Climate Change in the U.S. Northeast Shelf: Observations and Projections

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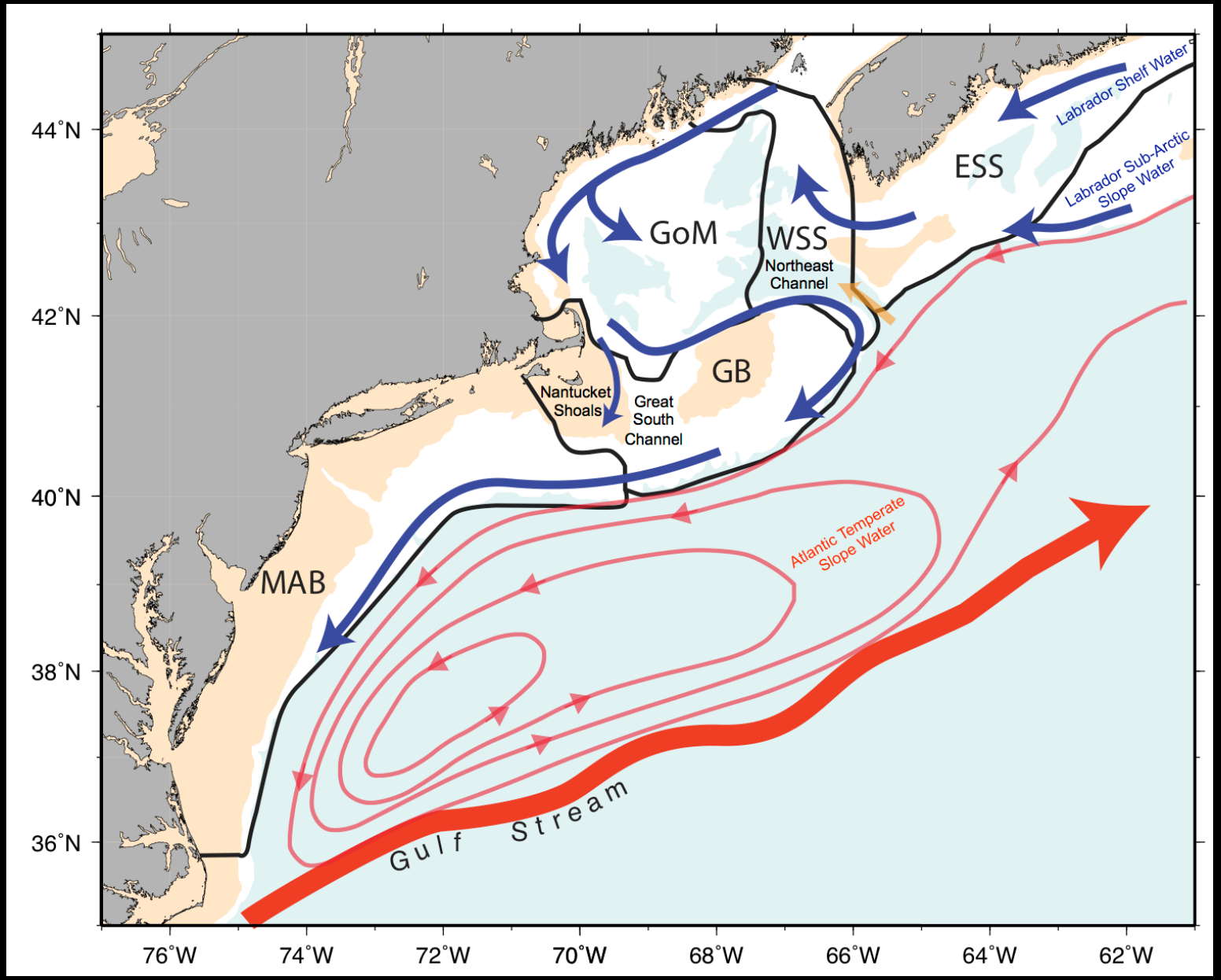
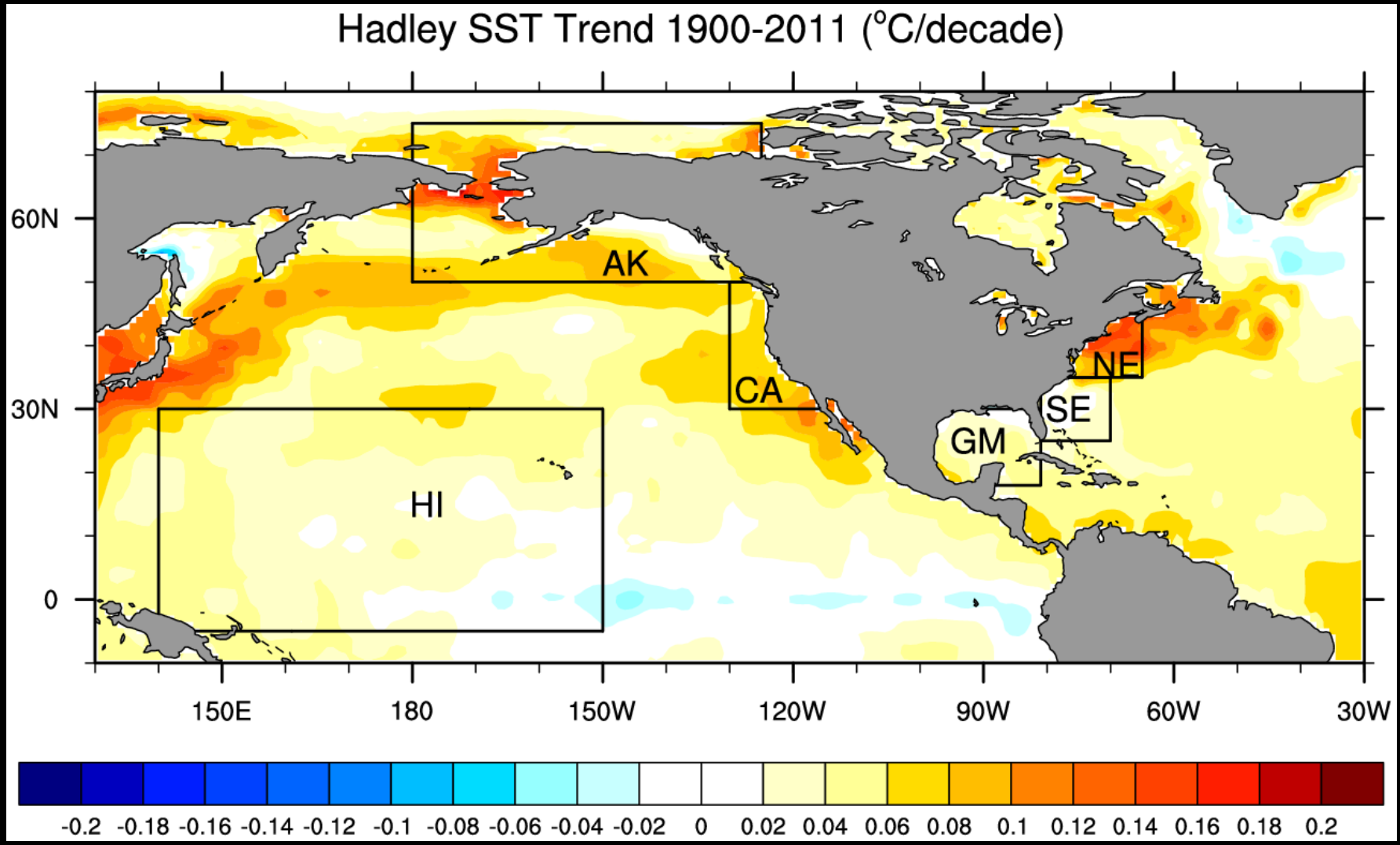
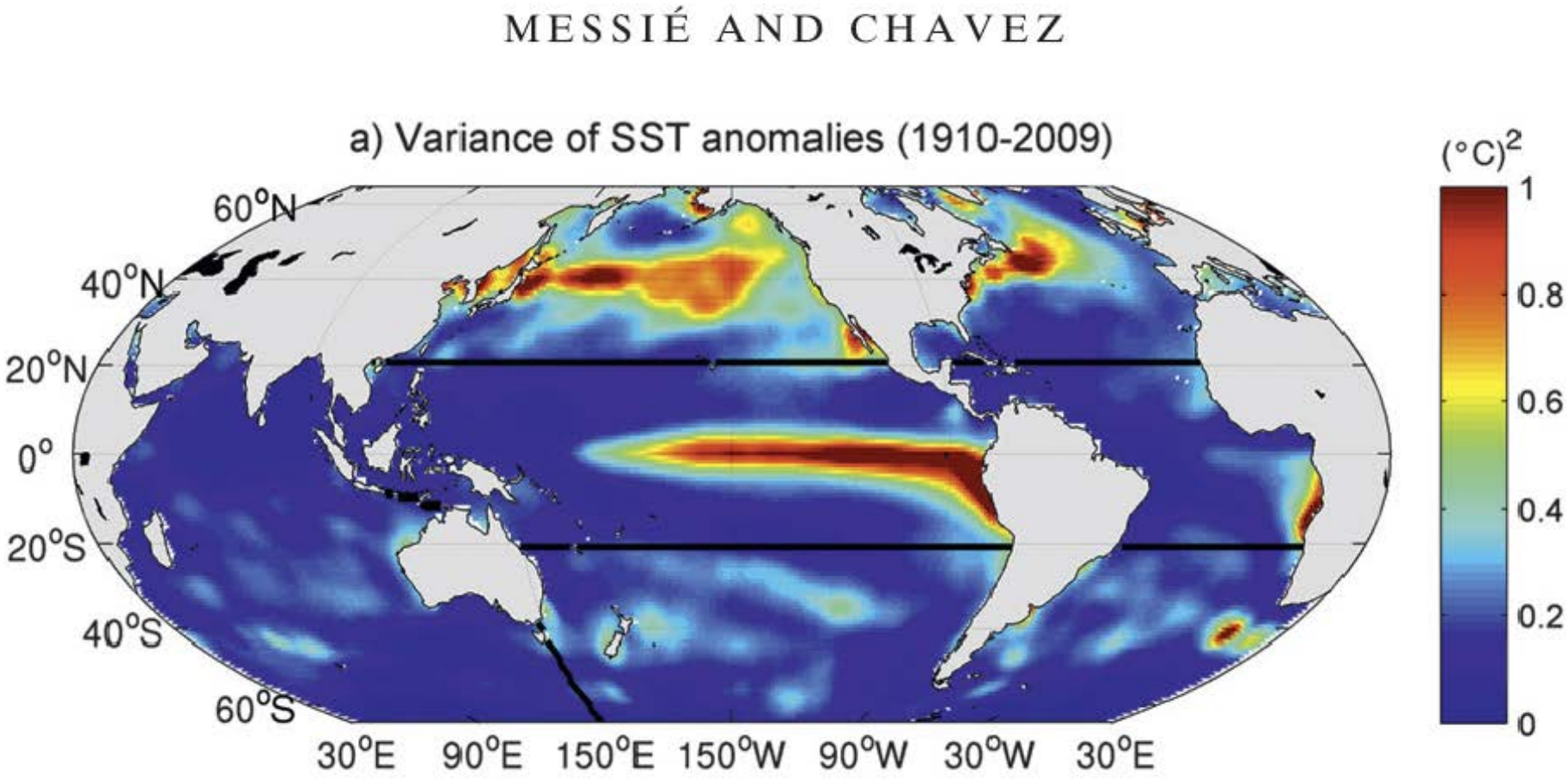
U.S. Northeast Shelf EPUs



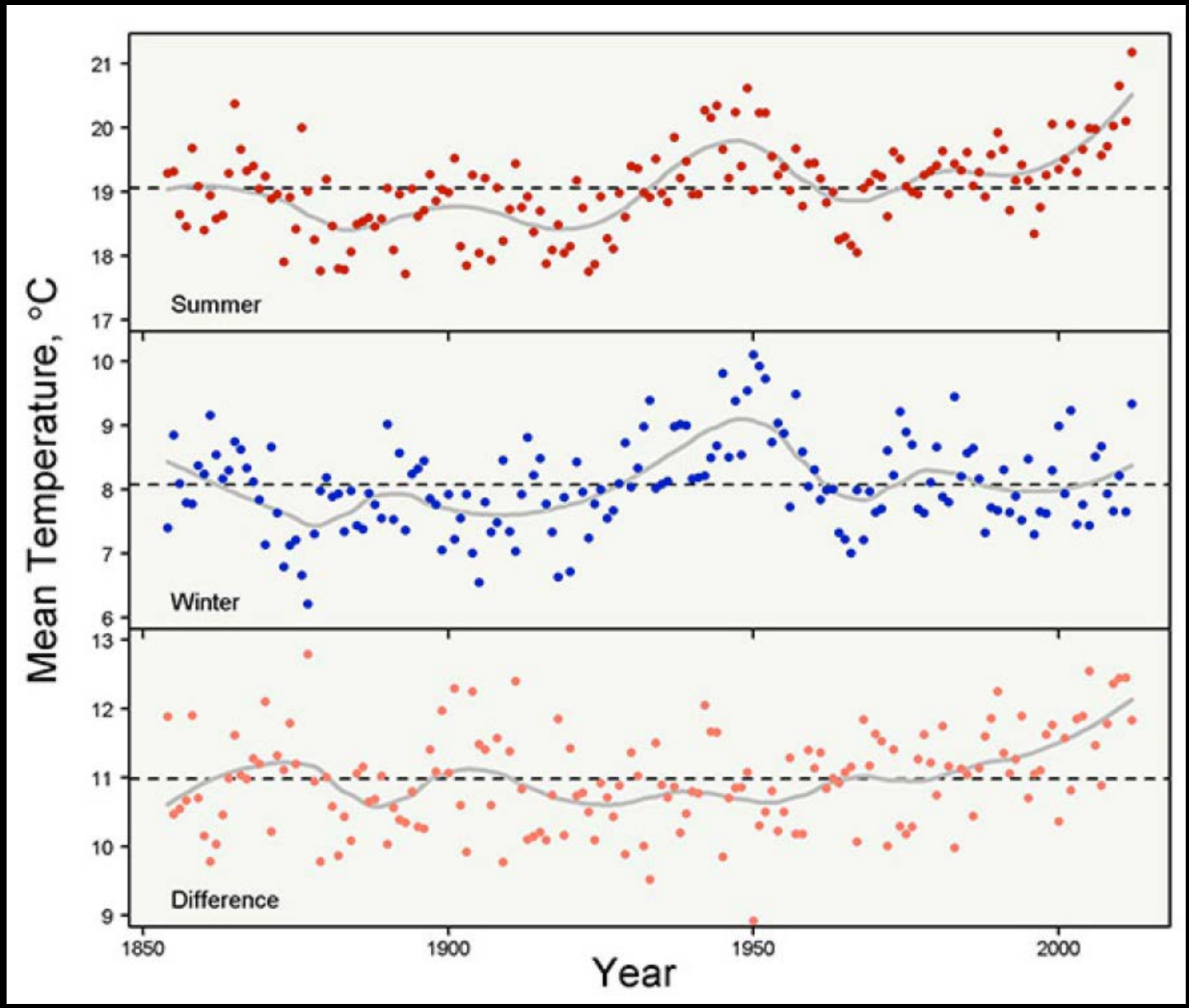
Ocean Temperature Trends



U.S. NE Shelf – Climate



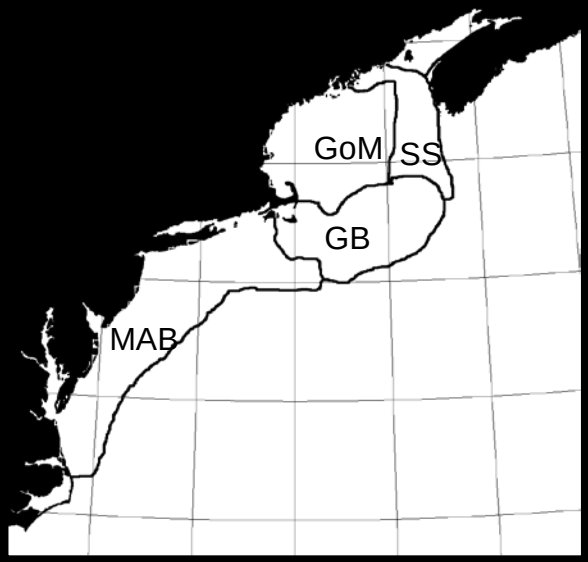
U.S. NE Shelf – SST



NOAA NEFSC Ecosystem Status Report, 2013

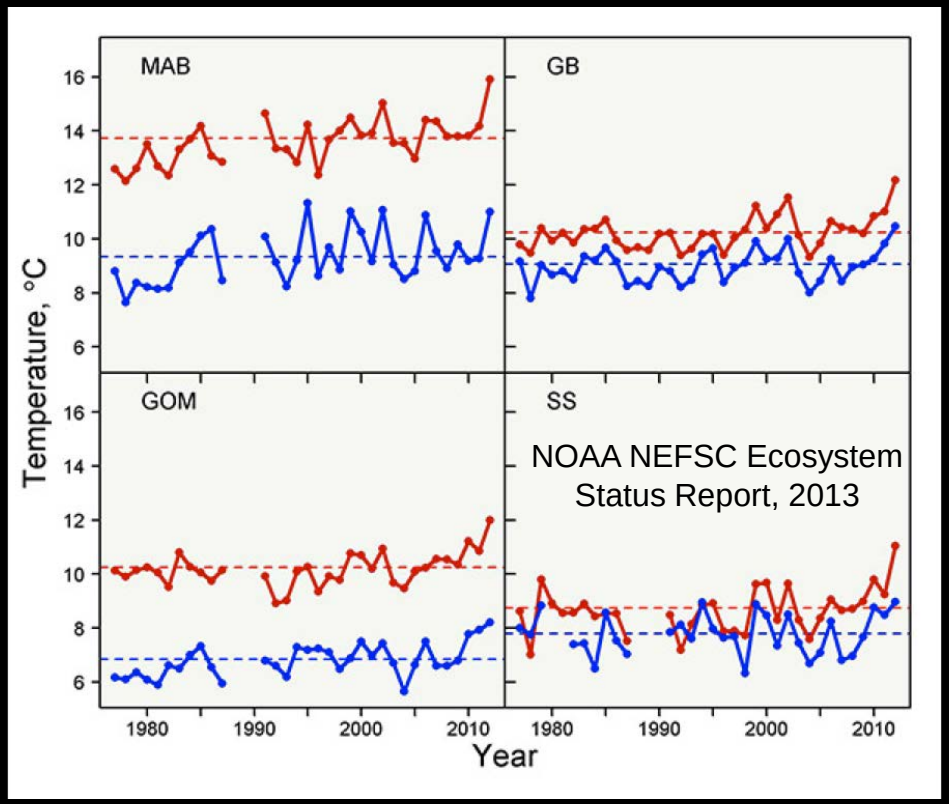
Temperature

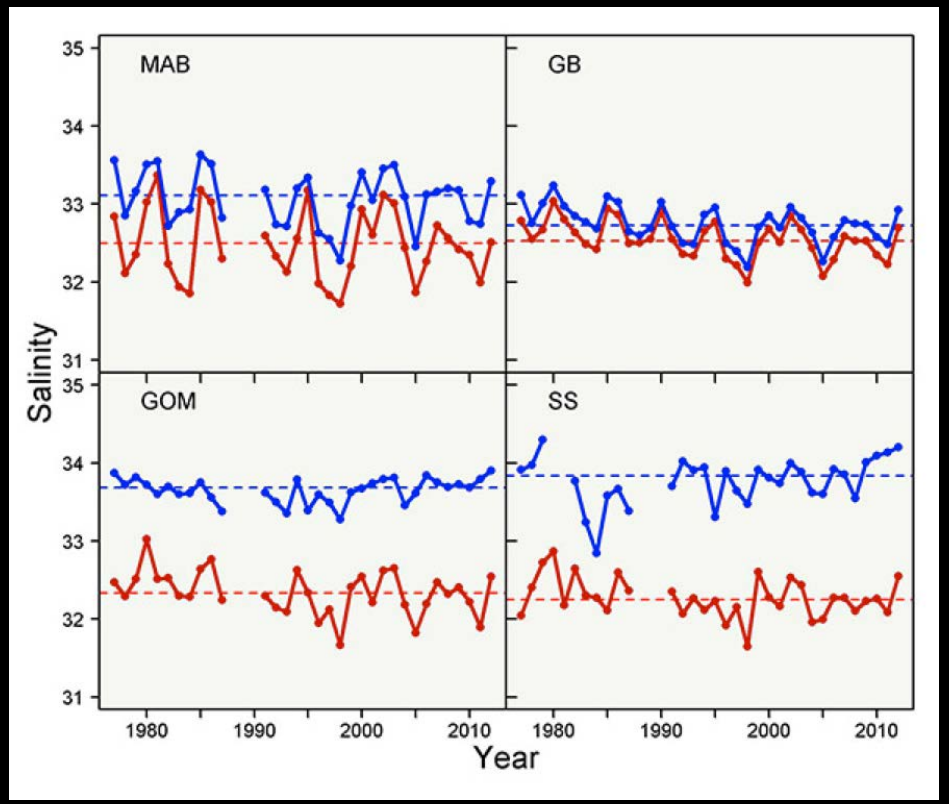
- Interannual variability > 2 ^{o}C
- Warming 1 to 1.7 ^{o}C



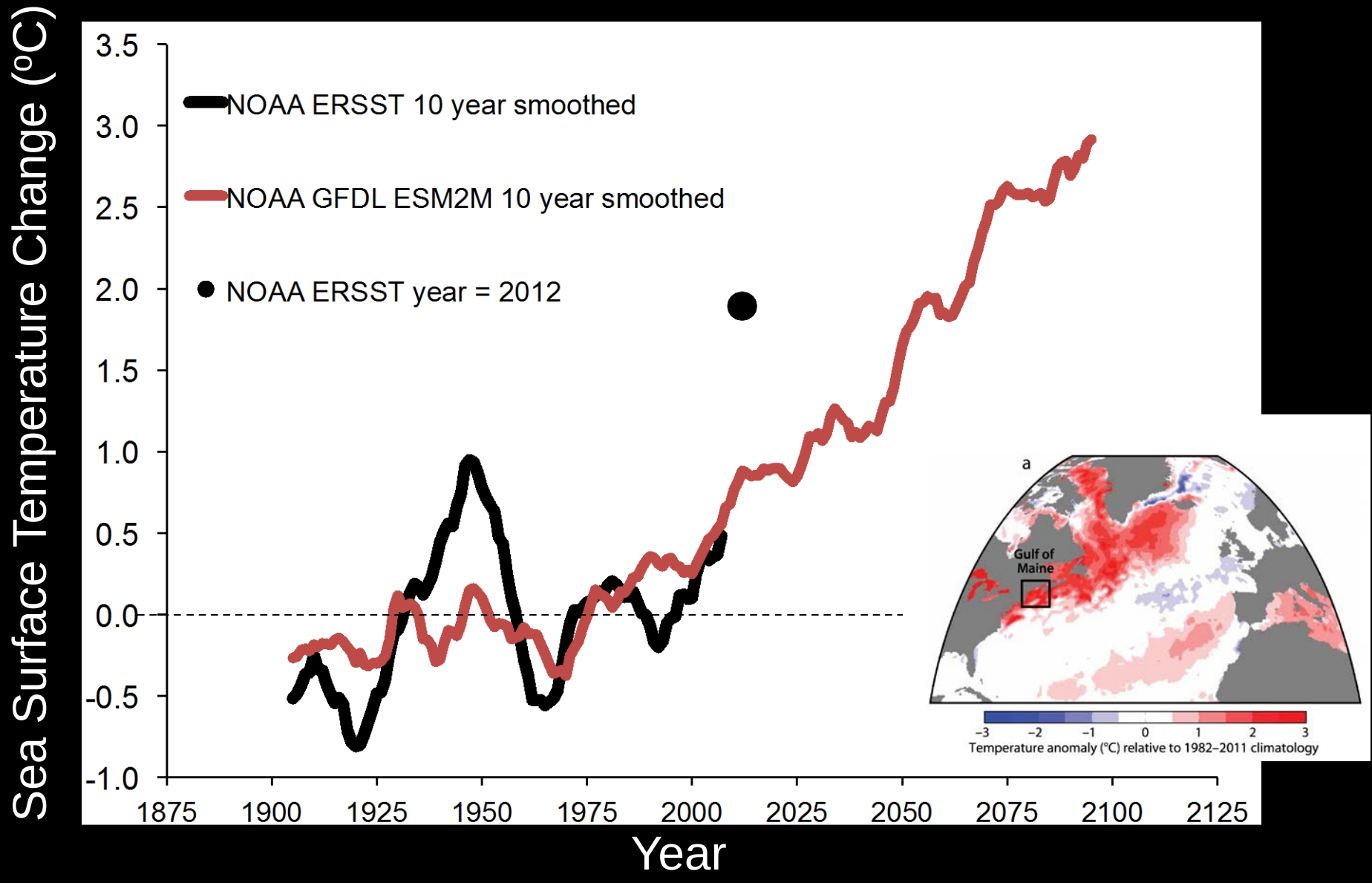
Salinity

- Interannual variability ~ 1.5 psu
- GB freshening ~ 0.3 psu





2012 ocean temperature of the U.S. Northeast Shelf



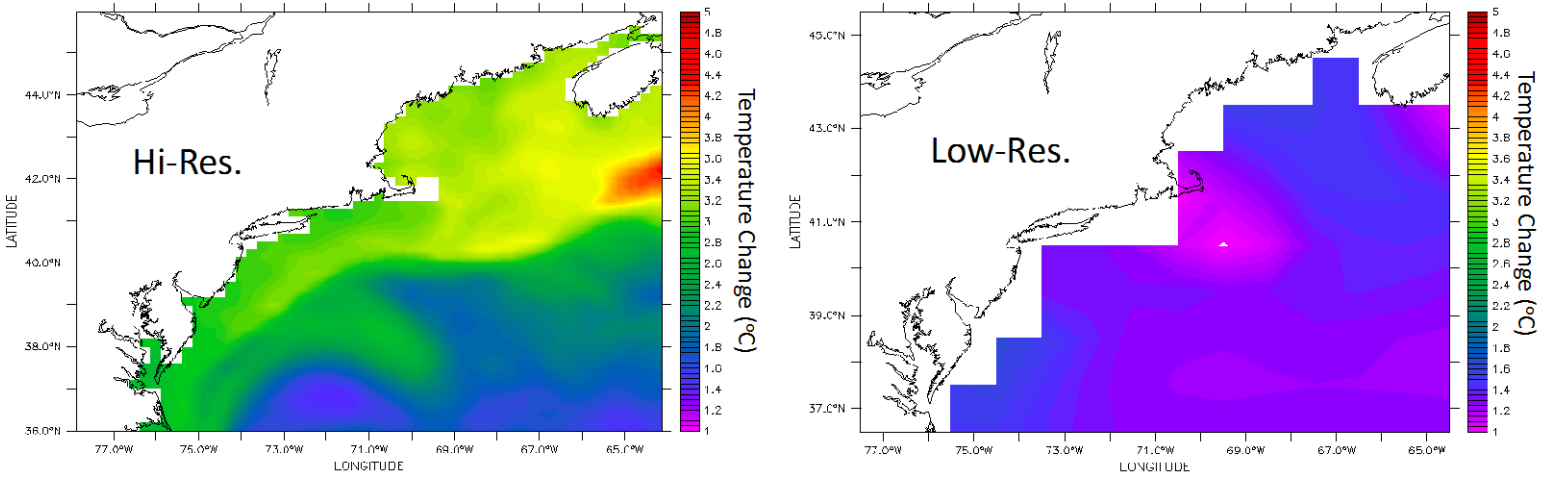
Projected impacts of climate change on the physical environment of the U.S. NES using a high-resolution climate model

V. Saba, J. Hare, et al.

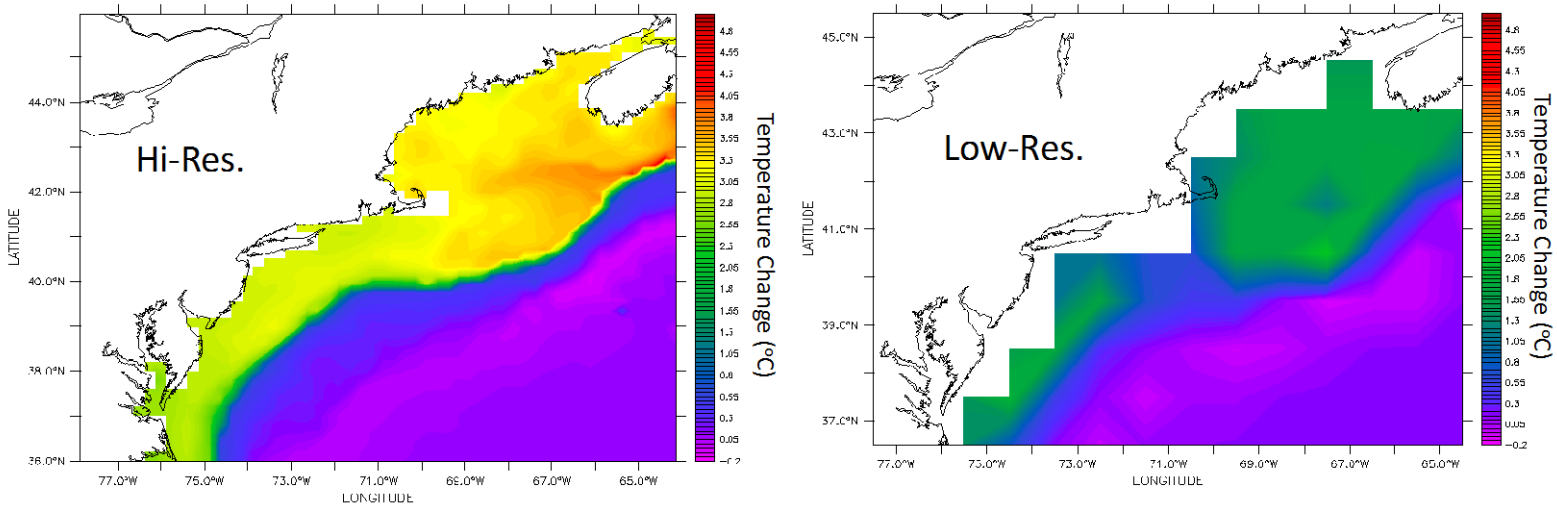
GFDL CM2.5 2xCO_2 simulations

GFDL CM2.1 2xCO_2 simulations

SST Change (2075-2100) minus (1990-2015)

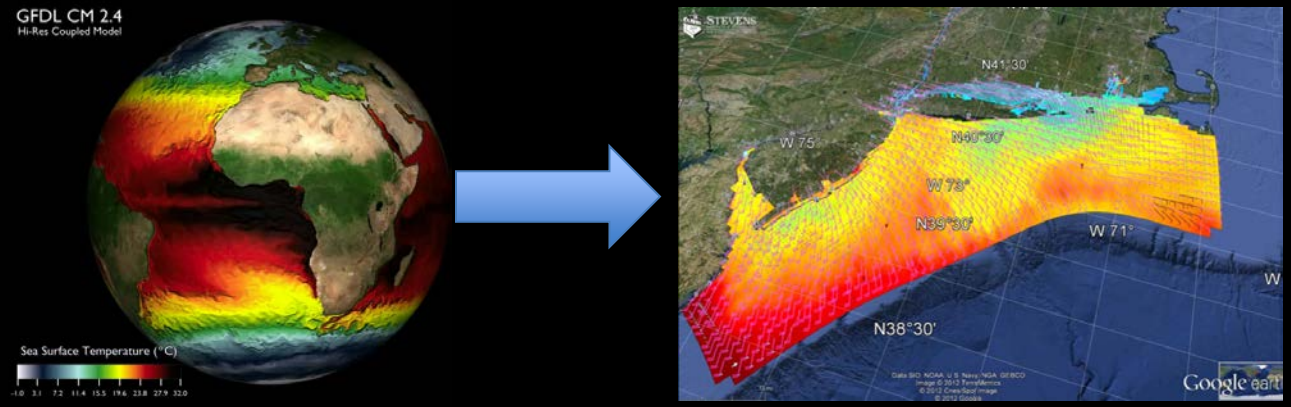


Bottom temp. Change (2075-2100) minus (1990-2015)



Bias Correction

1) Dynamical Downscaling



2) Stastical Downscaling
   - Delta method
   - Use observed data to remove bias in both the mean and variability of the model output.

$$Corr\_Model\_Temp_{m_y} = Model\_Temp_{m_y} \times \left(\overline{Obs\_Temp_m} / \overline{Model\_Temp_m}\right)$$

Vol. 393: 111–129, 2009
doi: 10.3354/meps08220

MARINE ECOLOGY PROGRESS SERIES
Mar Ecol Prog Ser

Published October 30

Changing spatial distribution of fish stocks in relation to climate and population size on the Northeast United States continental shelf

Janet A. Nye[1,*], Jason S. Link[1], Jonathan A. Hare[2], William J. Overholtz[1]

Vol. 415: 23–33, 2010
doi: 10.3354/meps08743

MARINE ECOLOGY PROGRESS SERIES
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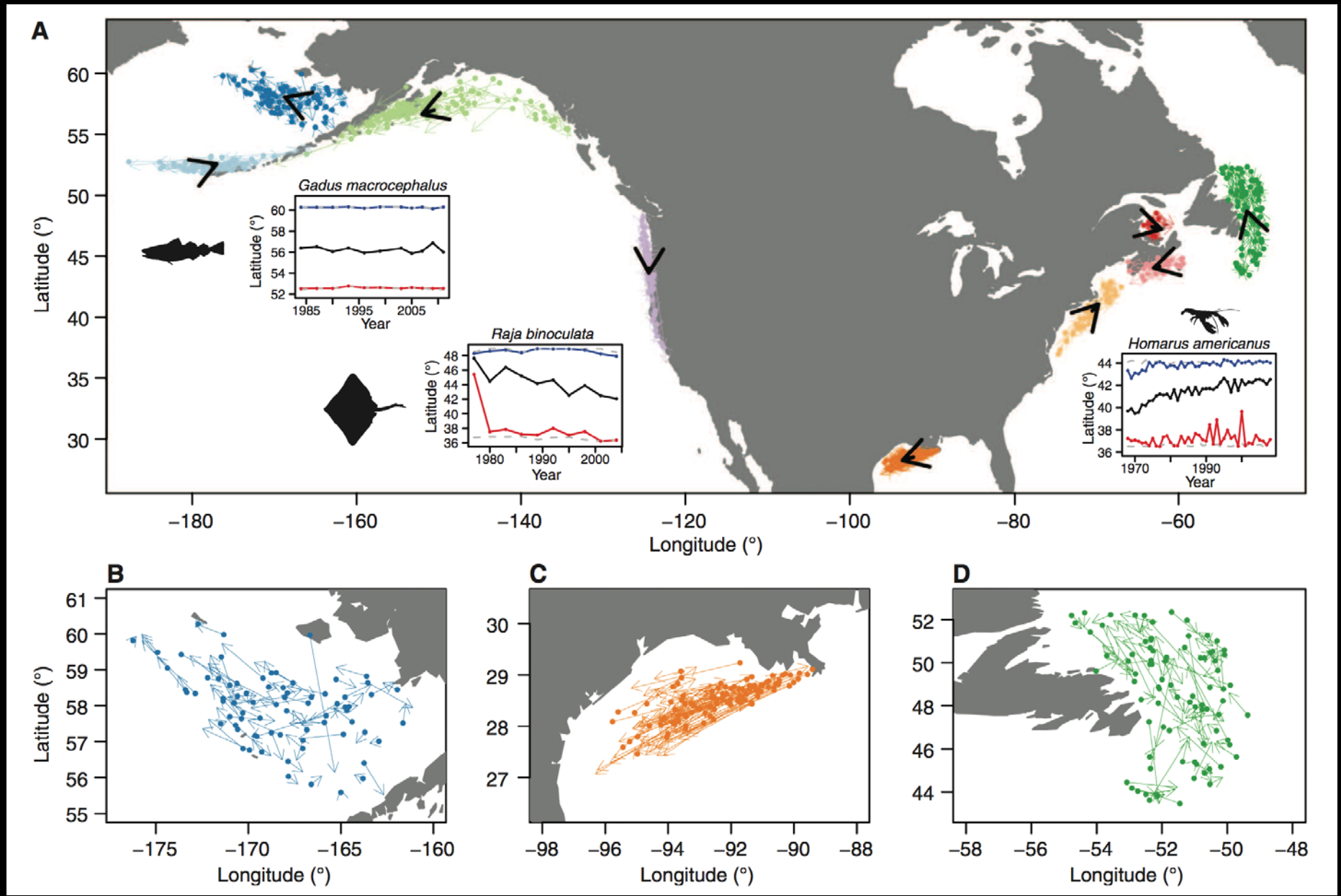
Published September 29

Shifting species assemblages in the Northeast US Continental Shelf Large Marine Ecosystem

Sean M. Lucey*, Janet A. Nye

Marine Taxa Track Local Climate Velocities

Malin L. Pinsky,[1,2]* Boris Worm,[3] Michael J. Fogarty,[4] Jorge L. Sarmiento,[5] Simon A. Levin[1]



Pinsky et al., 2013

Should we only consider temperature as the driving mechanism between climate change and living marine resources?

1) Fishing
2) Bottom-Habitat
3) Multi-species Interactions
4) Ocean Acidification
5) <u>Bottom-up Forcing</u>

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Drivers of Climate Change
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Projected Impacts of Climate Change – Potential Winners and Losers

Atlantic Cod | Atlantic Croaker | Cusk

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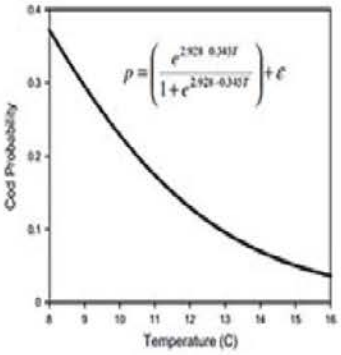

Figure 23

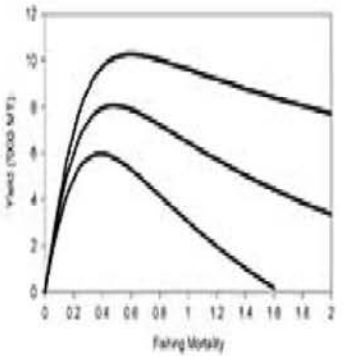

Figure 24

Projections for Atlantic cod under a high greenhouse gas emissions scenario to the year 2100 suggest that cod in the U.S. NES LME will be vulnerable to a loss of thermal habitat from Georges Bank to the southern limits of its present-day range (Figure 23). In the Gulf of Maine, the early life history survival of cod is projected to decline with increasing ocean temperature, rendering the stock more vulnerable to high fishery mortality rates. Projected yields of cod in the Gulf of Maine under various temperature conditions and various levels of fishing mortality show a robust, negative influence of warming temperature on yield (Figure 24).

Thank you


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