Future ocean warming and impacts on U.S. Northeast fisheries

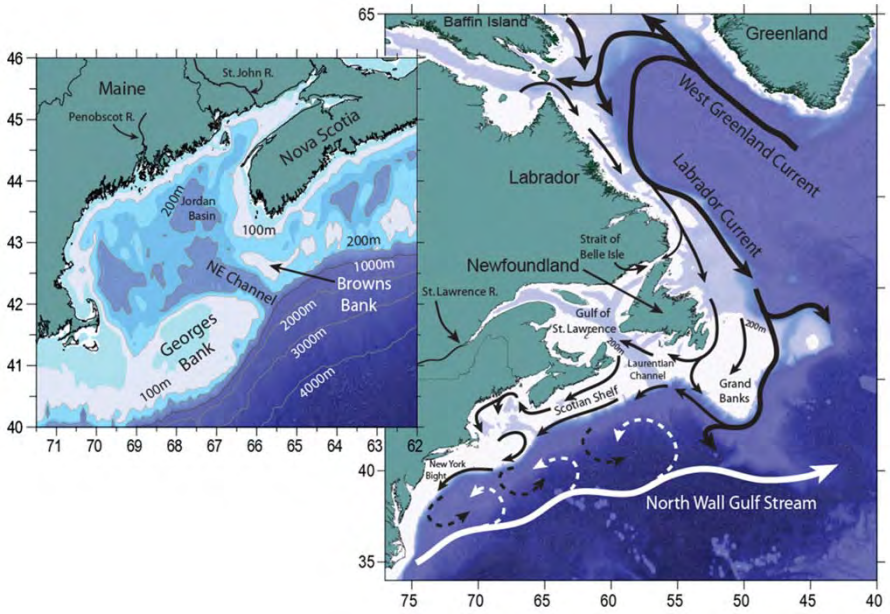
Presented by Vincent Saba

Geophysical Fluid Dynamics Laboratory Review

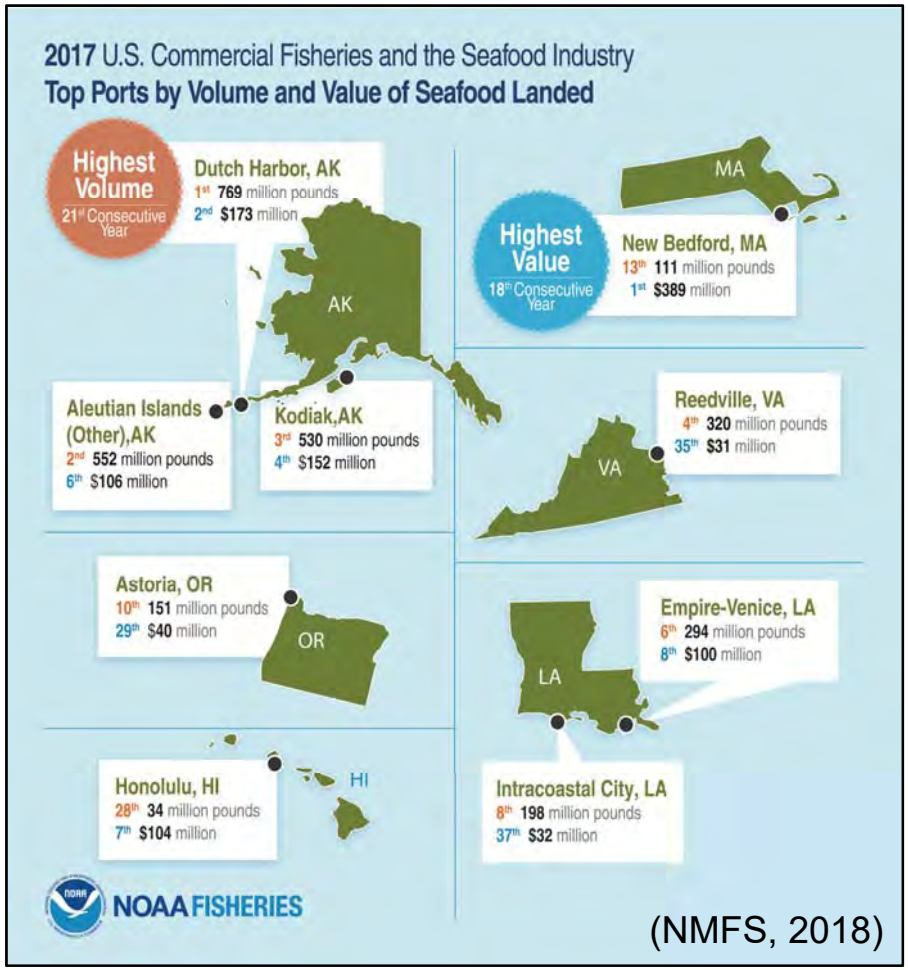
October 29-31, 2019

Background

The U.S. Northeast shelf accounts for over <u>one third</u> of the annual U.S. fishery value.



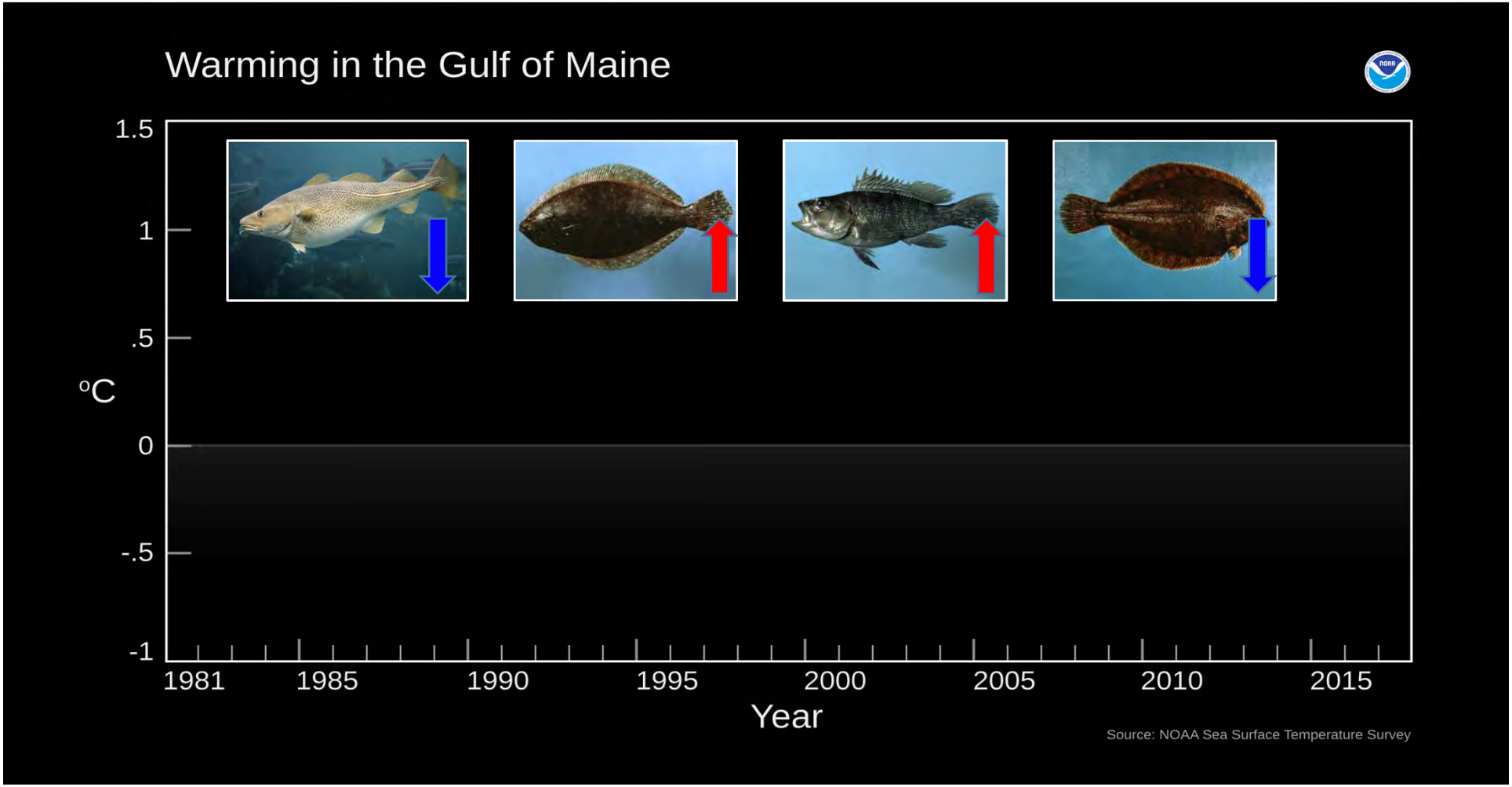
The U.S. Northeast shelf is at the interface of the Gulf Stream and Labrador Current.



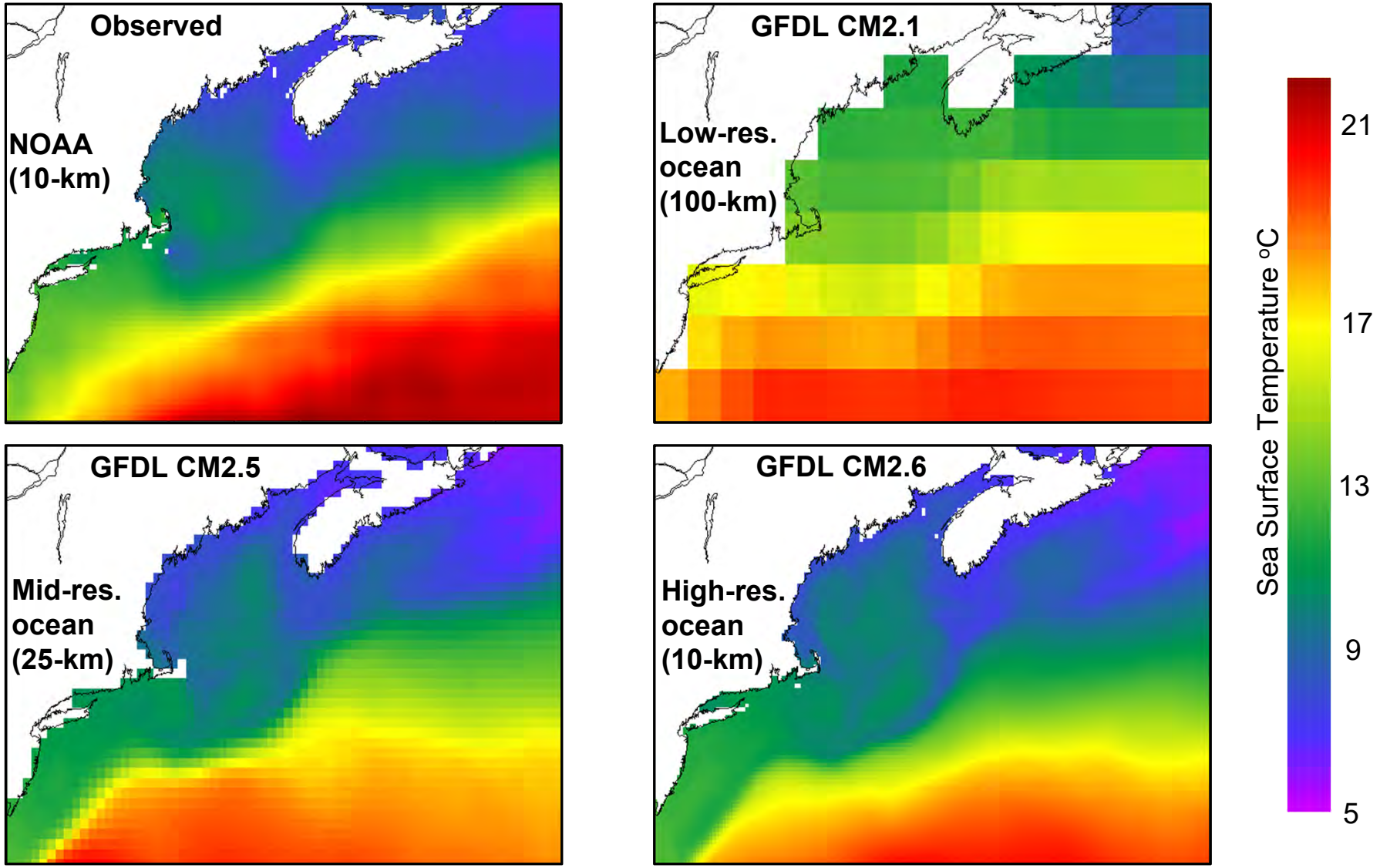
(NMFS, 2018)

Background

The U.S. Northeast shelf has warmed faster than many other coastal regions worldwide.

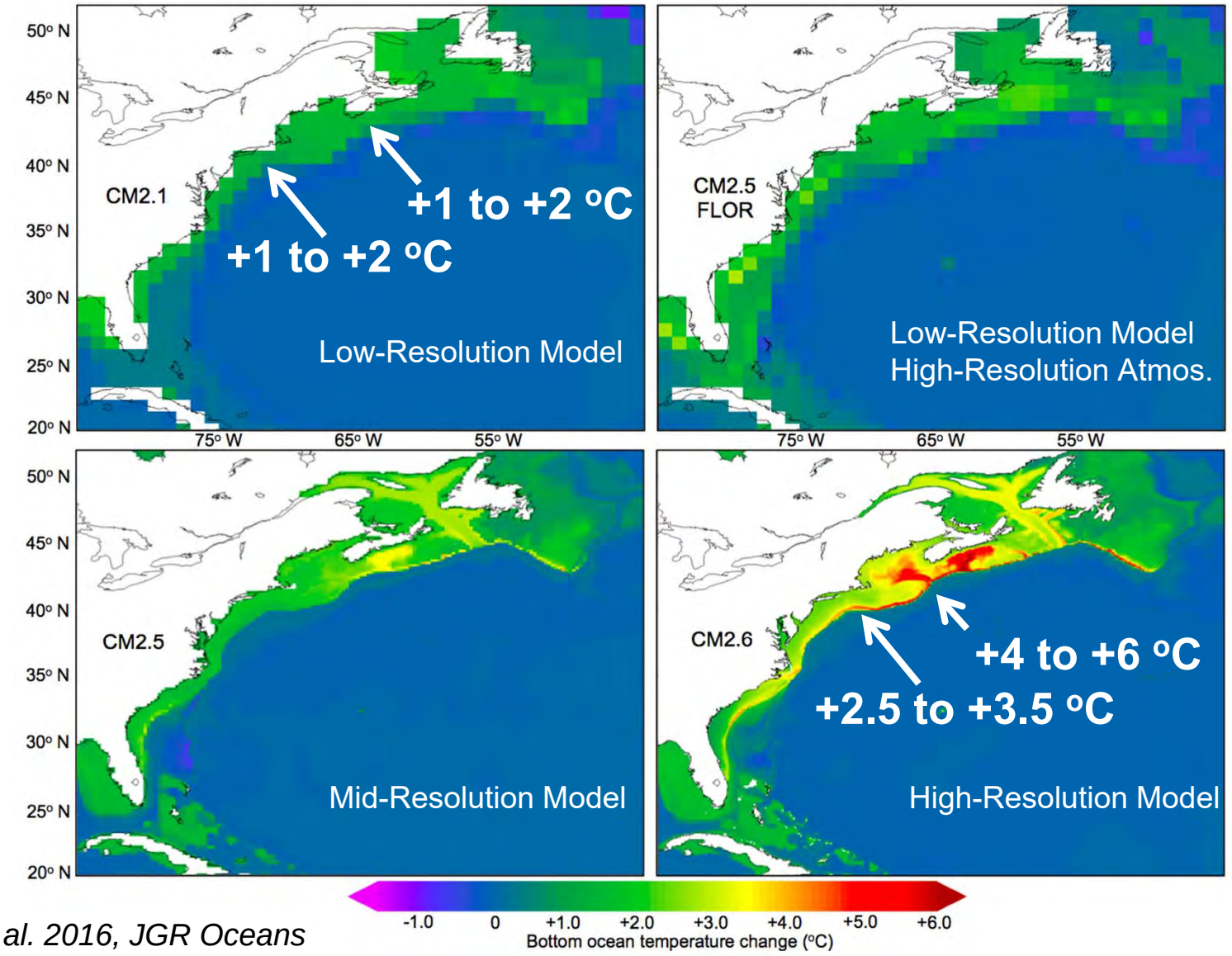


GFDL's high-resolution GCM



Saba, Griffies, Anderson, Winton, Delworth, Harrison, Rosati, Vecchi, Zhang et al. 2016, JGR Oceans

GFDL's high-resolution GCM 2xCO2 run

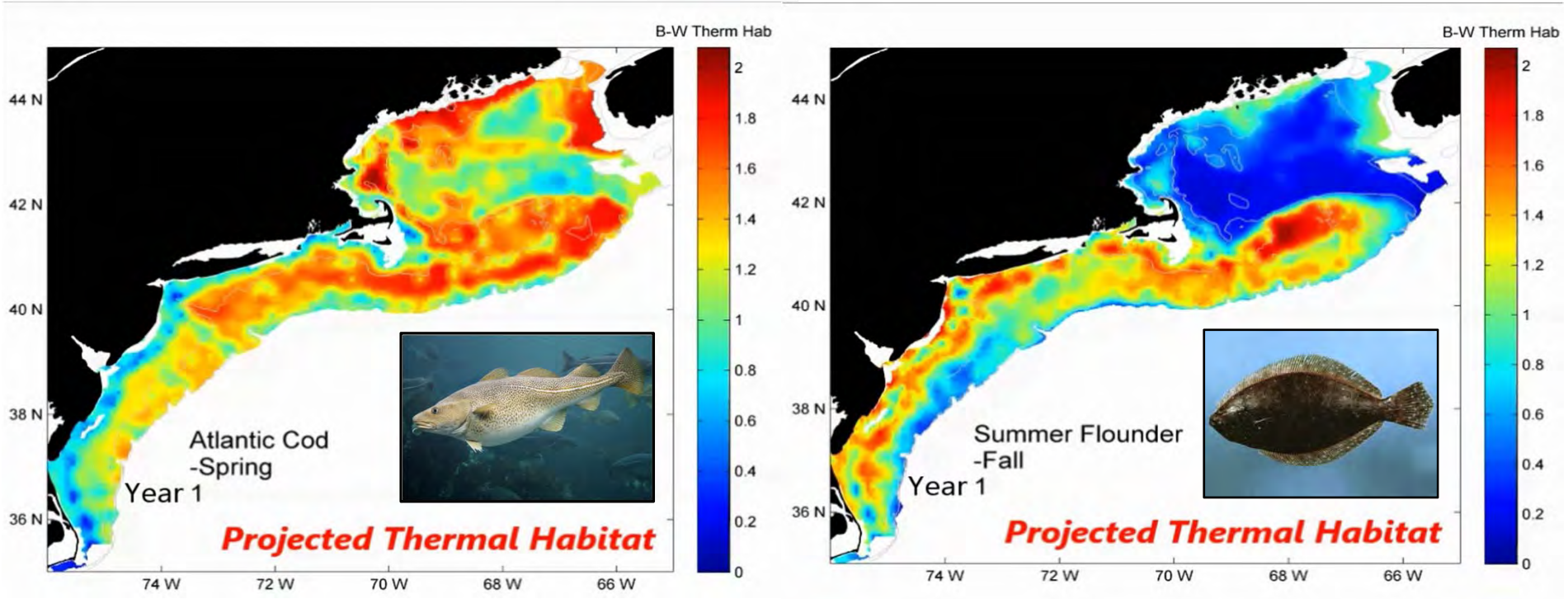


Saba et al. 2016, JGR Oceans

Projected impacts of ocean warming

- **Since 2016, NOAA GFDL's CM2.6 has been widely used for climate change research in the U.S. Northeast.**

- **Projections of species distribution shifts (over 100 species).**



Kleisner et al. 2017, Prog. Oceanogr.

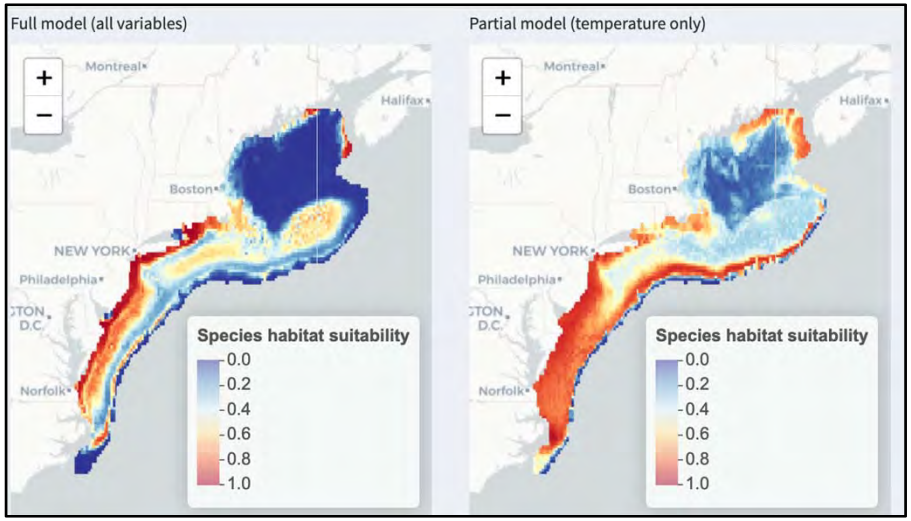
Projected impacts of ocean warming

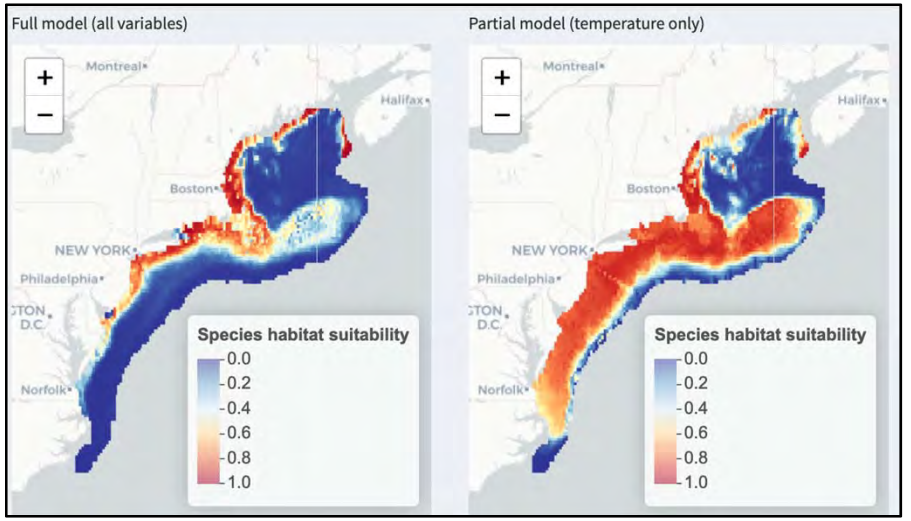
PRIMARY RESEARCH ARTICLE

Global Change Biology WILEY

Projecting marine species range shifts from only temperature can mask climate vulnerability

Jennifer McHenry[1] | Heather Welch[2,3] | Sarah E. Lester[1] | Vincent Saba[4]





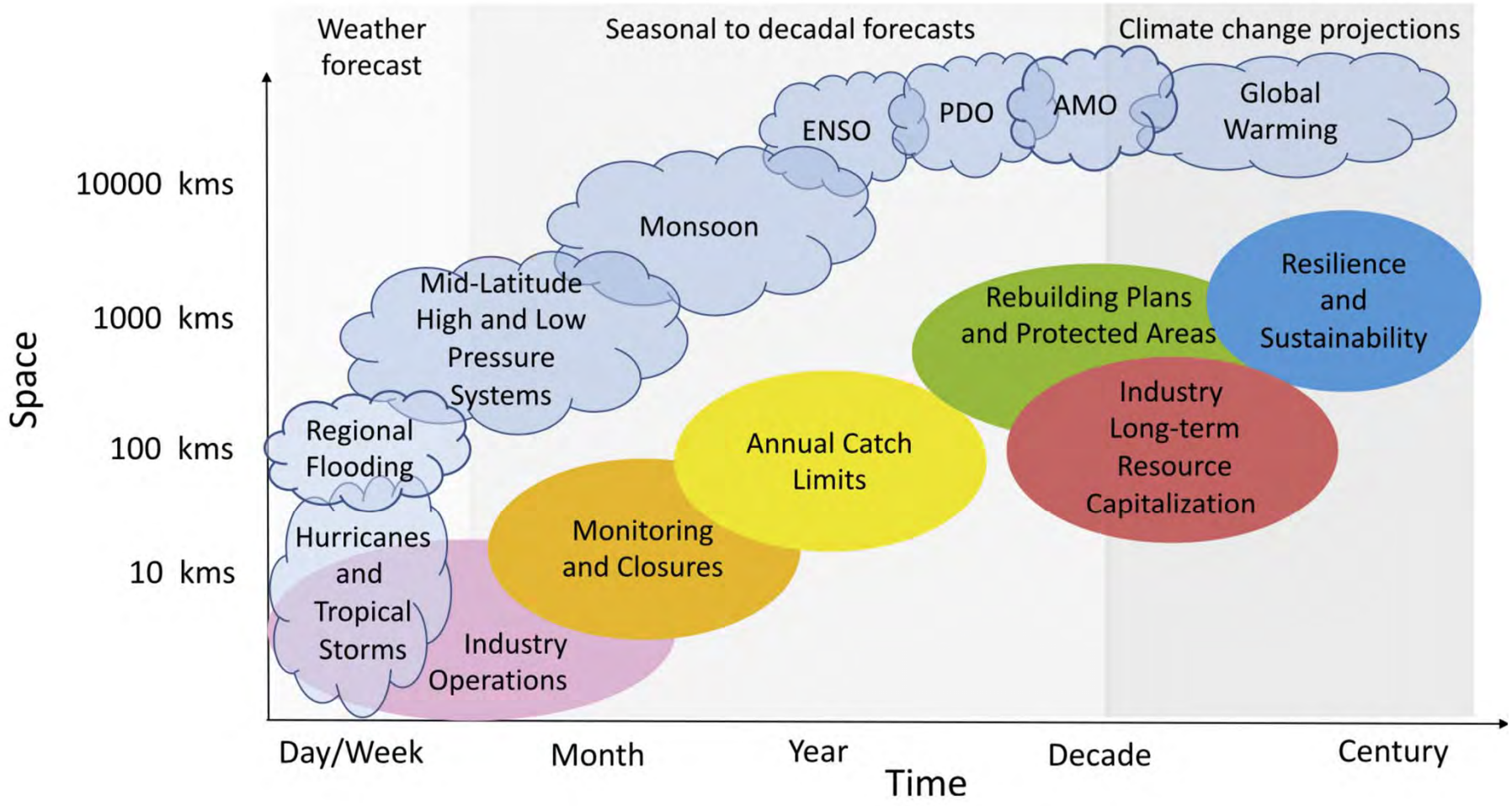
McHenry et al. 2019, Glob. Ch. Bio.

NOAA Fisheries application of CM2.6

- **Projections of species distribution shifts** (*Kleisner et al. 2017; McHenry et al. 2019*)
- **Changes in key zooplankton species** (*Grieve et al. 2017*)
- **Predator-prey interactions** (*Selden et al. 2018*)
- **Social vulnerability assessment** (*Greenan et al. 2019*)
- **Climate change and AMOC weakening** (*Caesar et al. 2018, Nature*)
- **High-res. habitat modeling: lobster, scallop, cobia, sea turtles**

Future Plans & Challenges

D. Tommasi et al./Progress in Oceanography 152 (2017) 15–49



Future Plans & Challenges

- **CM2.6 has limitations:**
  - **Older model.**
  - **Does not resolve the seasonal cold pool.**
  - **Only has idealized 2xCO2 run (no RCP scenario).**
  - **No forecasts.**

- **What do we need?**
  - **Global and regional high-resolution hindcasts, forecasts, and projections that include biogeochemistry. Alistair Adcroft's MOM6 presentation (Theme 1).**

  - **Applications to the time-scale of fisheries and protected species management (seasonal, annual, decadal).**