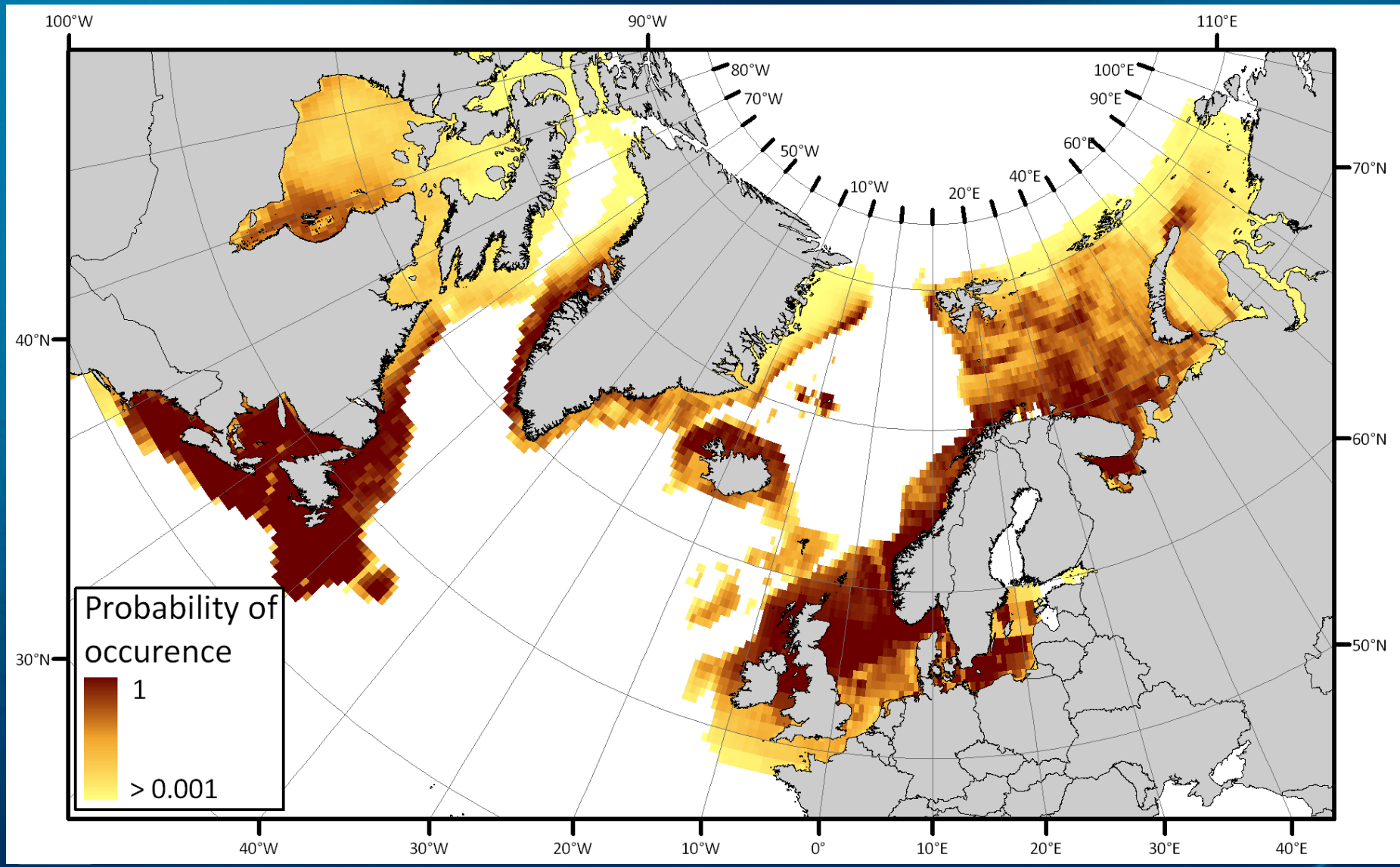
Effects of climate change on the survival of larval cod

Trond Kristiansen[1], Charles Stock[2], Ken Drinkwater[1], Enrique N. Curchitser[3]

[1]Insititute of Marine Research, Nordnes, Norway
[2]Geophysical Fluid Dynamics Laboratory, Princeton University Forrestal Campus, 201 Forrestal Road, Princeton, NJ-08540, USA
[3]Institute of Marine and Coastal Sciences, Rutgers University, New Jersey, USA

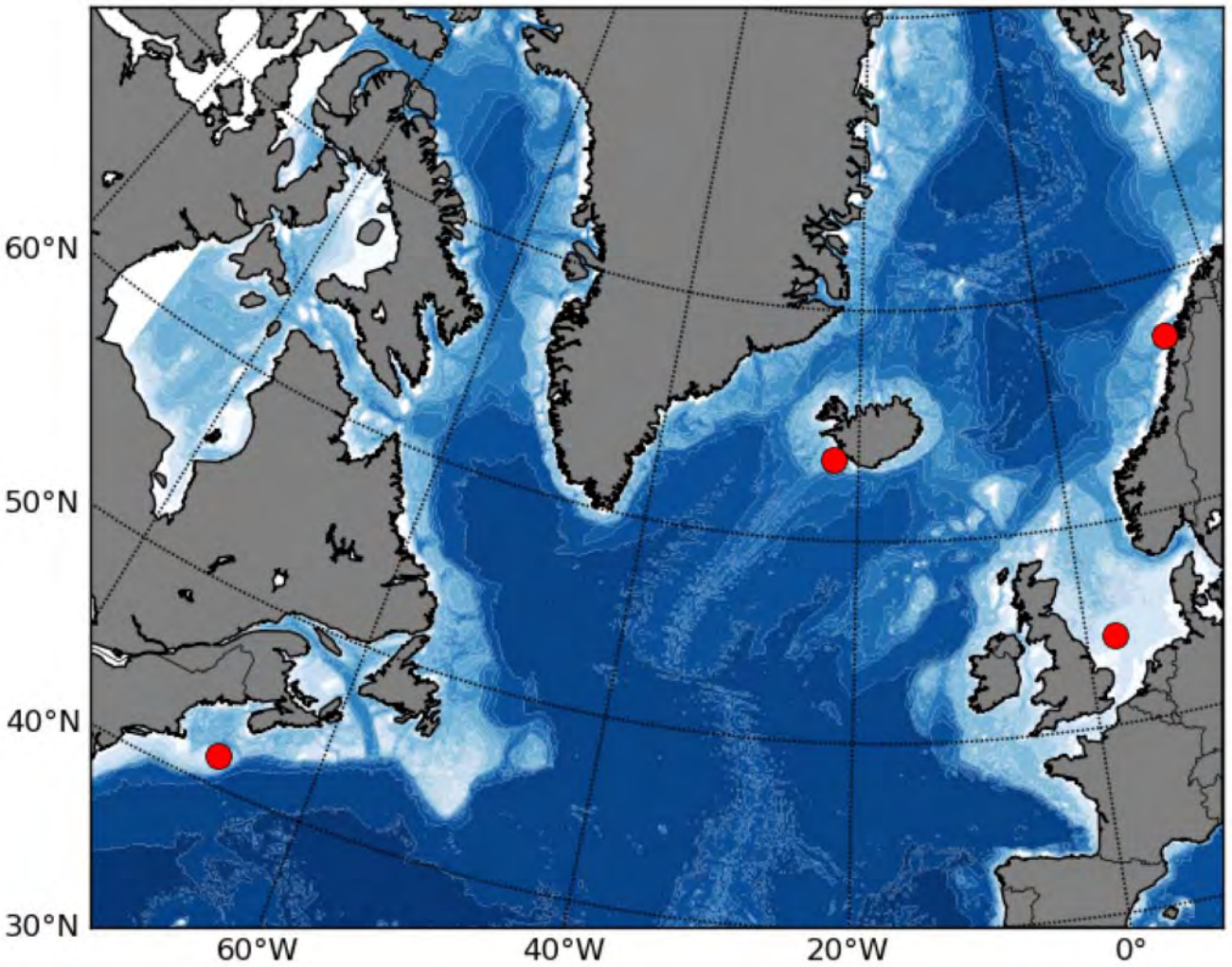
PICES 2010 Annual Meeting – Portland, OR

Cod distribution present 2050

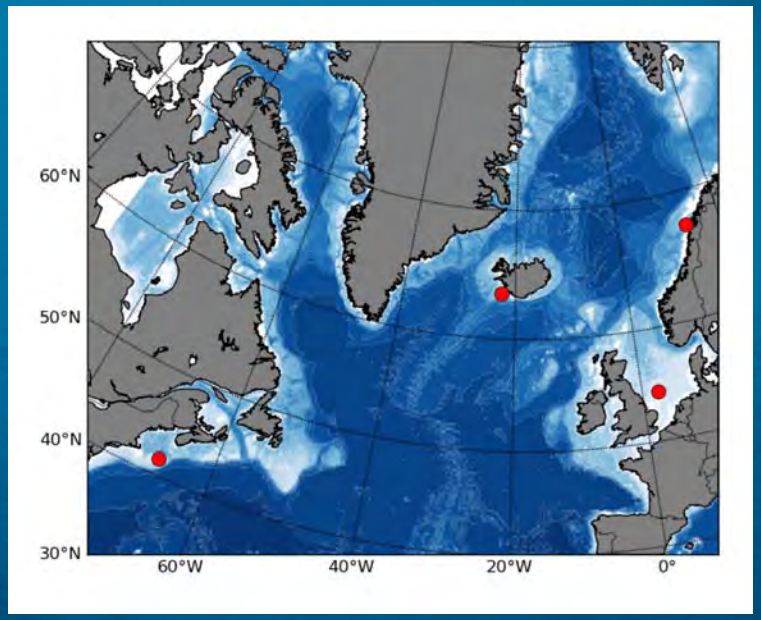


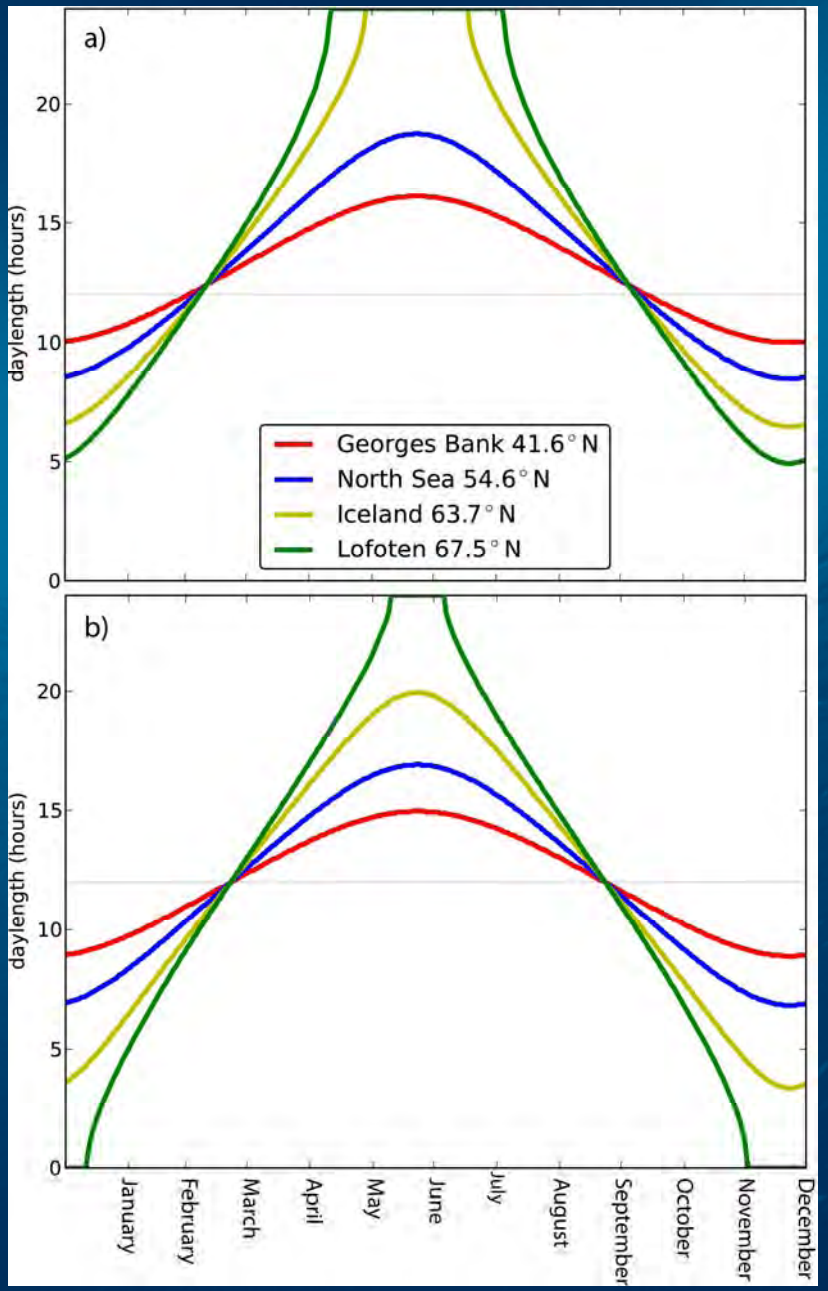
Data from Aquamaps

Important spawning locations



Light at spawning locations

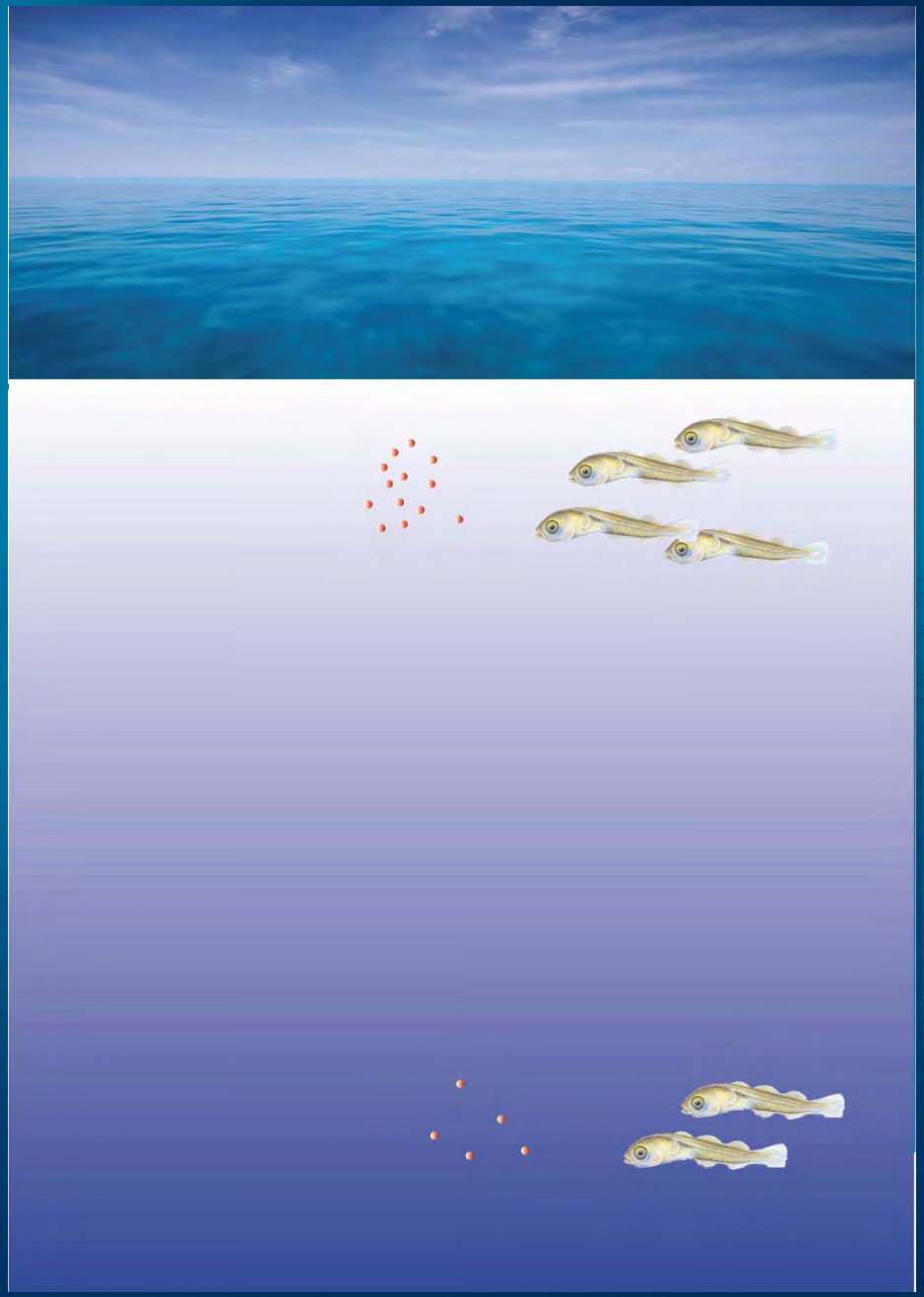




Surface layer

20 meters depth

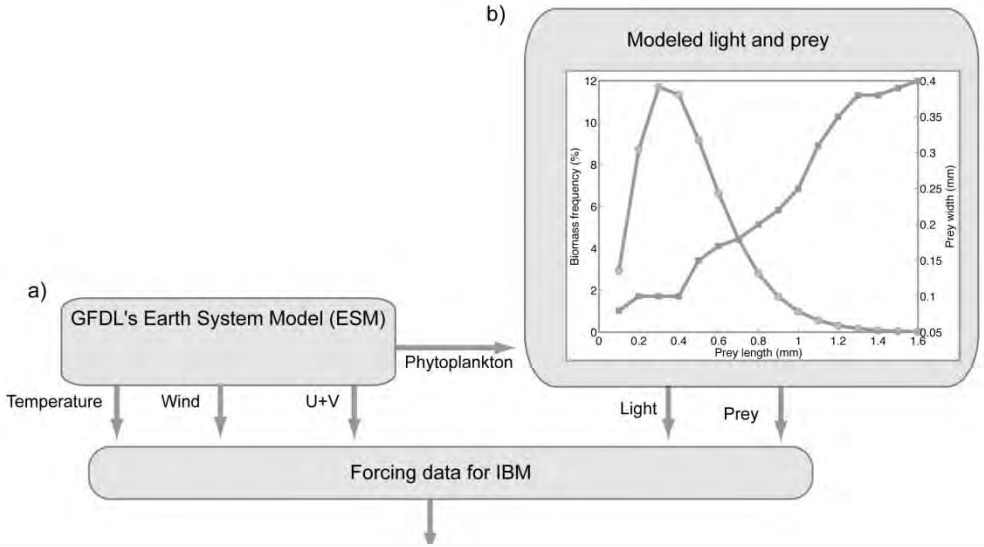
Mechanistic modeling



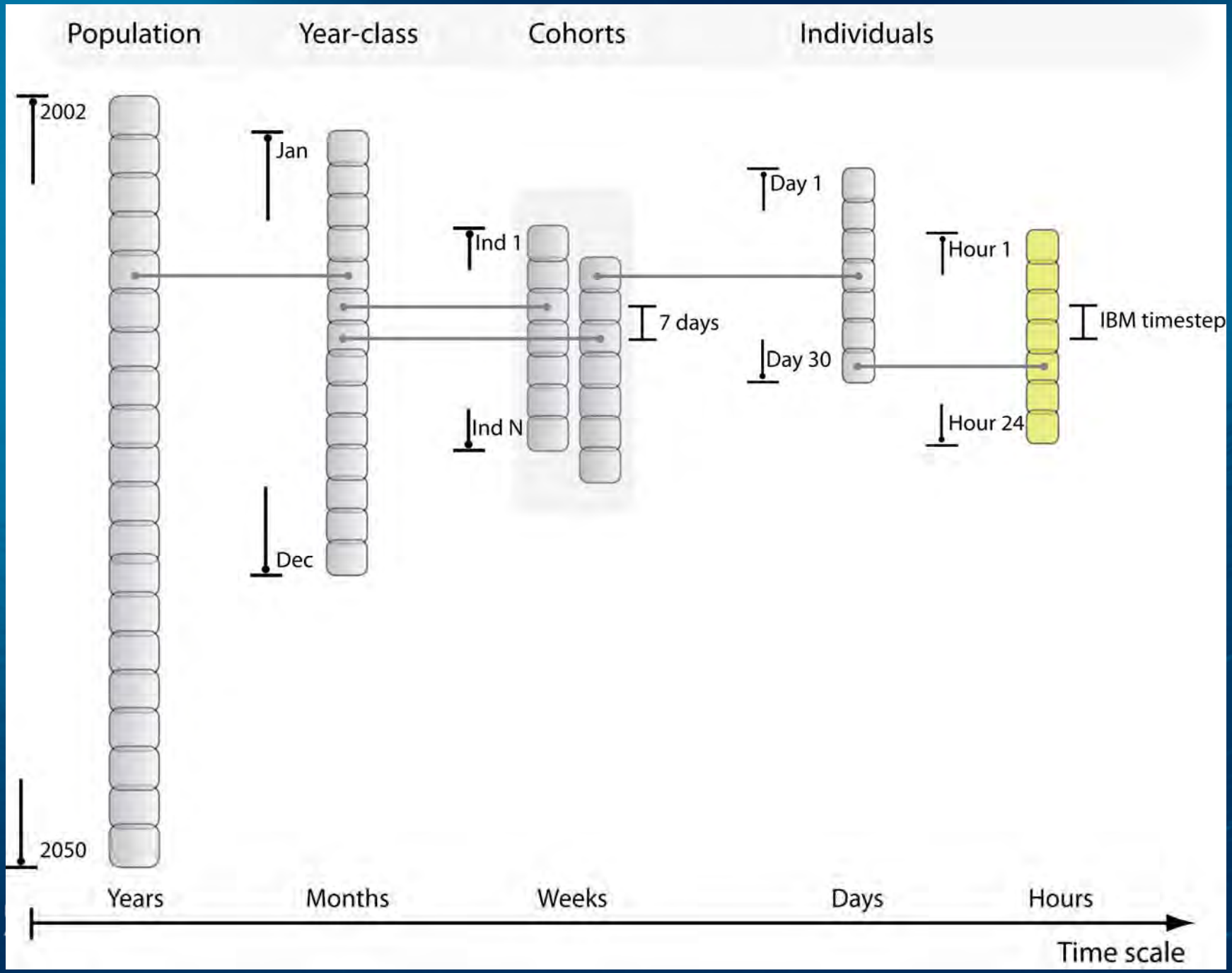
Mechanistic modeling considers the physical and biological properties that affect larval fish, e.g.

- light
- temperature
- turbulence
- contrast
- prey density
- prey size
- prey swimming speed
- ….

Materials and methods



R. G. Lough, et al. (2009). "Individual-based modeling of and prey selection of larval cod on Georges Bank." Marine s Series **376: 227-243.**


Population
Year-class
Cohorts
Individuals
2002
Jan
Dec
2050
Ind 1
Ind N
7 days
Day 1
Day 30
Hour 1
Hour 24
IBM timestep
Years
Months
Weeks
Days
Hours
Time scale

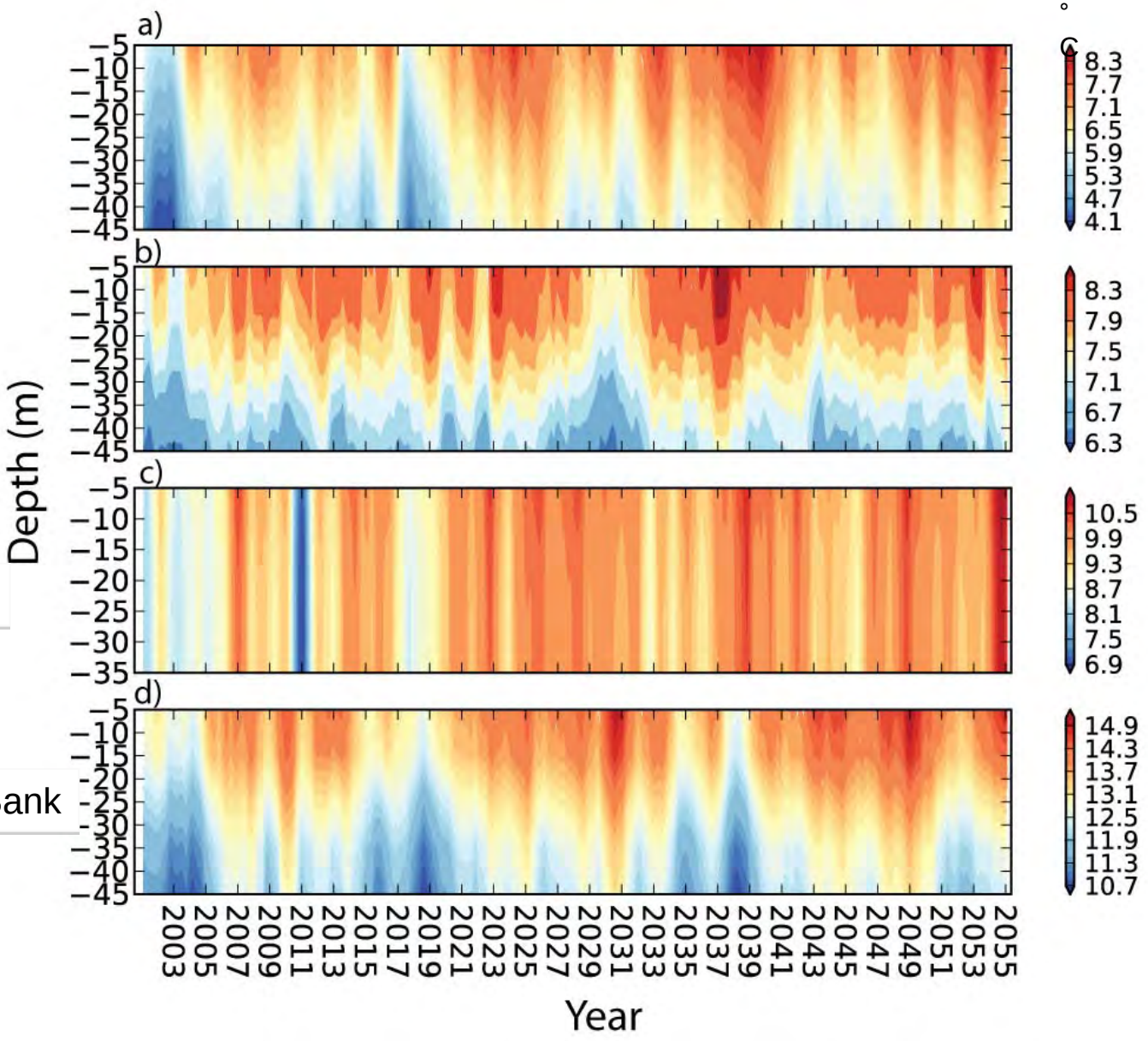
Temperature (ESM2.1)

Lofoten

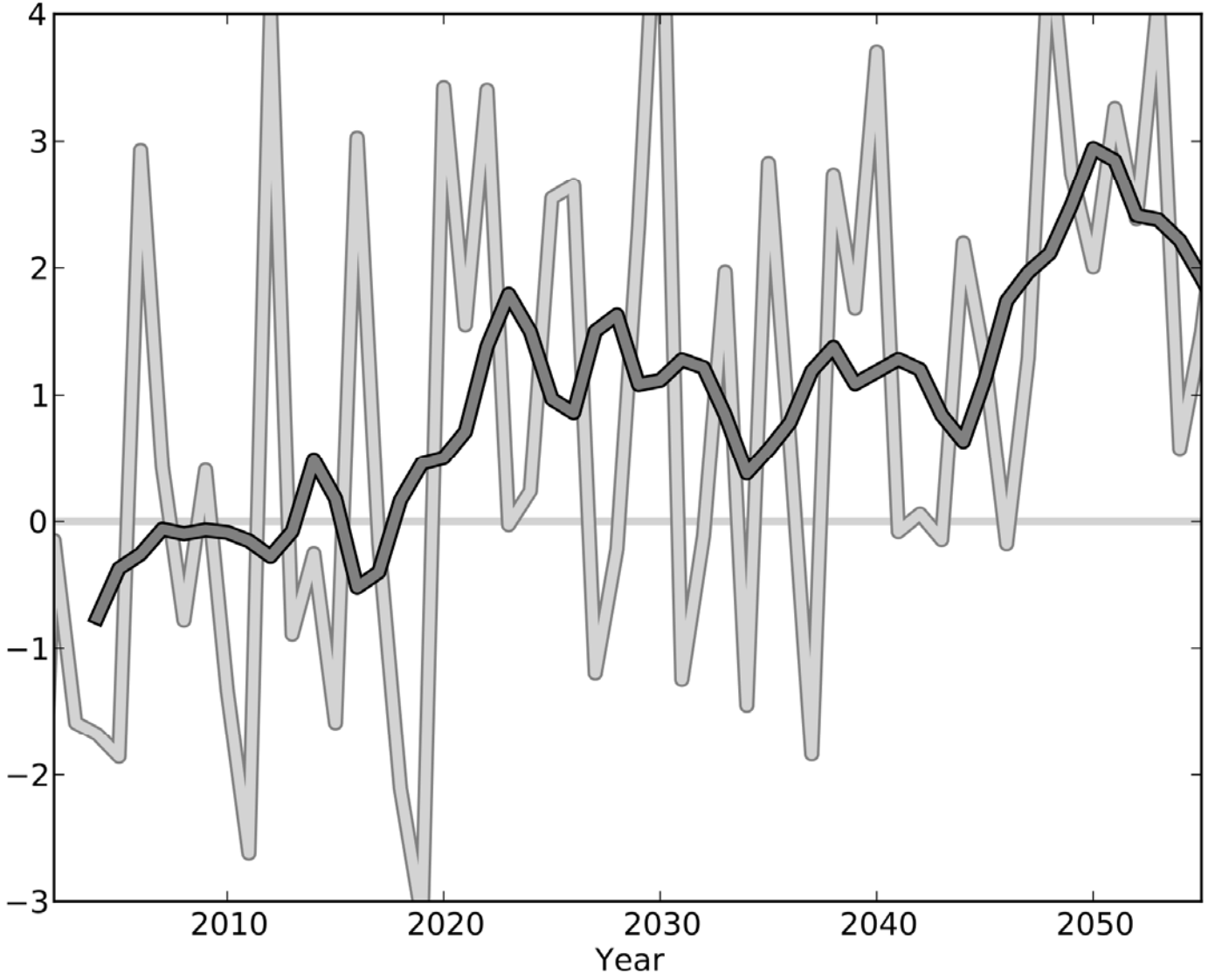
Iceland

North Sea

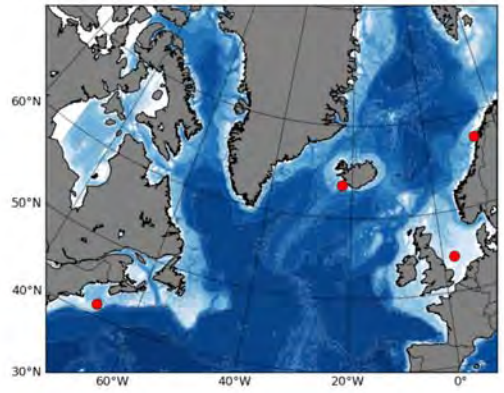
Georges Bank

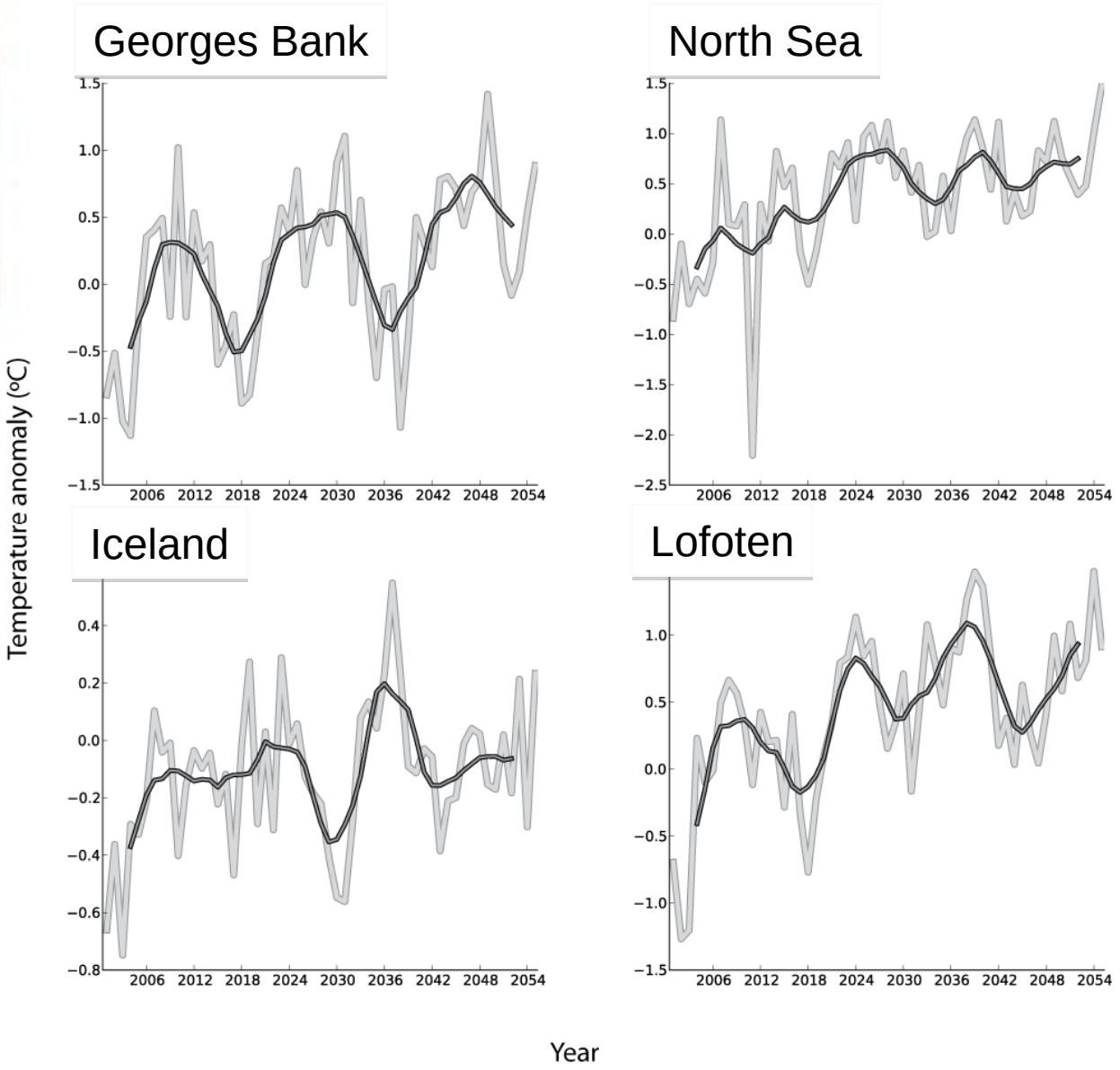


North Atlantic Oscillation

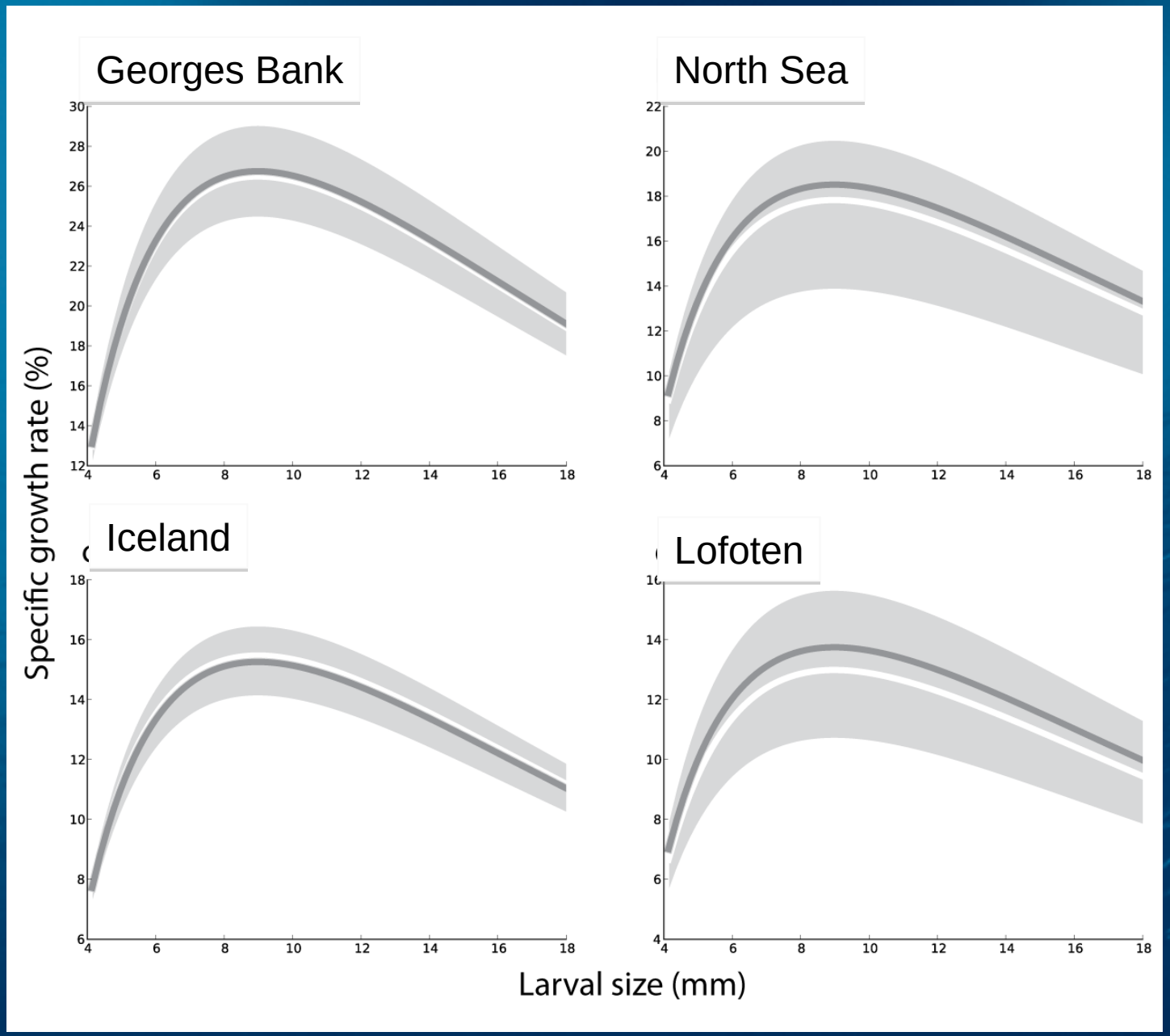


Temperature anomalies





Specific growth rate (temperature determined)



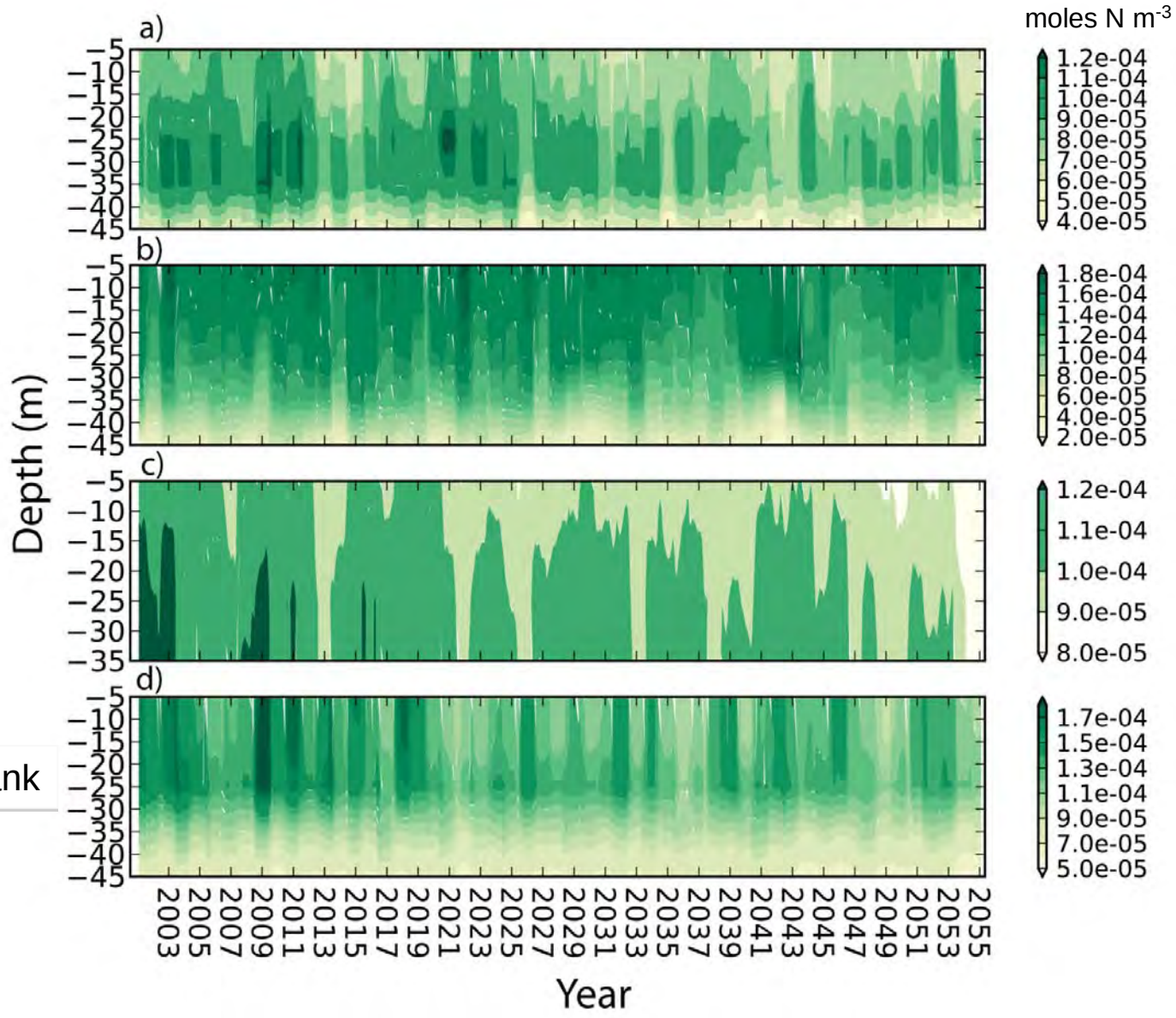
Large phytoplankton (ESM2.1)

Lofoten

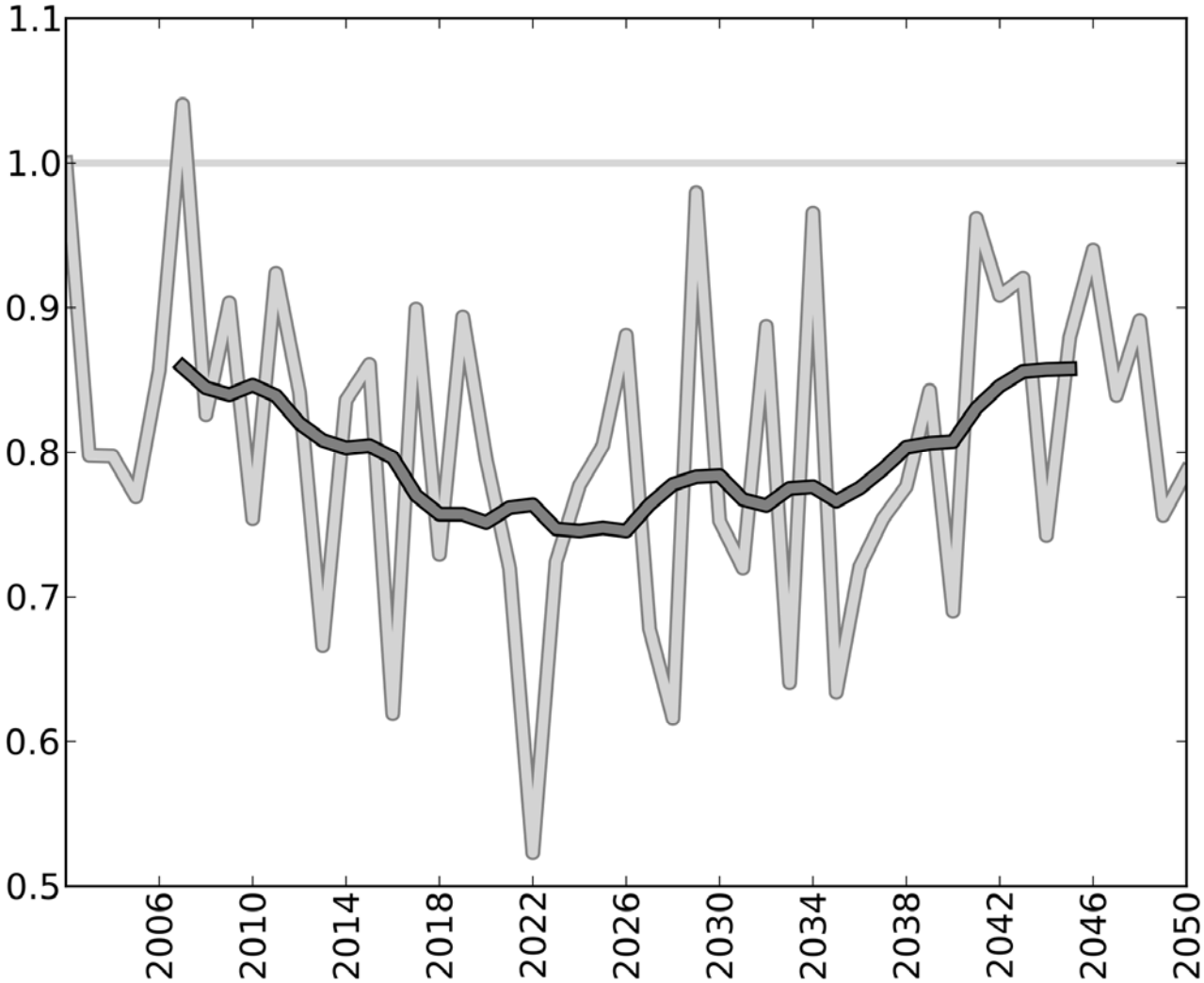
Iceland

North Sea

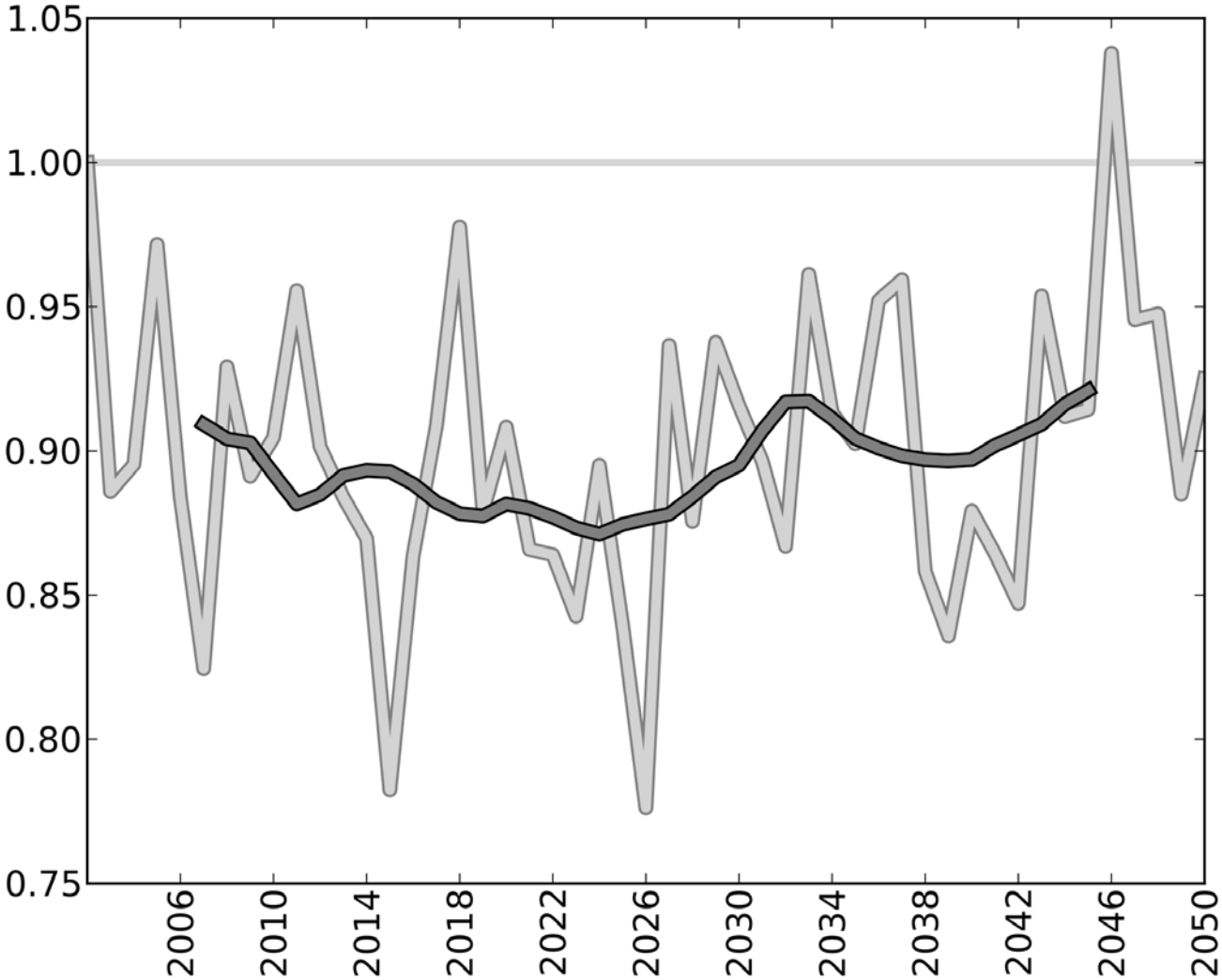
Georges Bank



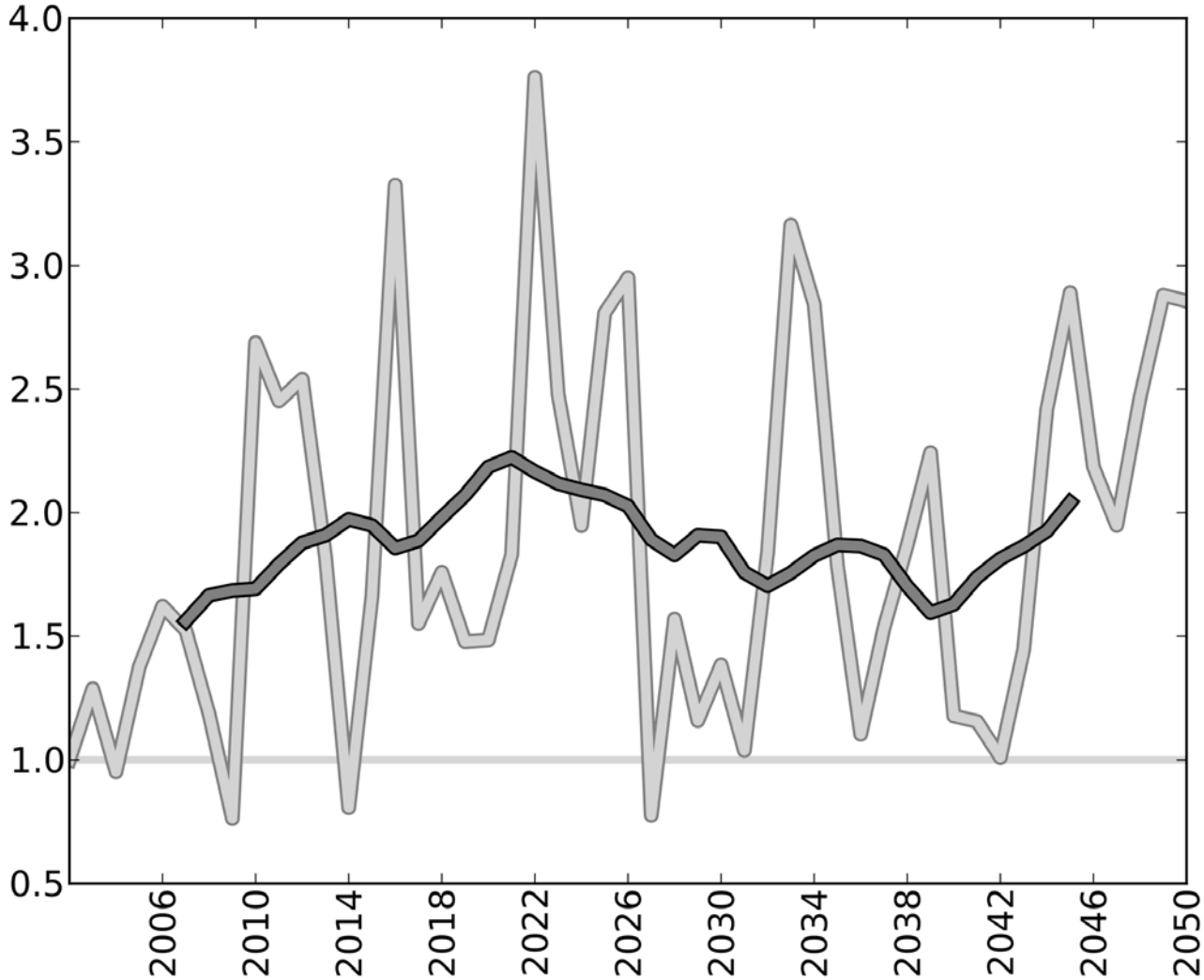
Predicted survival rate in Georges Bank



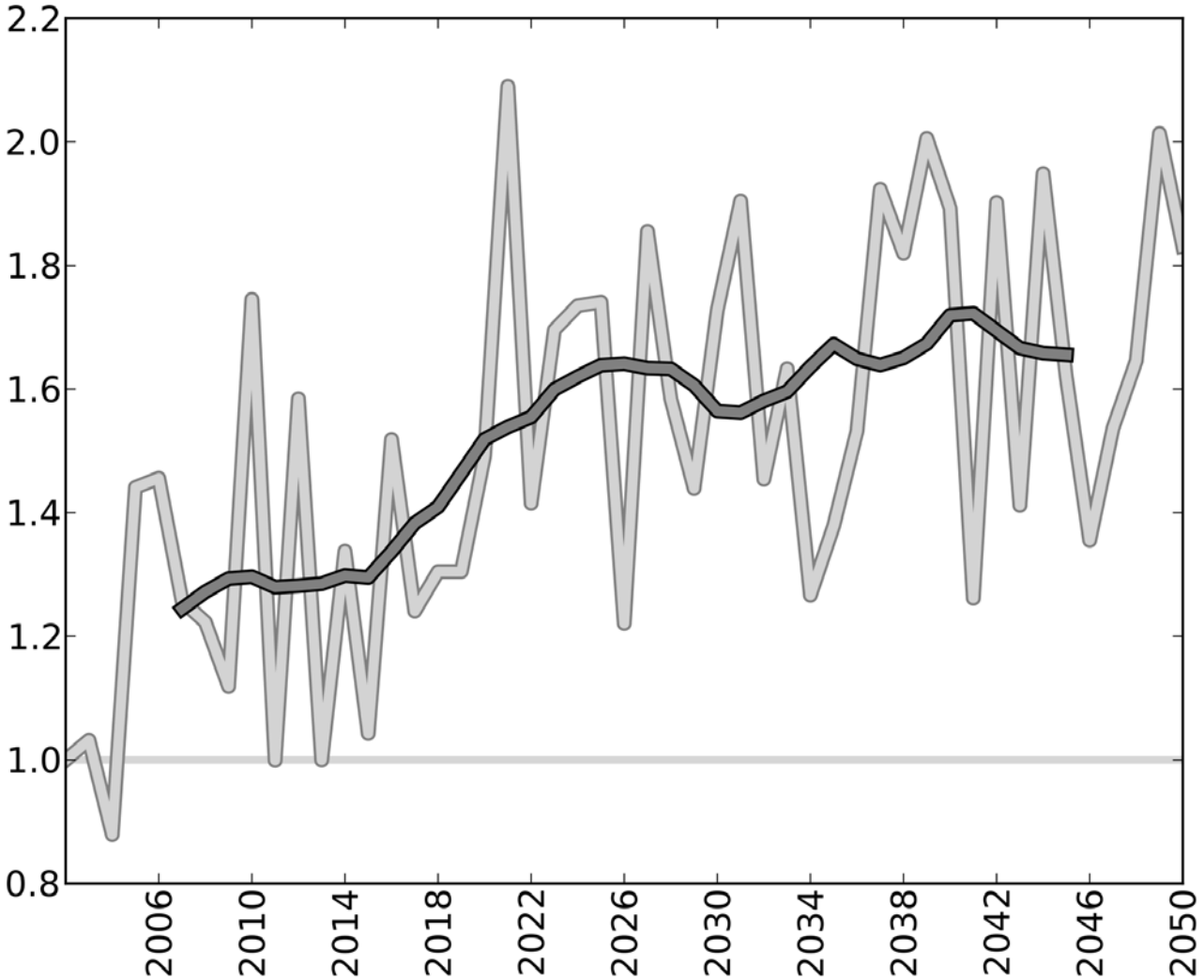
Predicted survival rate in the North Sea



Predicted survival rate in Iceland



Predicted survival rate in Lofoten



Preliminary conclusions

- Larval growth and survival are strongly controlled by ocean temperature, light, and prey conditions and operate non-linearly in combination.
- Larval cod survival rates were predicted to increase in Lofoten and Iceland.
- Larval cod survival rates were predicted to decrease in the North Sea and Georges Bank.