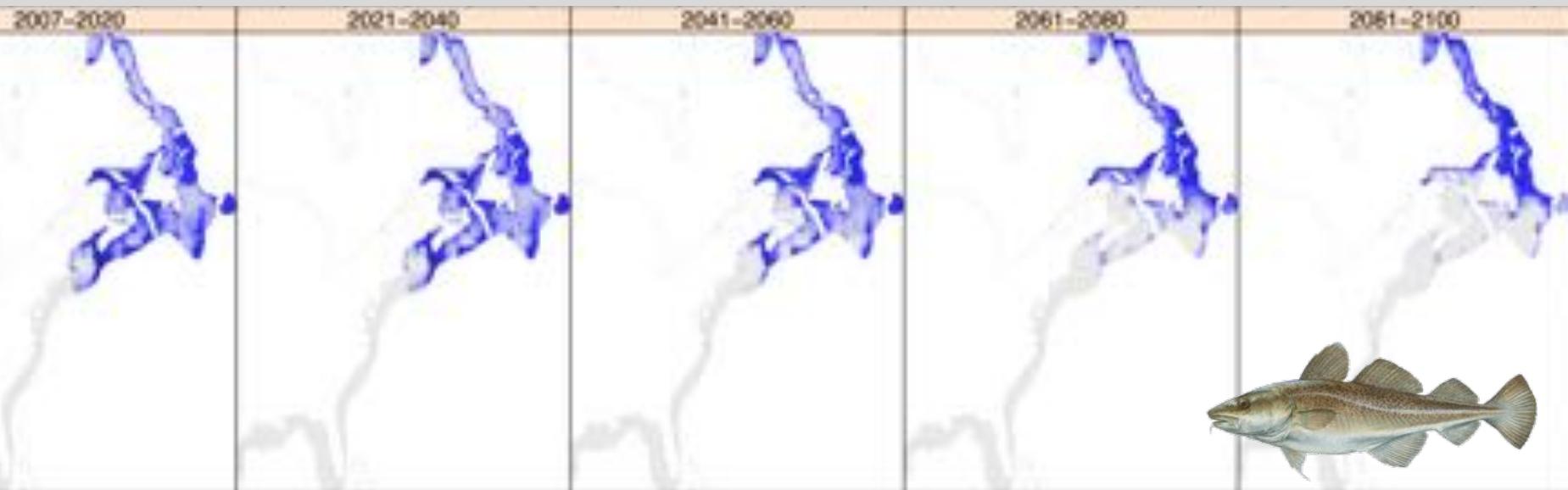


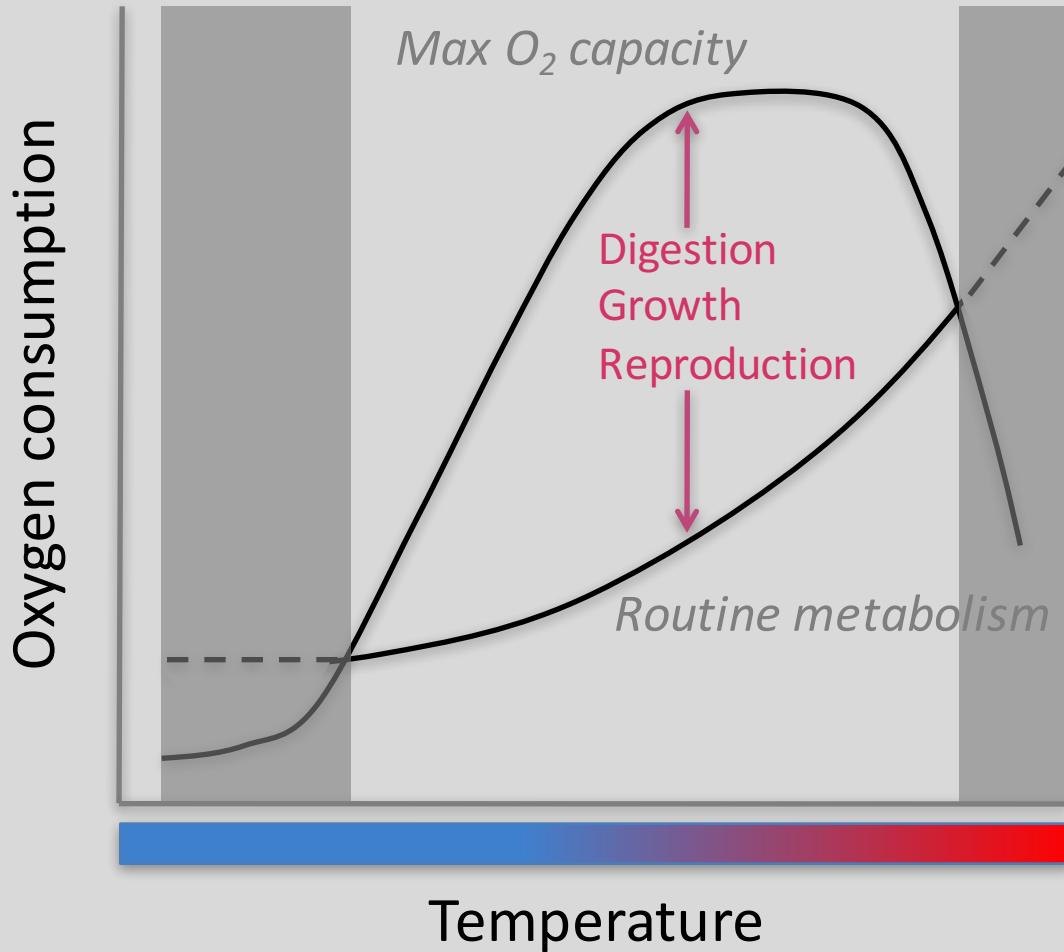
# Predicting geographic range shifts of marine species and understanding sources of uncertainty



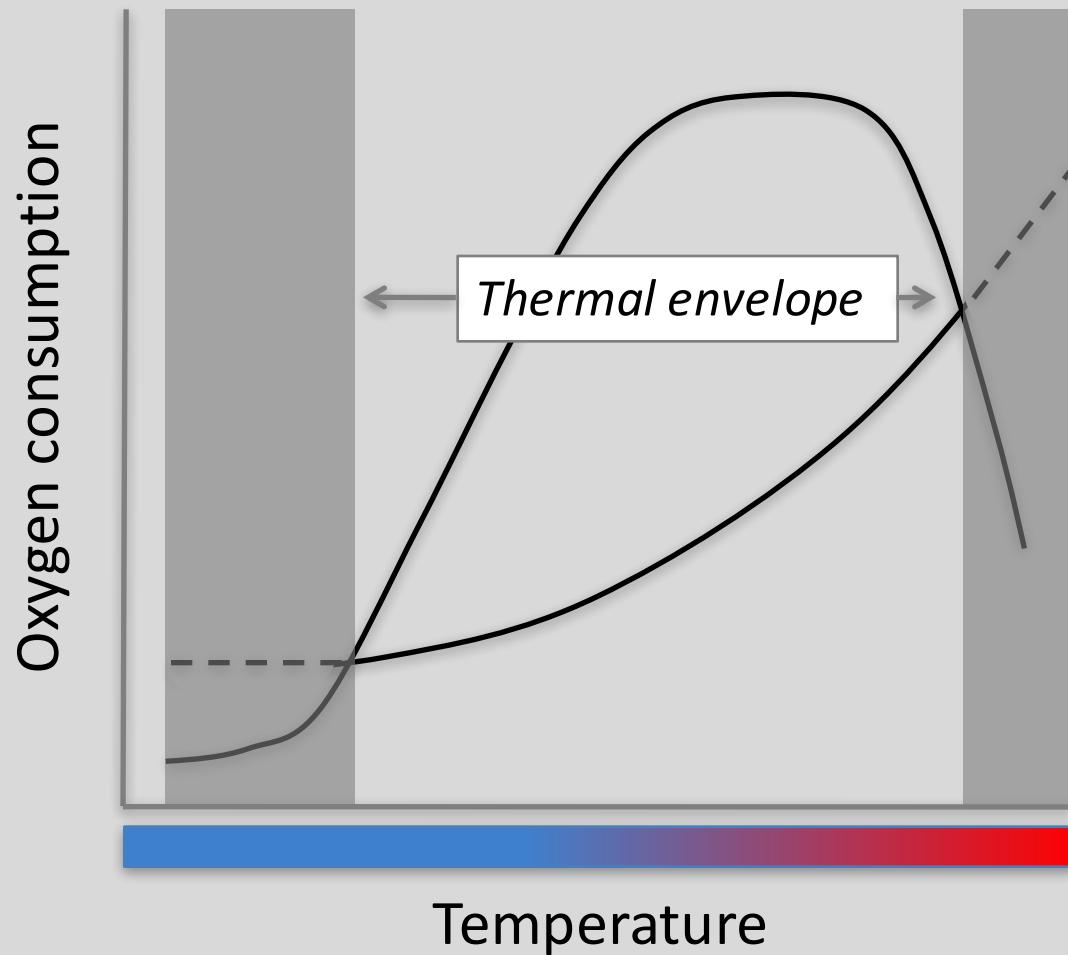
Jim Morley, Becca Selden, Malin Pinsky—Rutgers University  
Thomas Frölicher—ETH Zurich



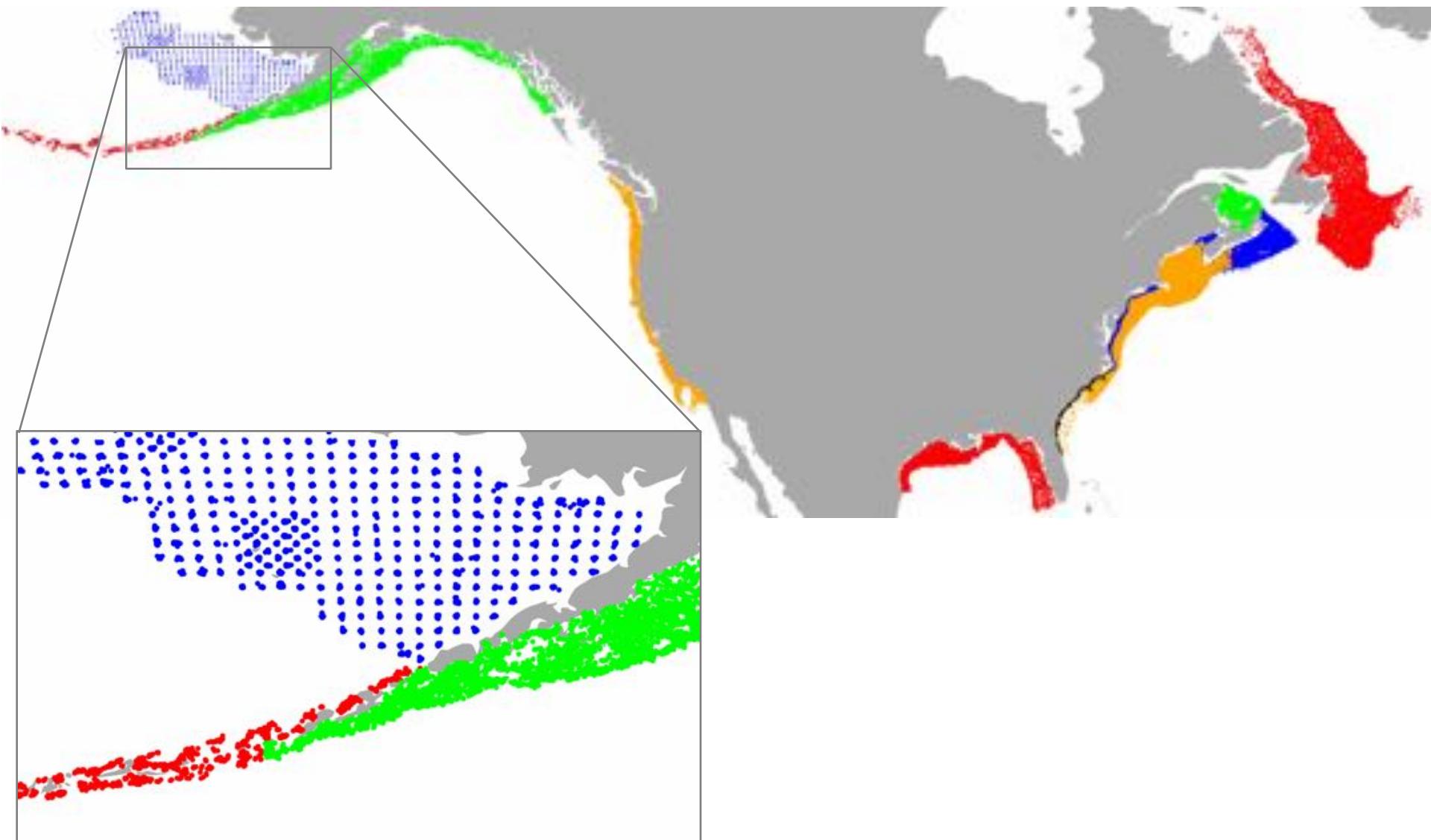
# Thermal envelopes



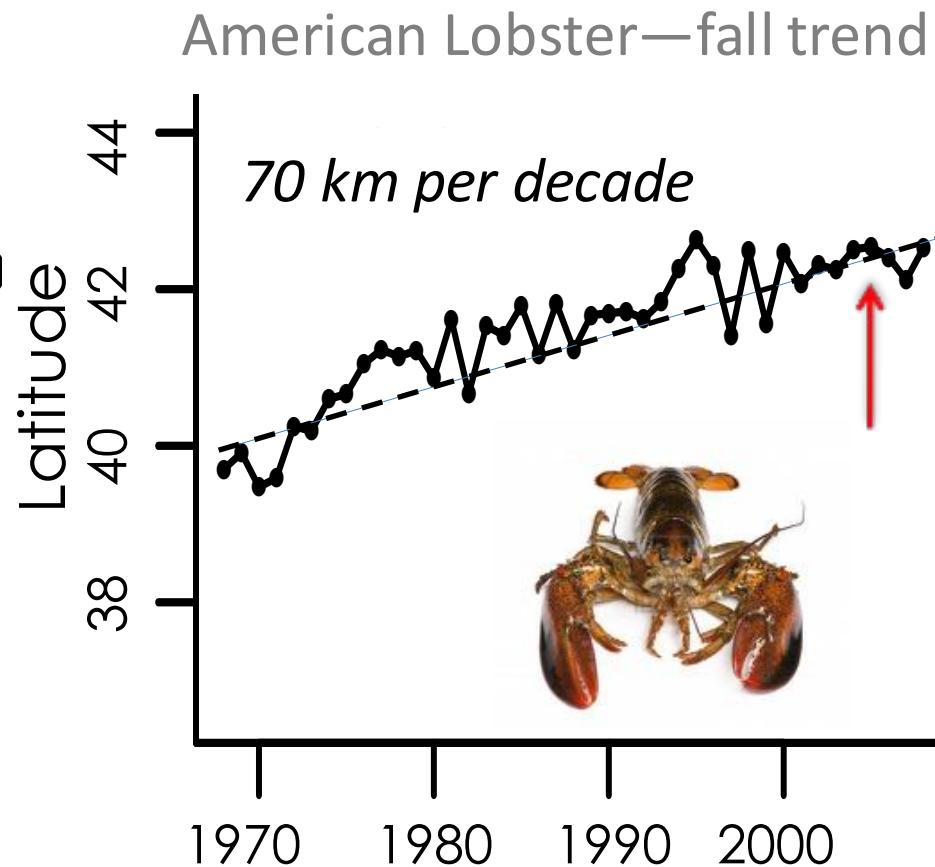
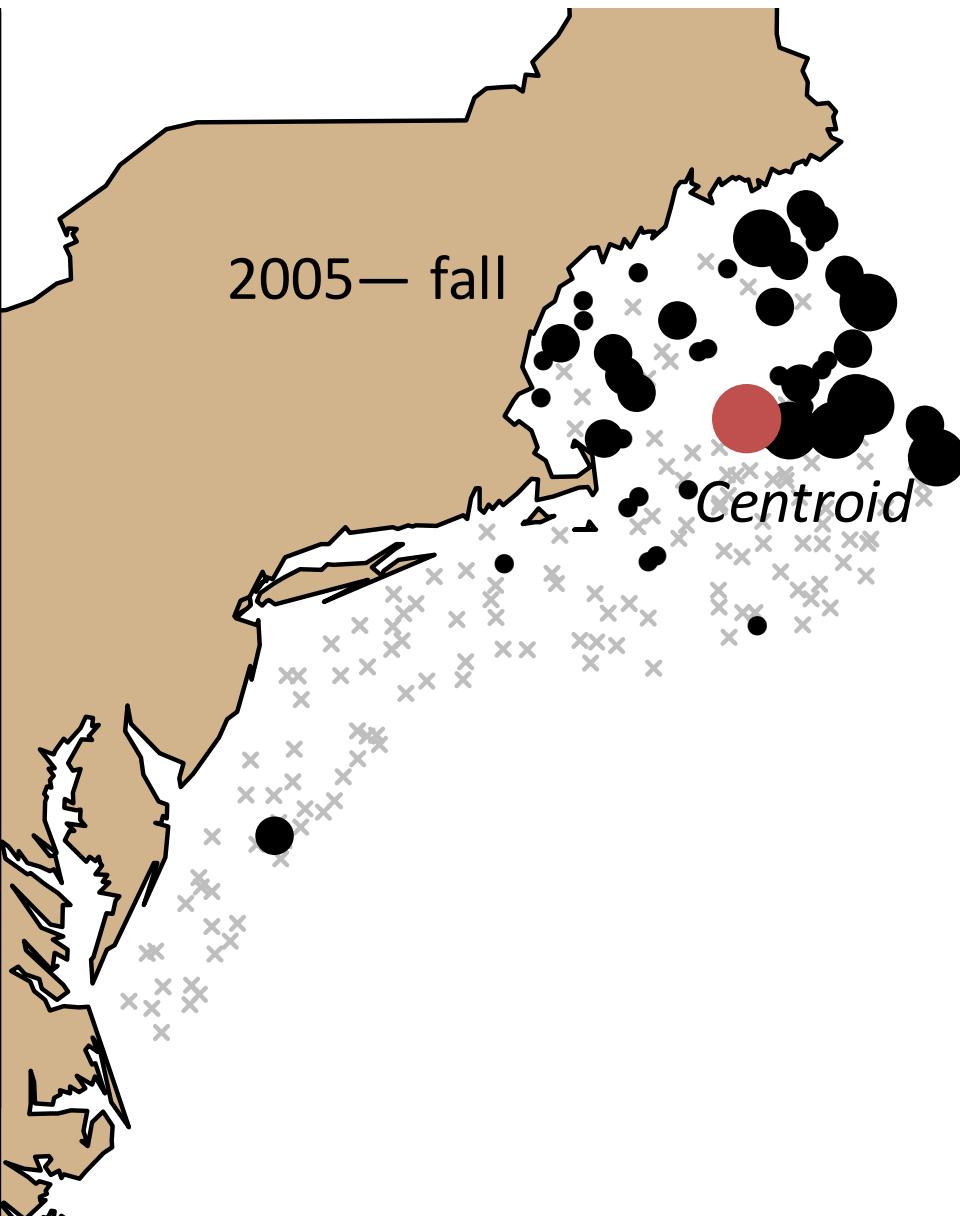
# Thermal envelopes



# Data from regional bottom trawl surveys



# Estimating historic range shifts



# OceanAdapt Webtool

RUTGERS School of Environmental and Biological Sciences

OceanAdapt

Exploring changes in marine species distributions

## About

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- The Lost Lobsters of Long Island Sound
- Shifting marine animals: Depth vs. latitude
- See All Blog Posts

## Explore Data



NATIONAL



REGIONAL

## Download Data



# OceanAdapt Webtool

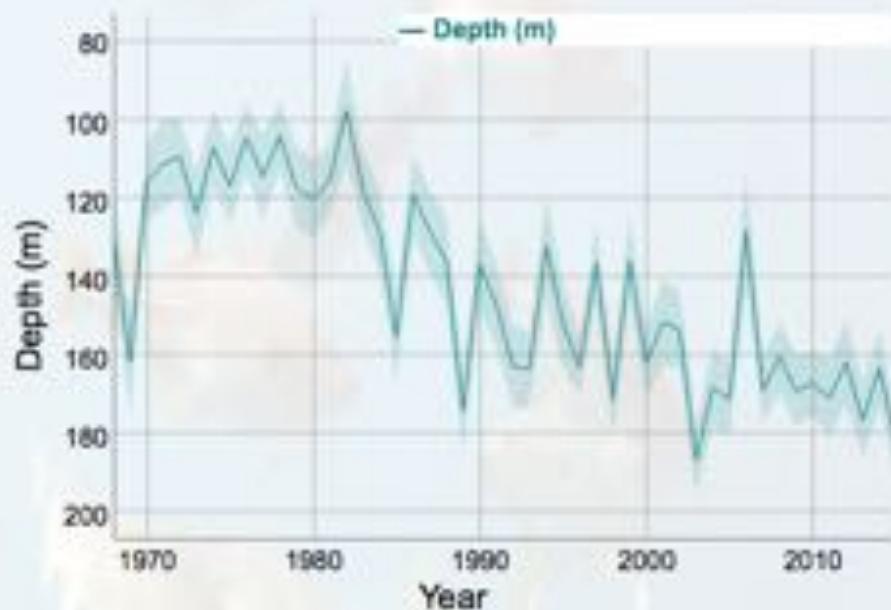
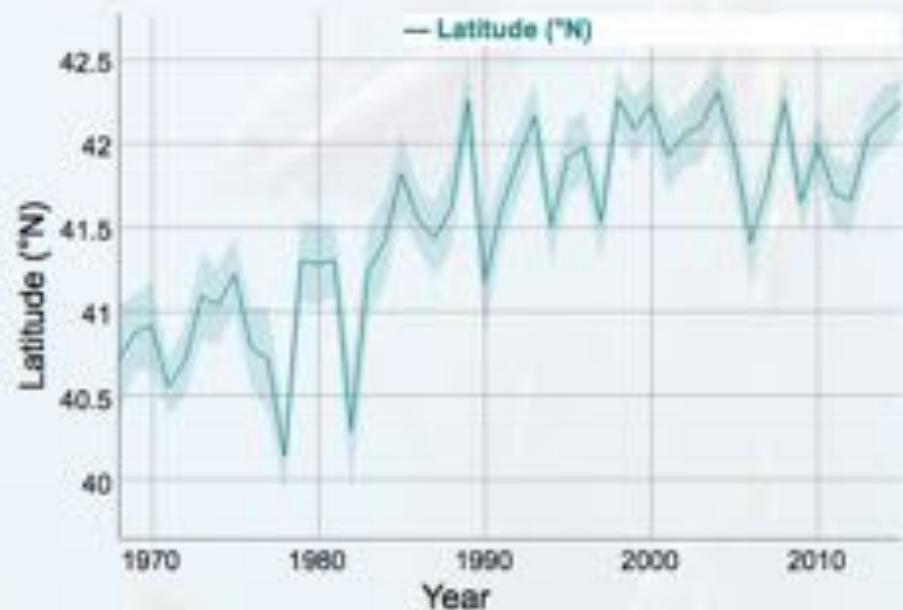
This page allows you to explore changes in the distribution of marine animals in the U.S. by region. Select "All" to graph the average change in species' distributions from the initial year. Choose a specific species to plot the latitude and depth for the center of its distribution, or to show animated maps of its distribution over time.

SELECT A REGION:

SHOW:  COMMON SPECIES NAME  SCIENTIFIC SPECIES NAME

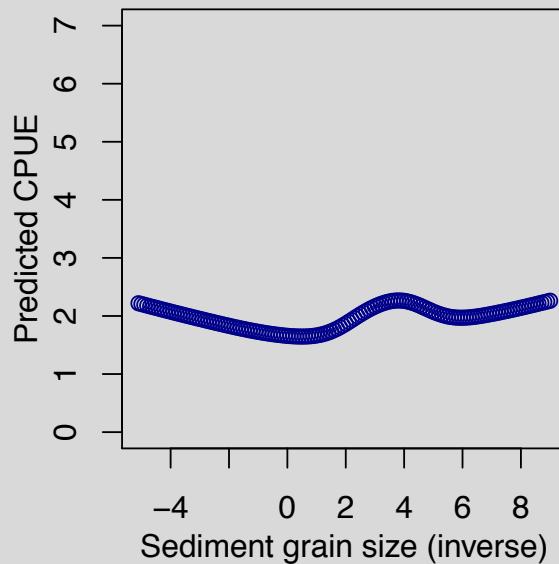
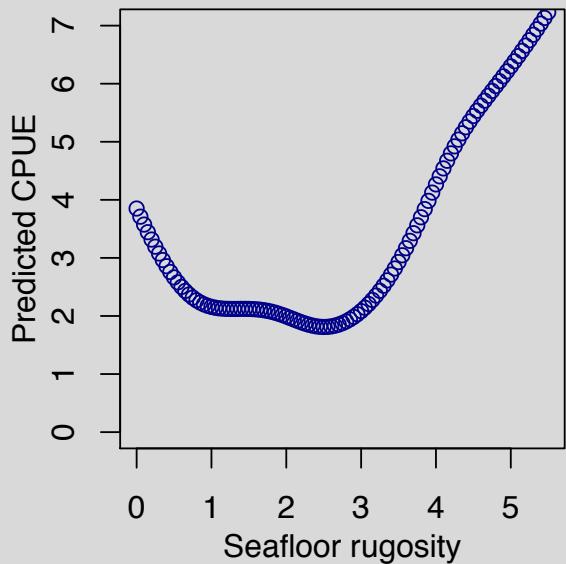
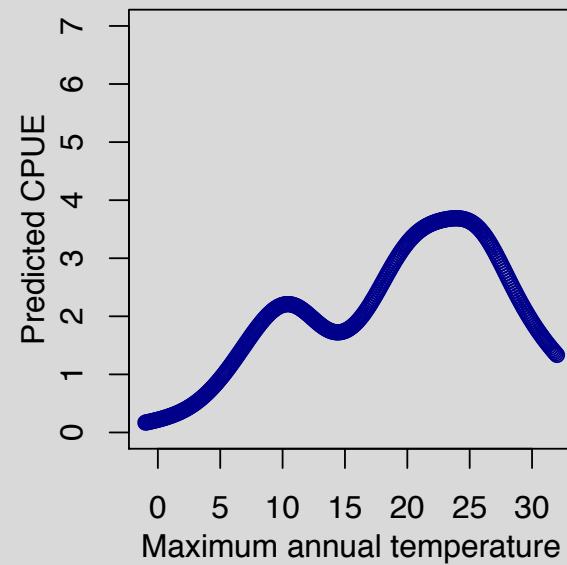
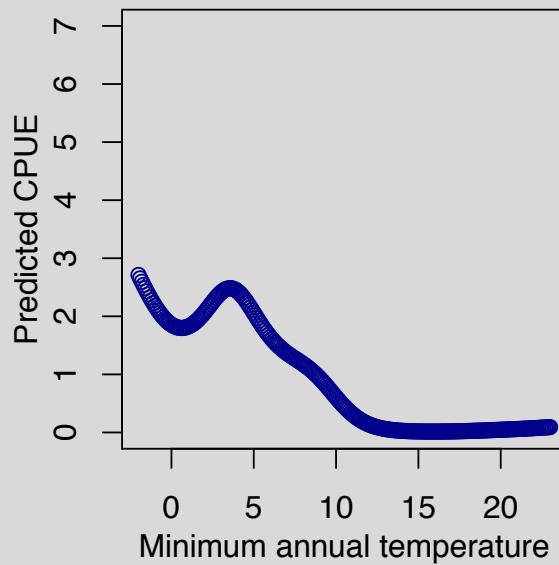
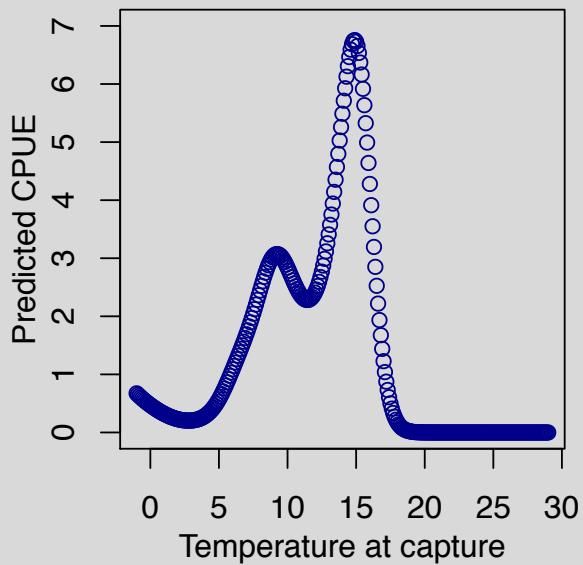
SELECT A SPECIES (OPTIONAL):

VIEWS: ALL | LATITUDE | DEPTH | MAP

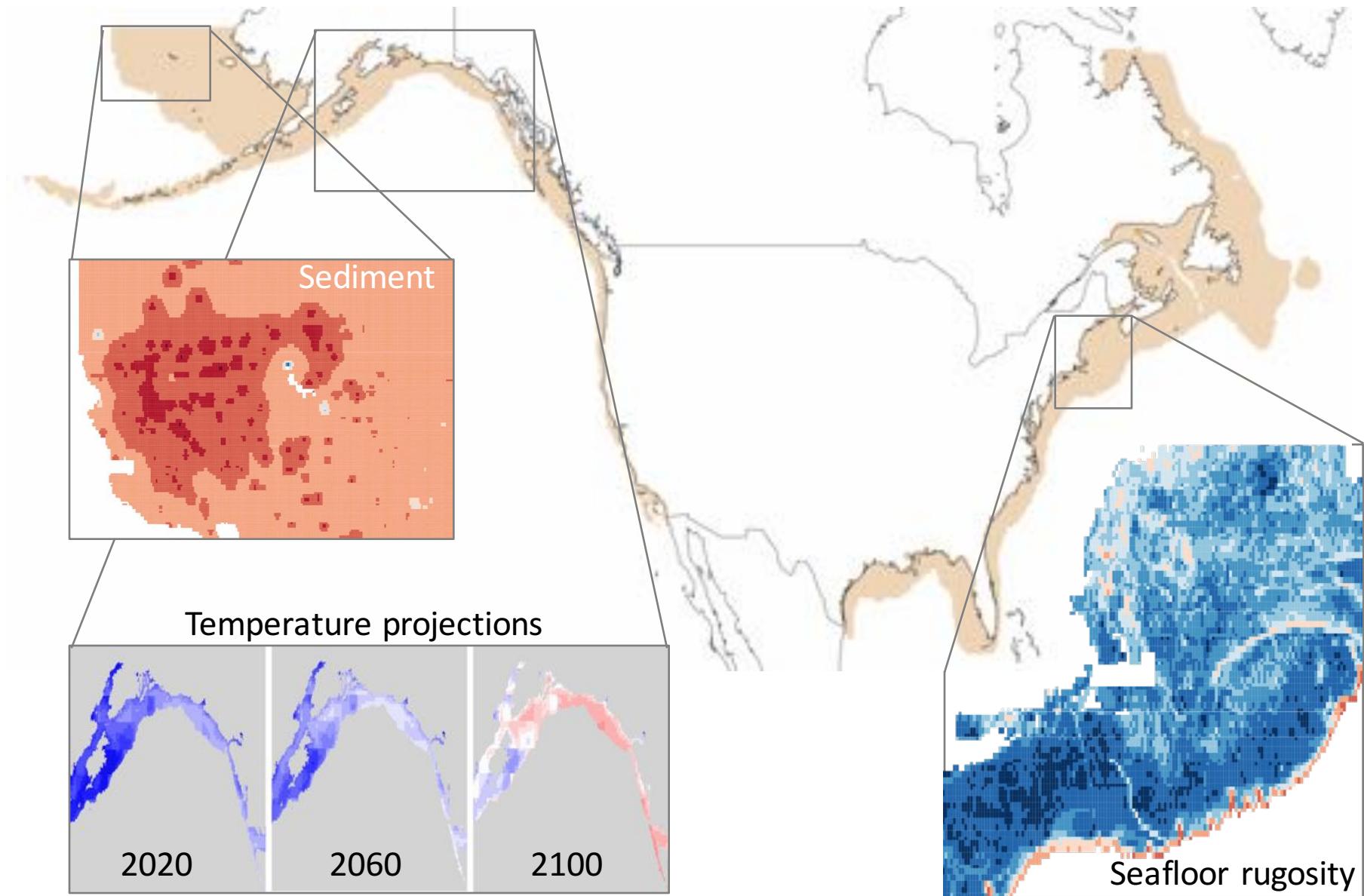


Click and drag the figure to zoom. Double click to zoom out.

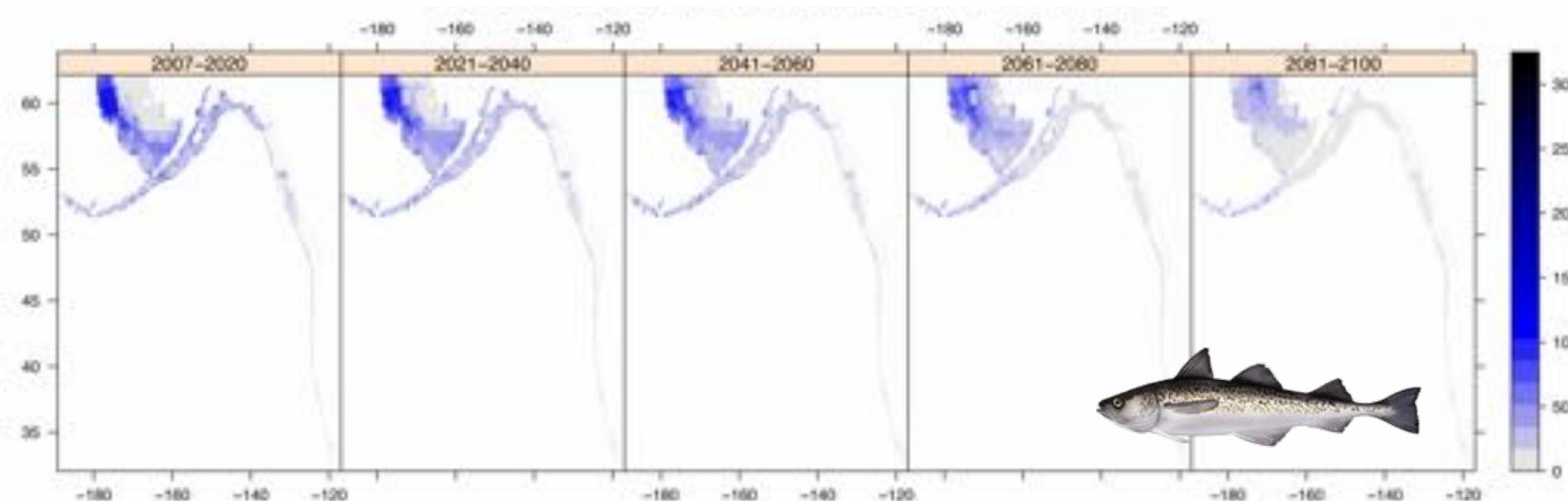
# Predicting range shifts: thermal envelope models



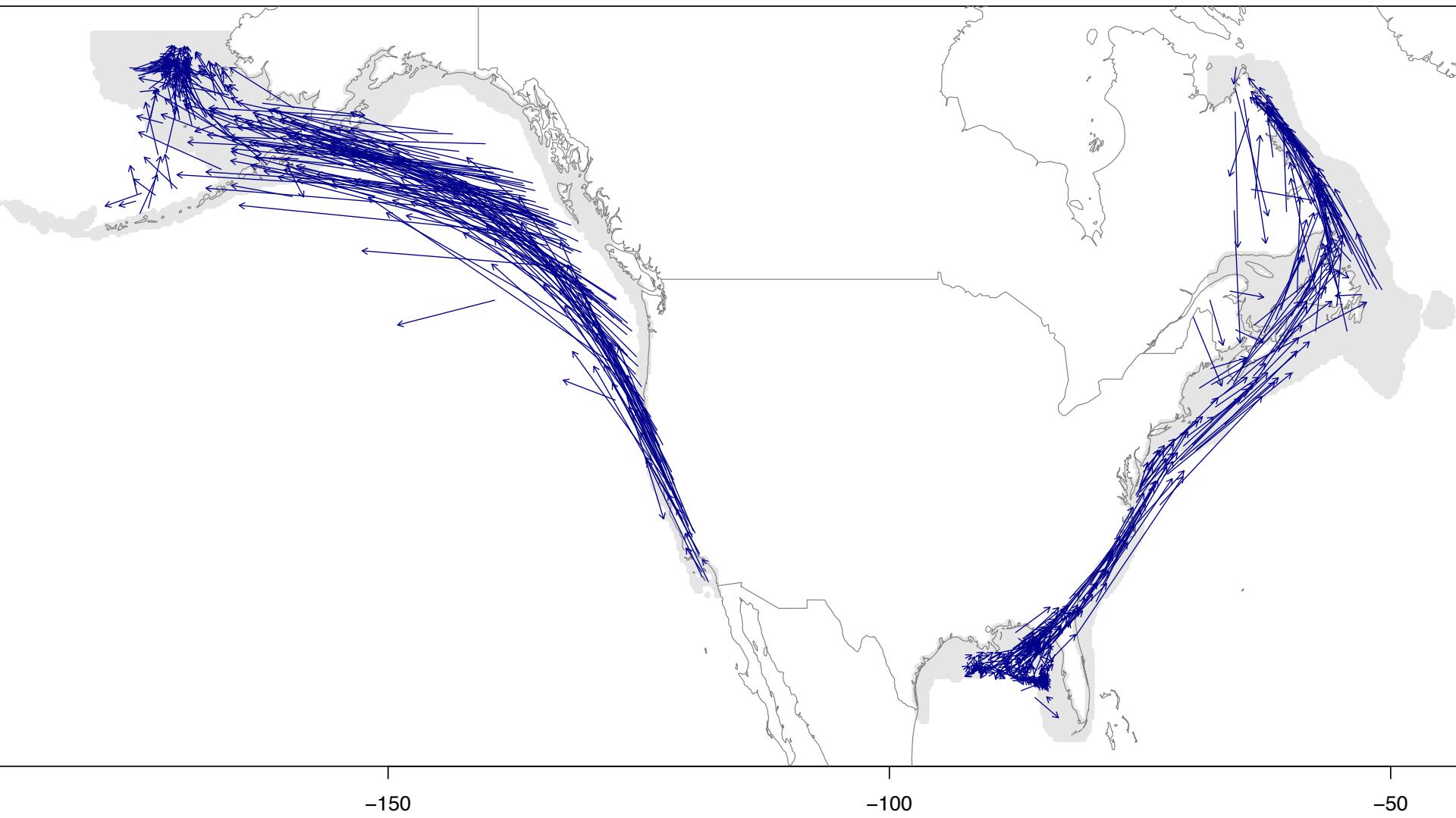
# Predicting range shifts



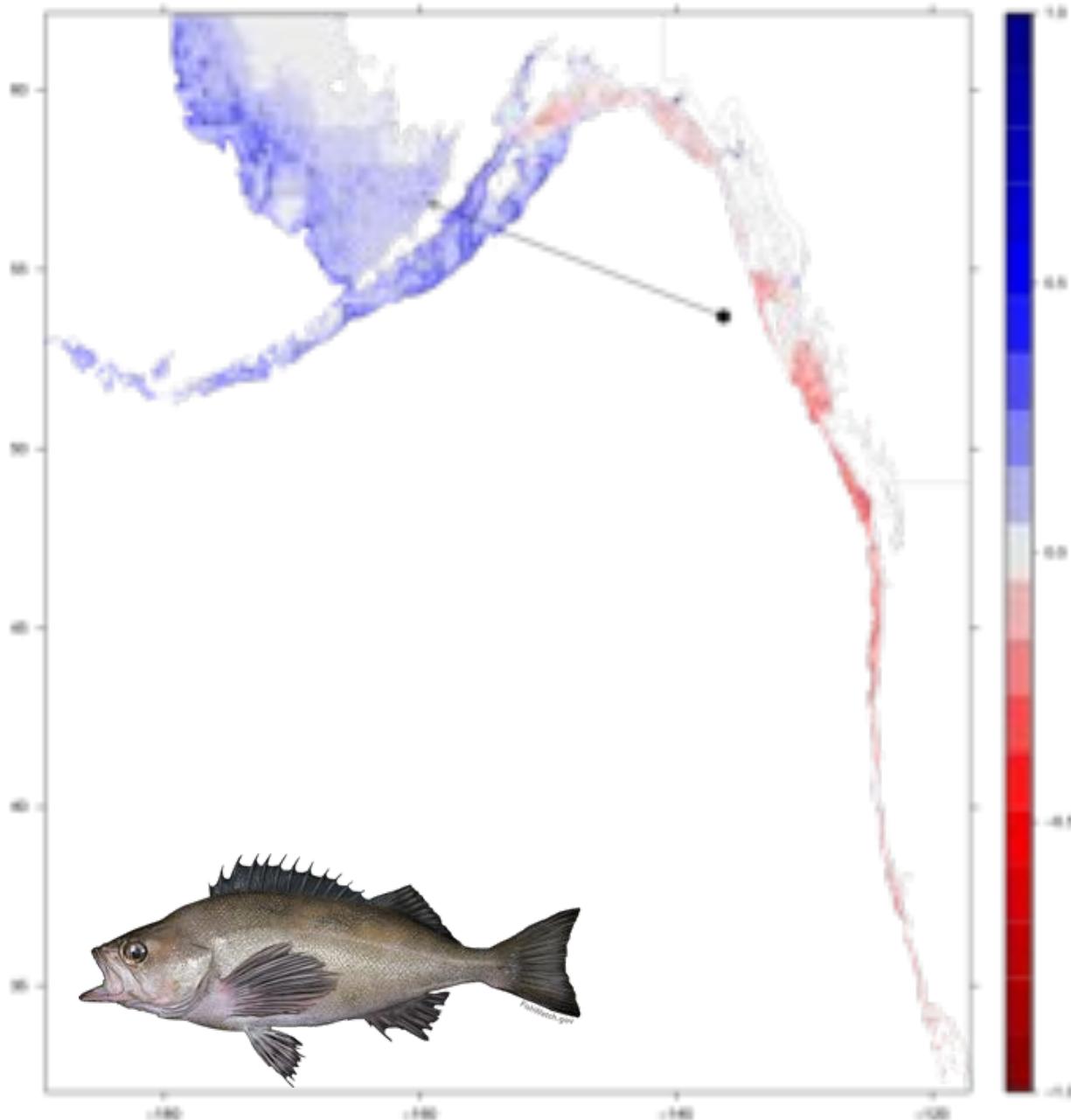
# Predicted biomass at future time periods



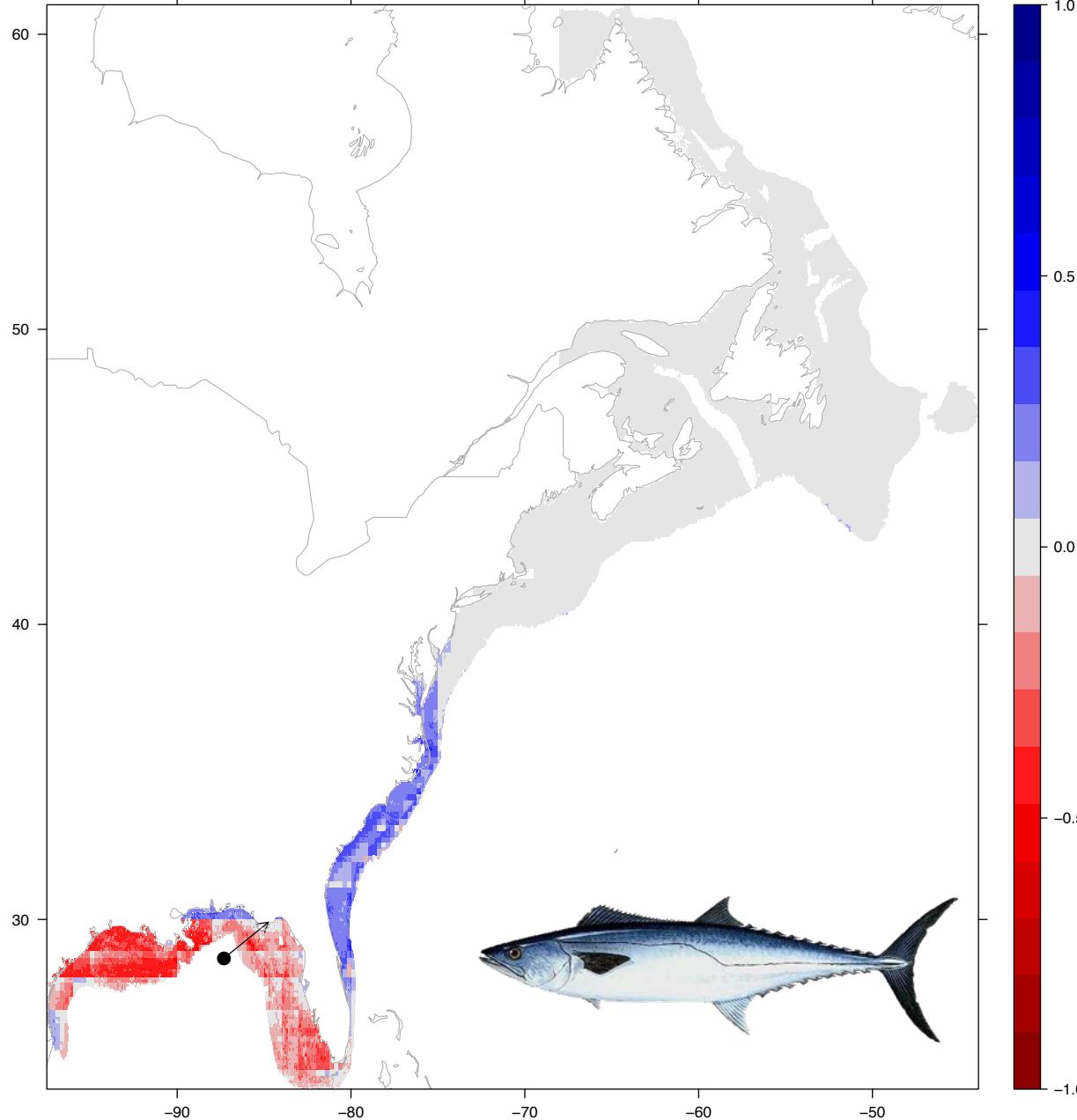
# Predicted centroid shifts for 658 species



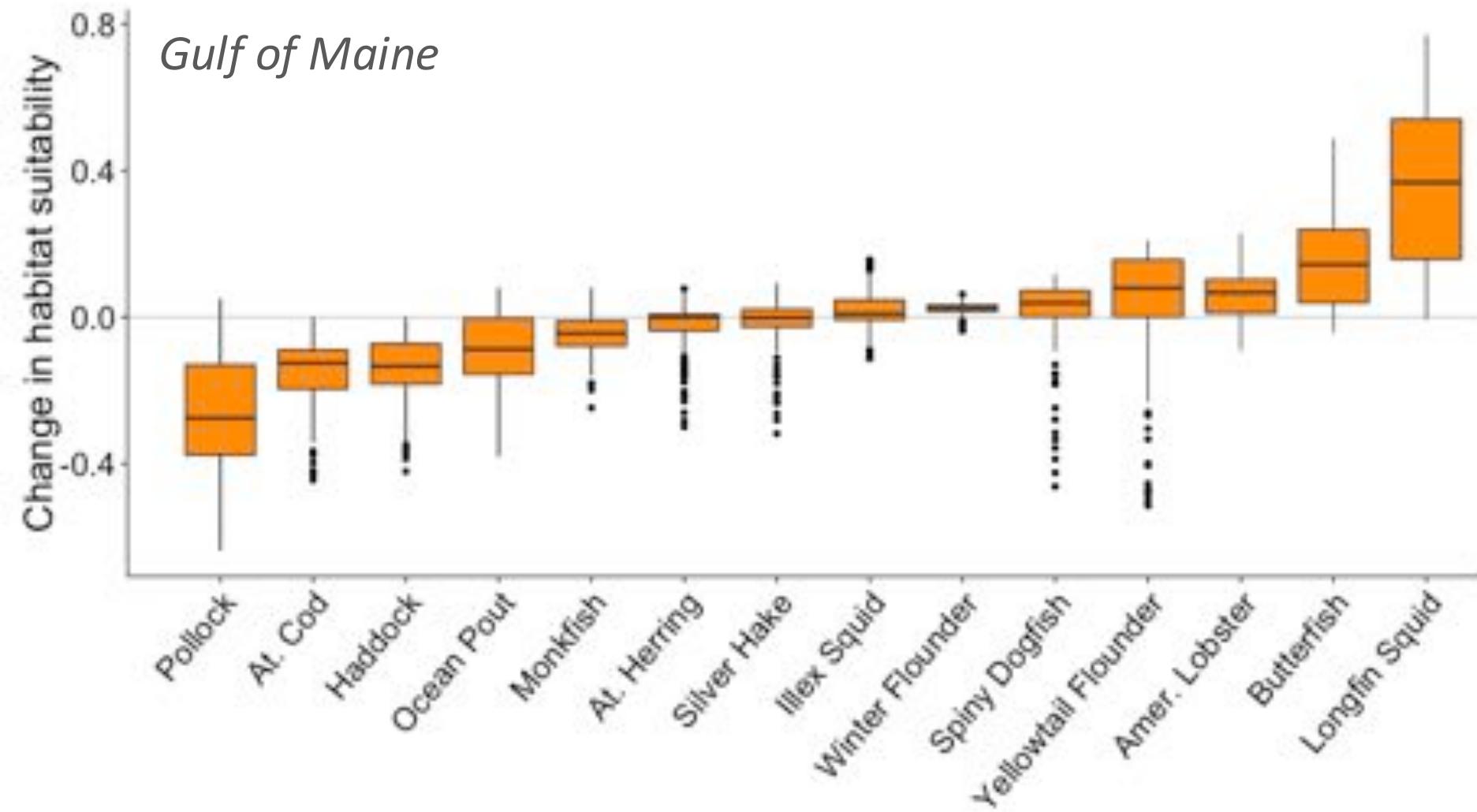
# Predicting changes in suitable habitat



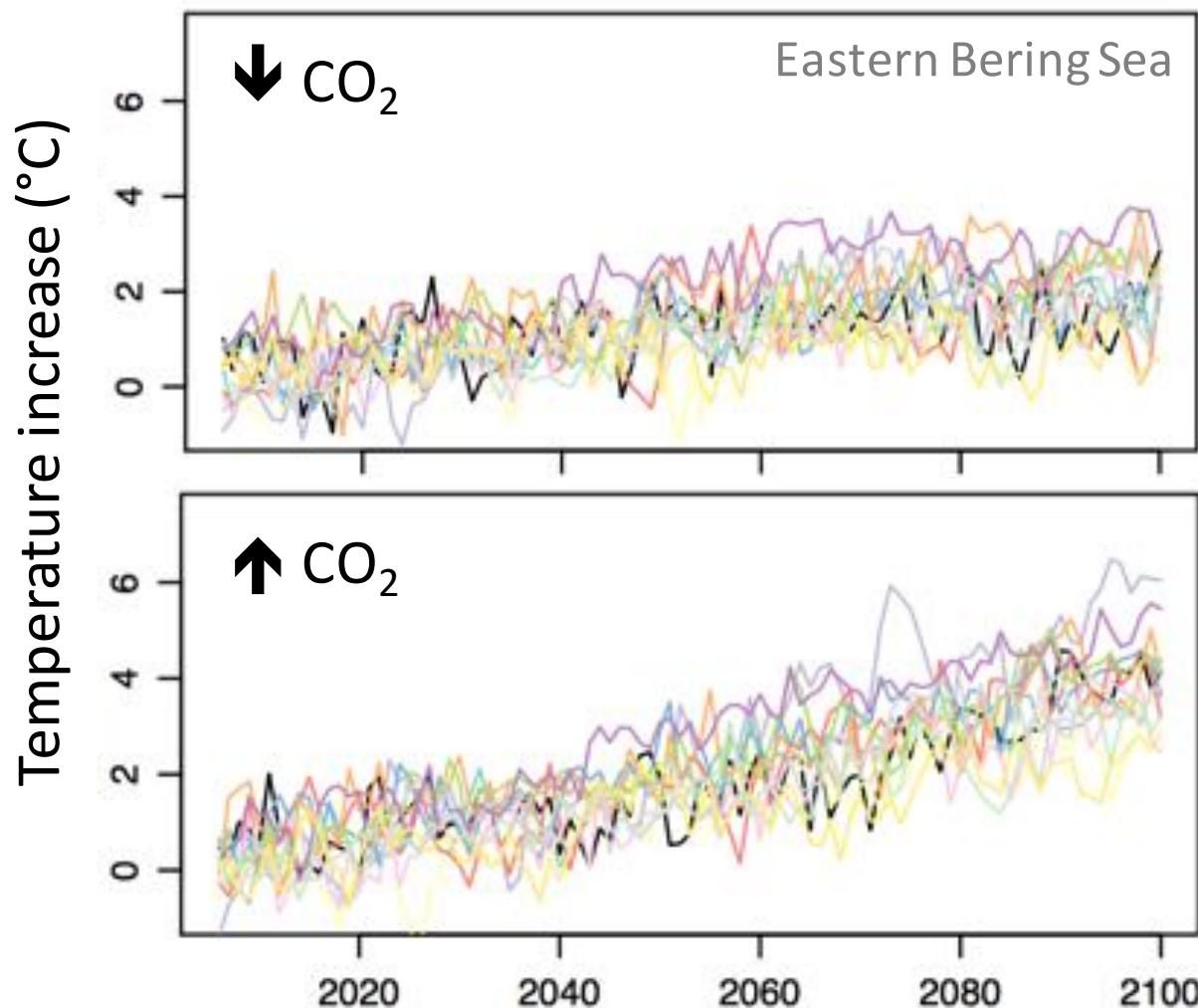
# Predicting changes in suitable habitat



# Predicting changes in suitable habitat—regional scale

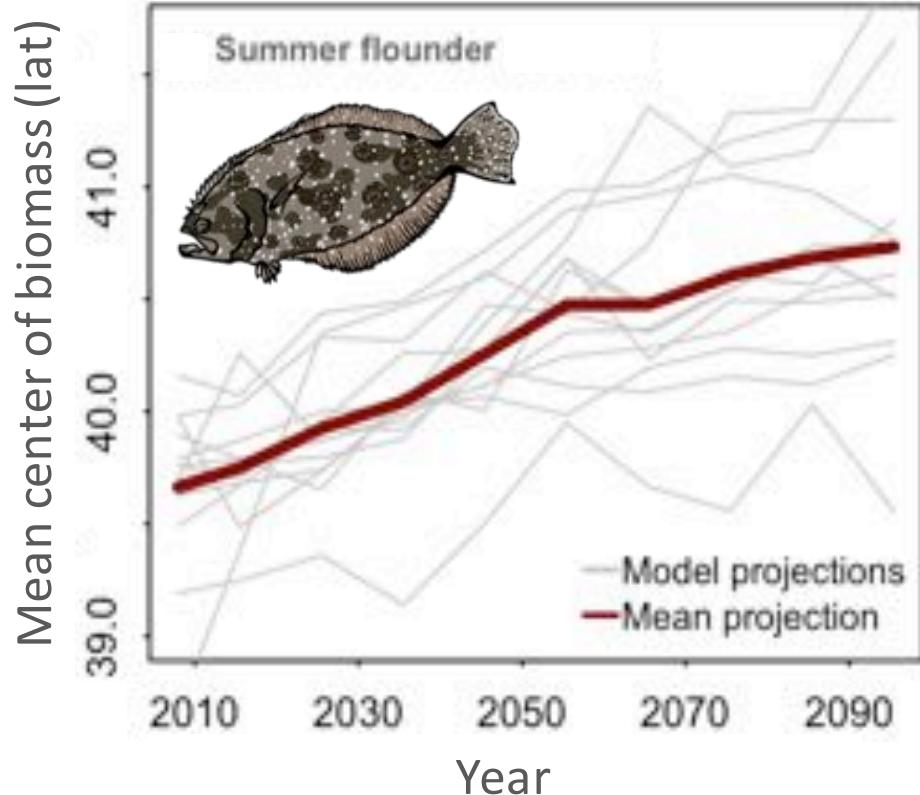


# Predicting range shifts: sources of uncertainty

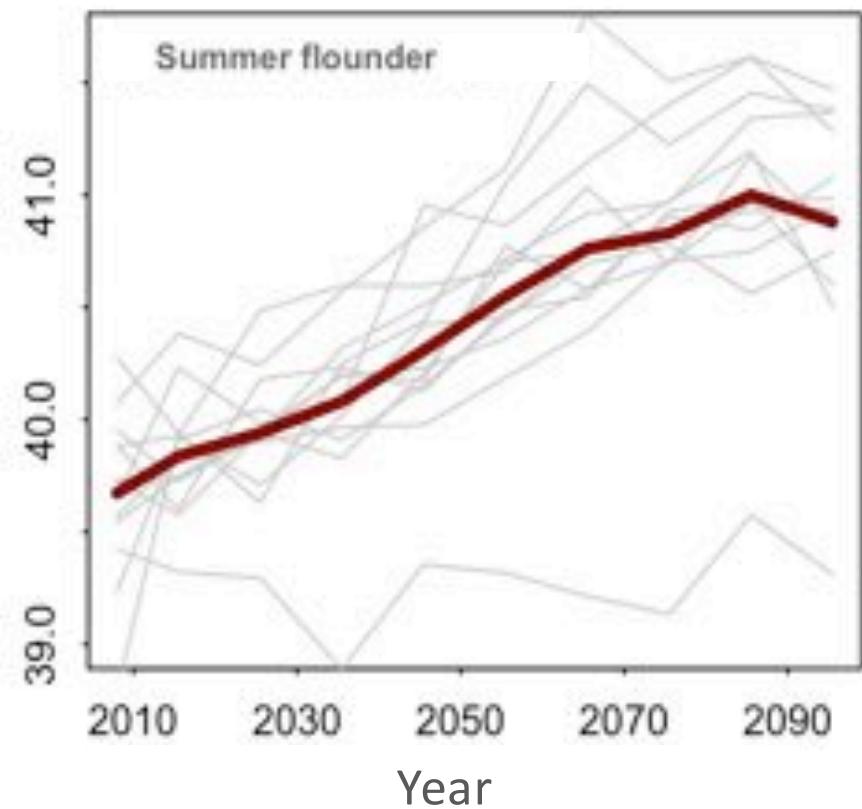


# Predicting range shifts: sources of uncertainty

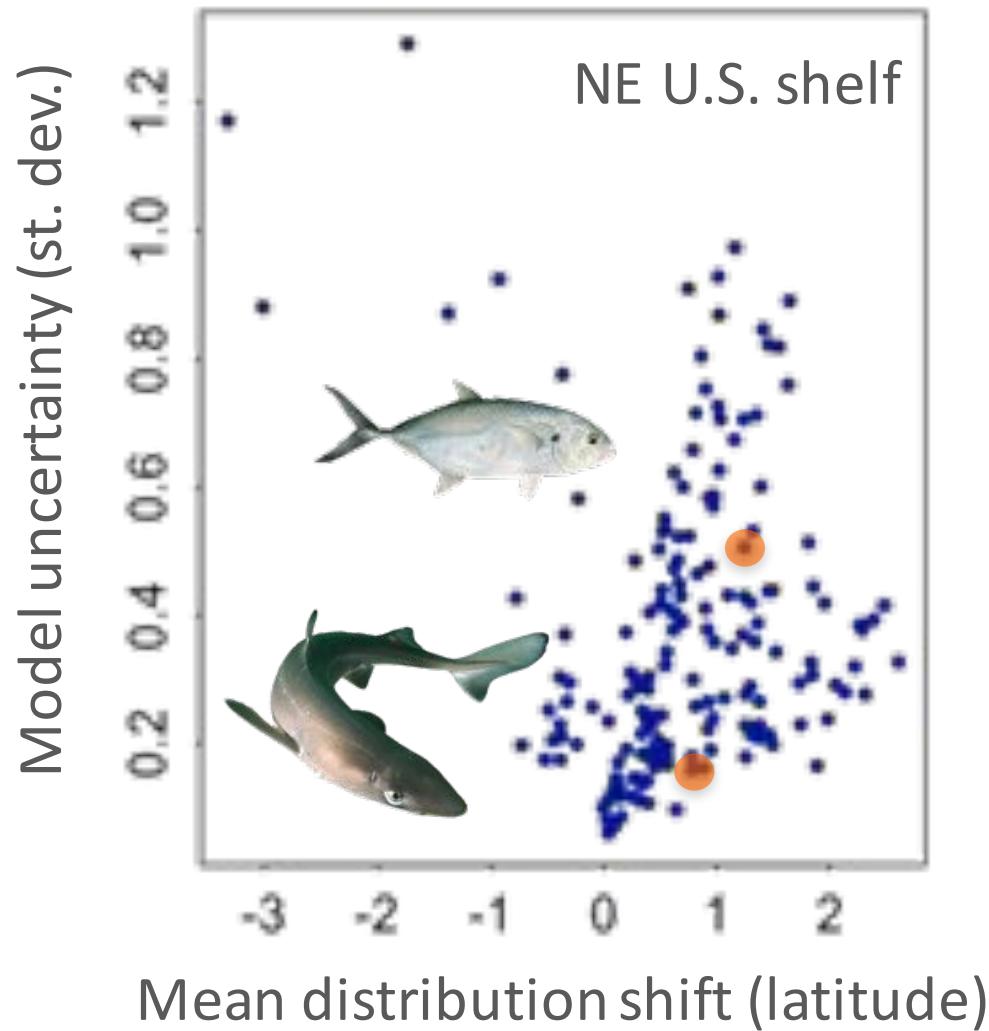
Mitigation scenario (RCP4.5)



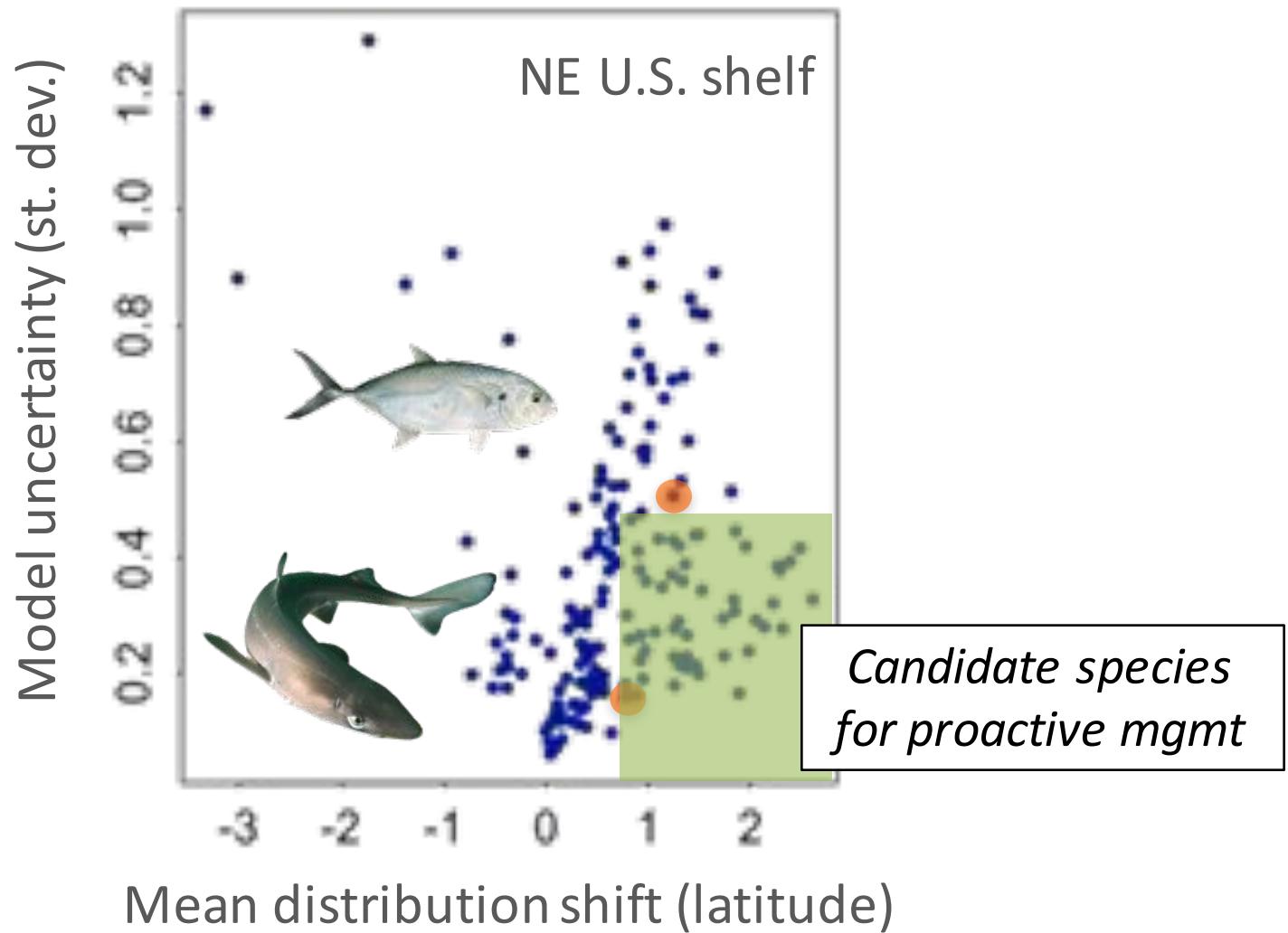
Business-as-usual scenario (RCP8.5)



# Identifying species for proactive management



# Identifying species for proactive management



# Conclusions and Caveats

- Anticipate major shifts in abundance between basins
  - Emerging fisheries
- Not all species predictions are equal
- The scale of these predictions ~20 year time frame
  - Predictions indicate magnitude of change
- Modeling approach is simplistic
- Results will be on OceanAdapt

# Acknowledgements

- Richard Seagraves—*Mid-Atlantic Fishery Management Council*
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