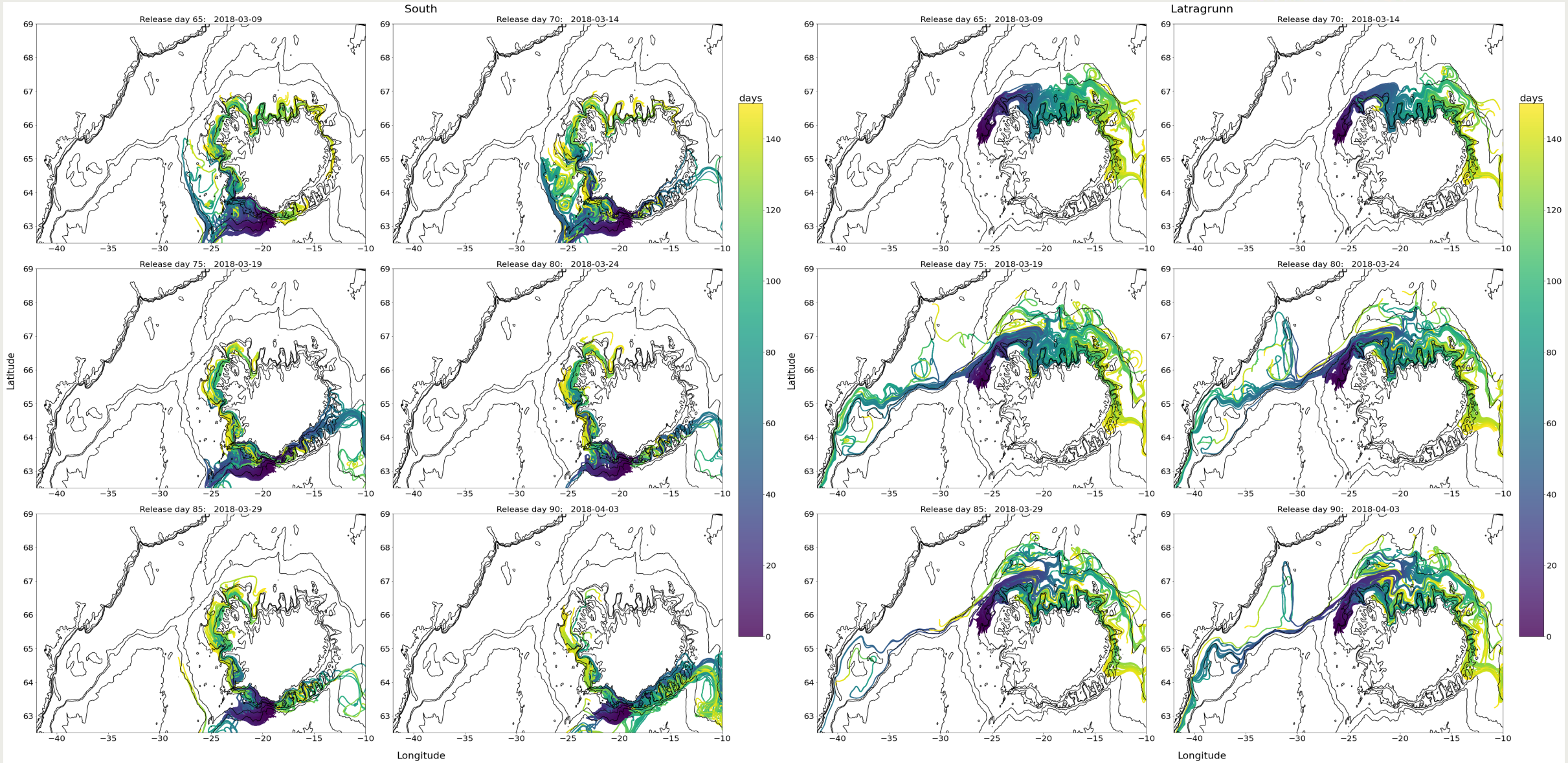


- Strong subpolar gyre: Restricted northward flow of Atlantic water

- Weak subpolar gyre: More northward flow of Atlantic waters

Ofstad L (2013) PhD thesis
Léon Chafik (2019) https://doi.org/10.17043/chafik-2019-gyre-1
Berx and Payne 2017. https://doi.org/10.5194/essd-9-259-2017, 2017

Time dependent connectivity



Reverse drift trajectories

- Hatching events can be inferred through backtracking.
- Trajectories calculated to back before conceivable hatching event
- Spawning event found along reverse drift trajectory using age data
- Larval transport pathways become evident