

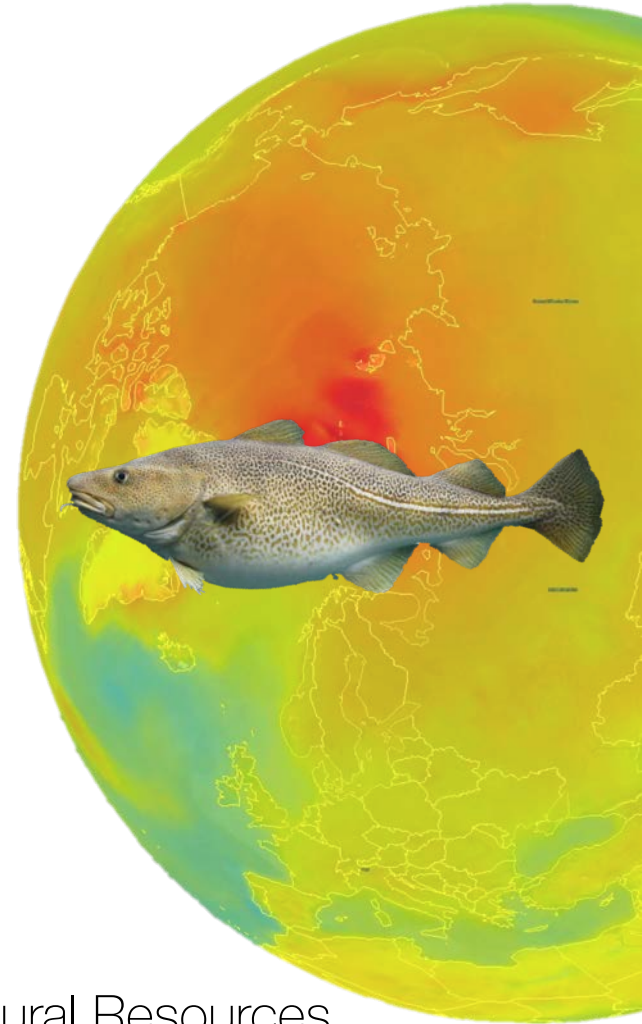
# Can we adapt to species on the move?

---

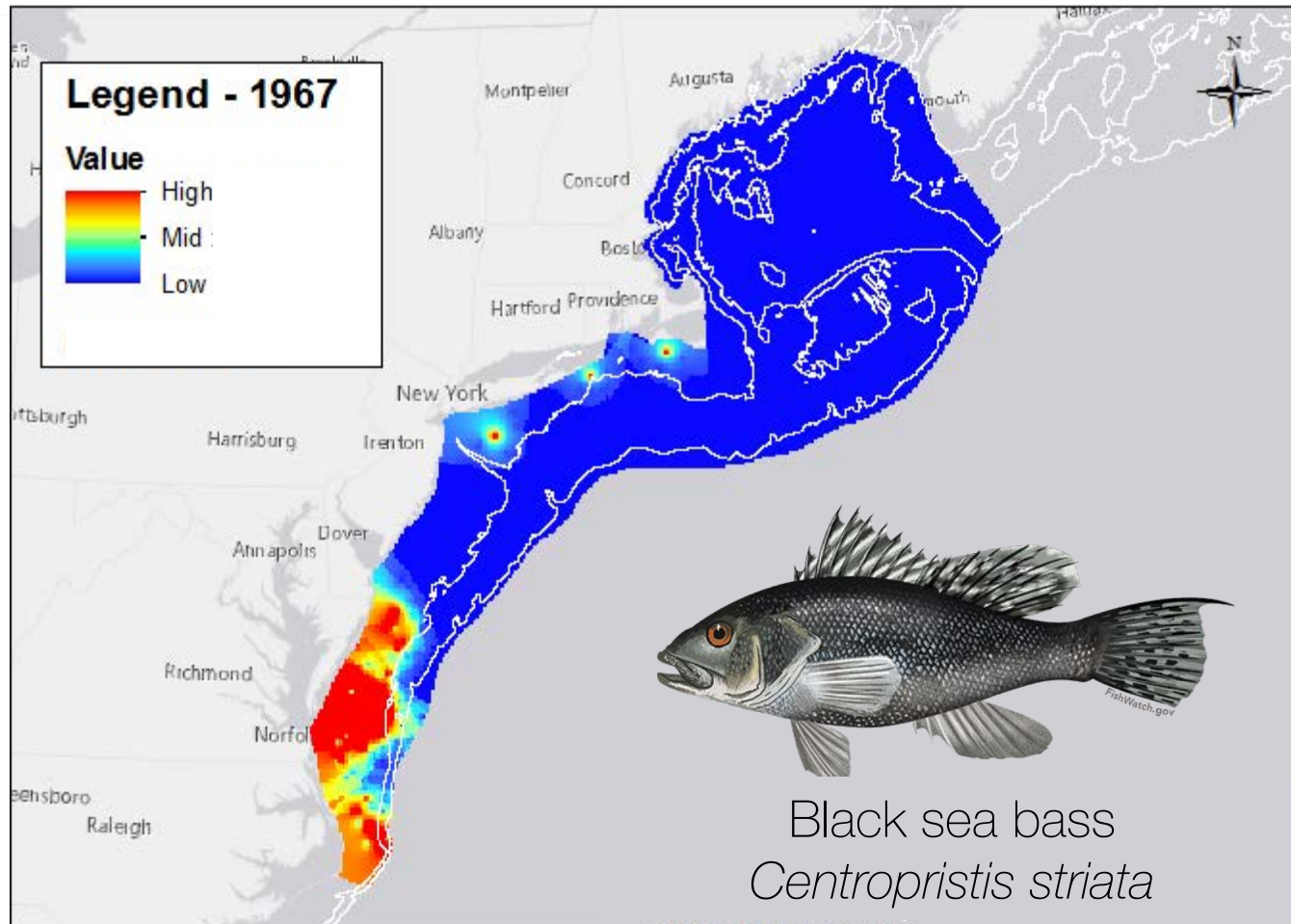
Malin Pinsky



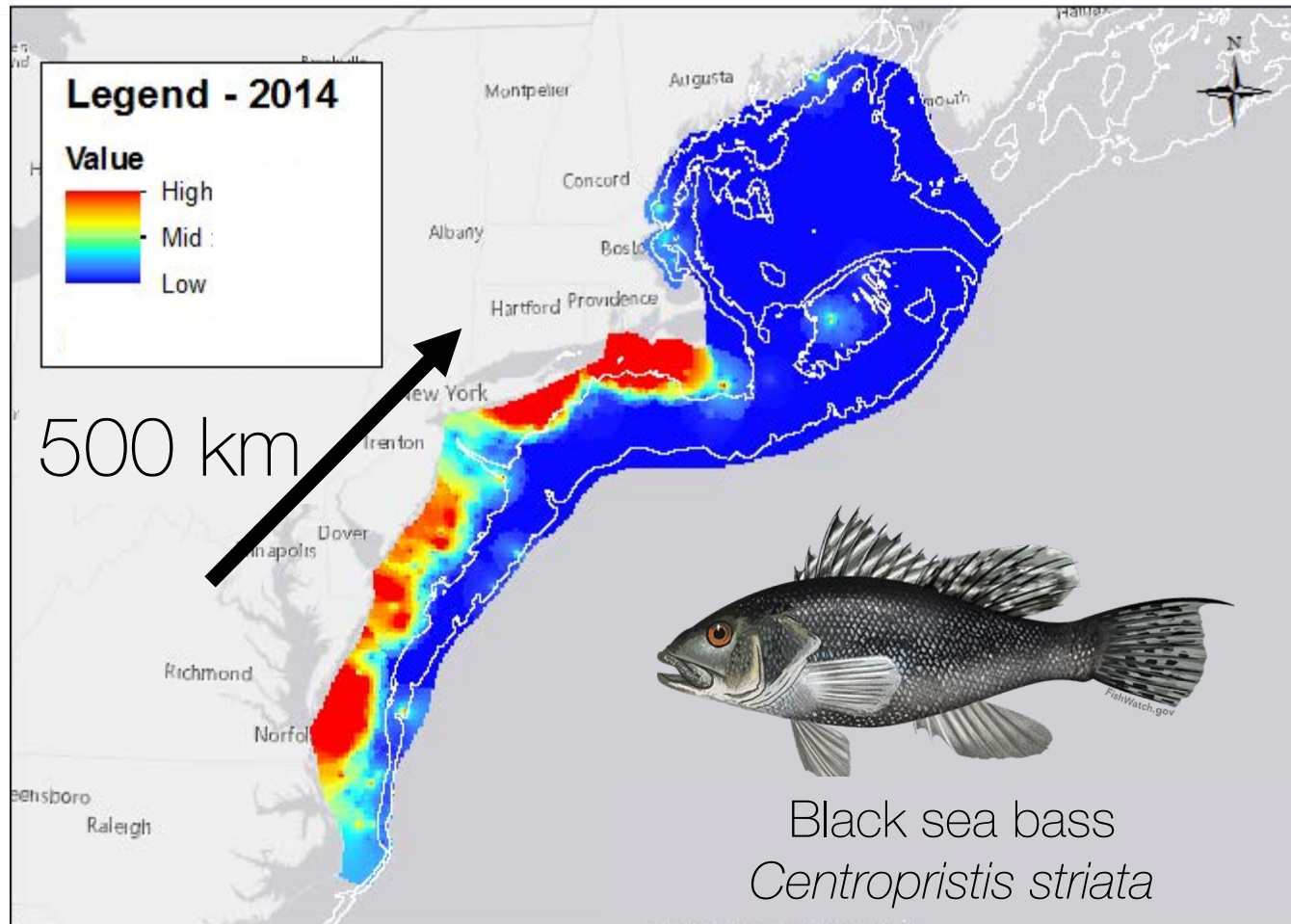
Department of Ecology, Evolution, and Natural Resources  
Institute of Earth, Ocean, and Atmospheric Sciences



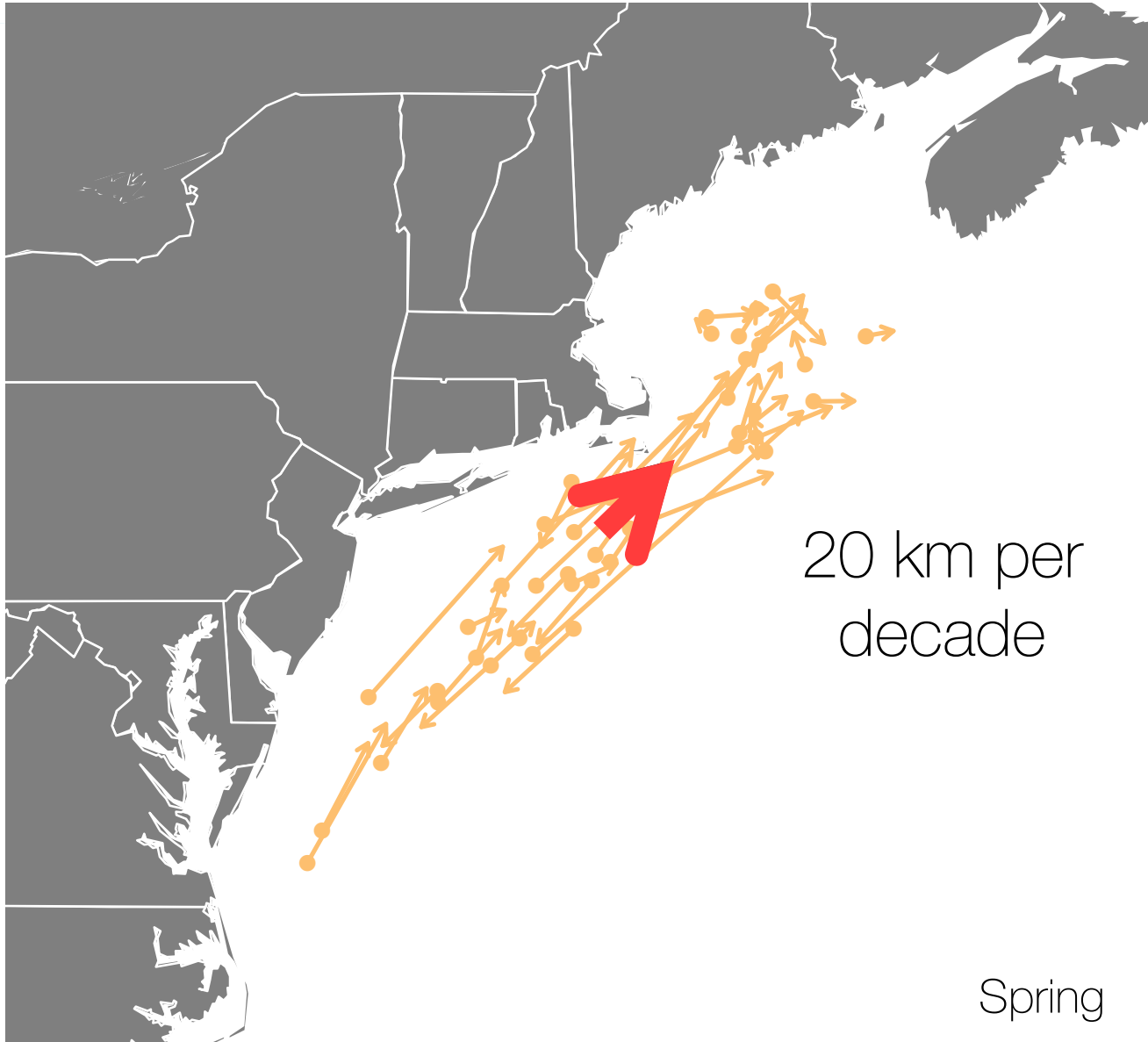
# Shifting distributions 1967



# Shifting distributions 1967-2014

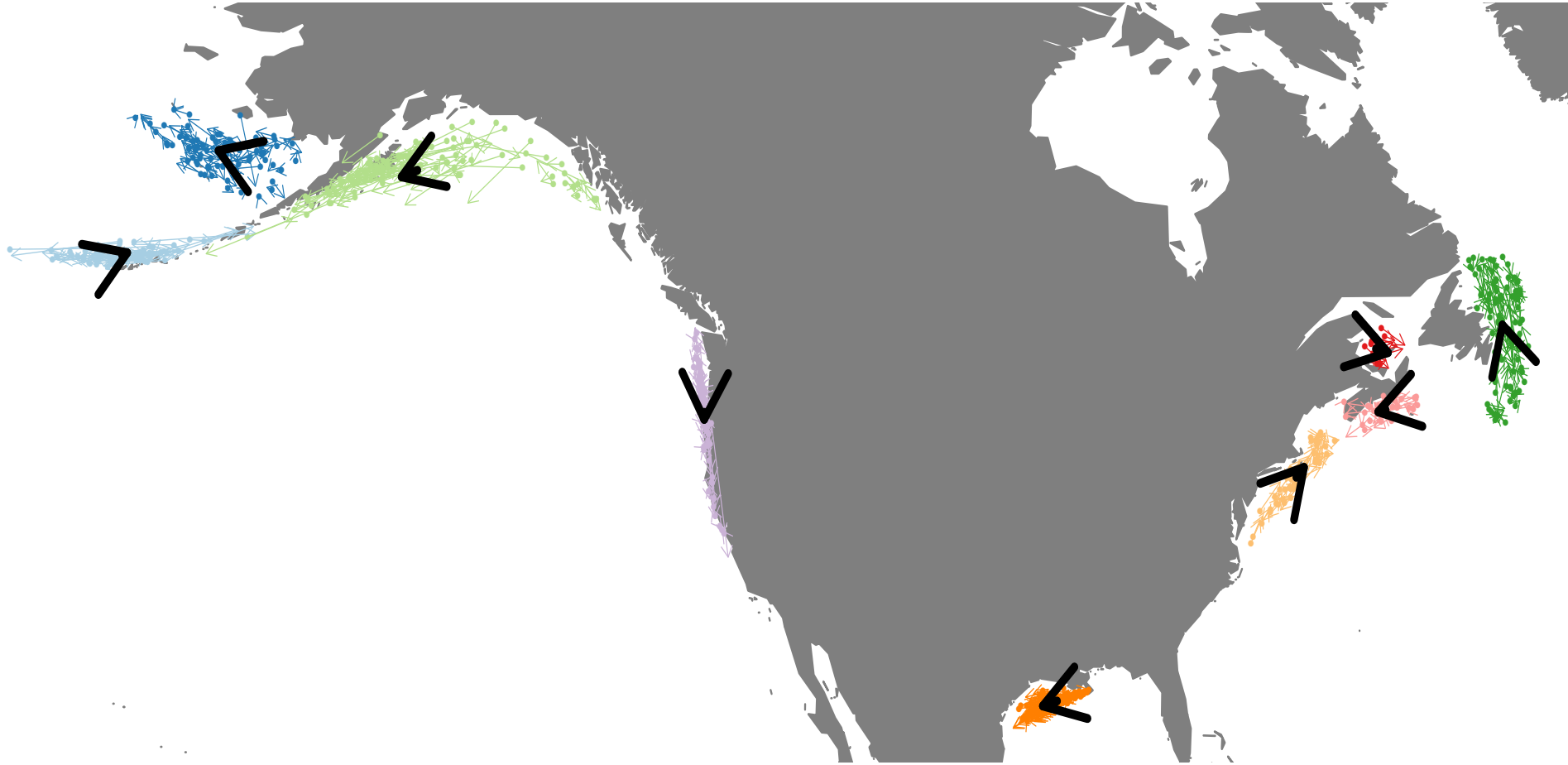


# Many species, many directions

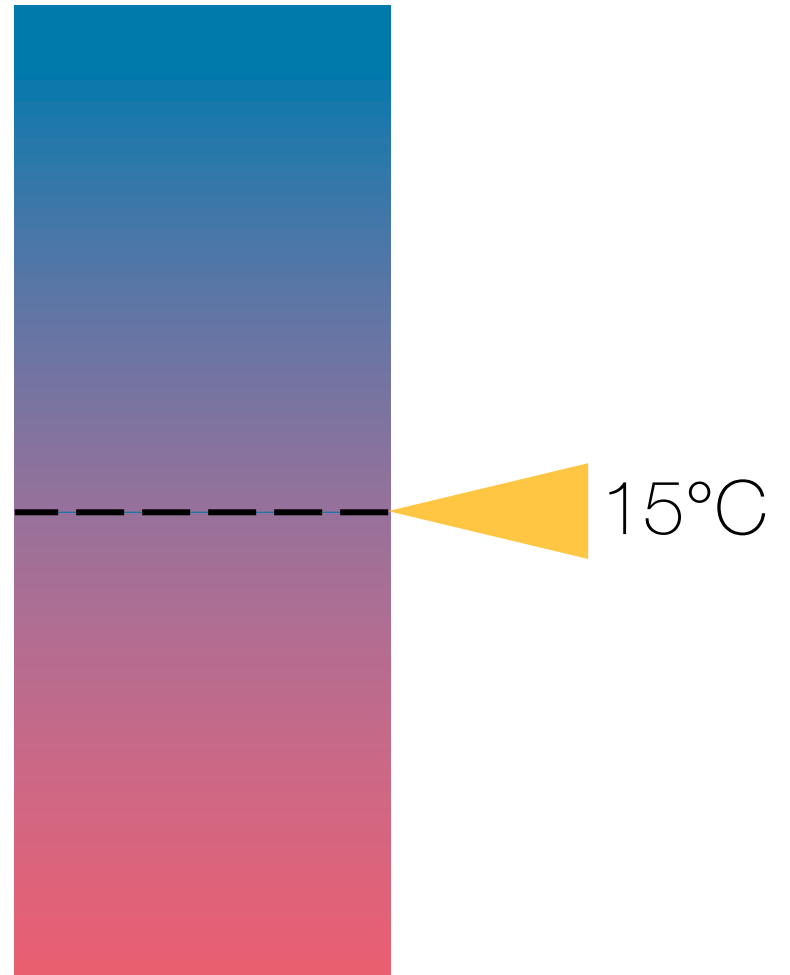




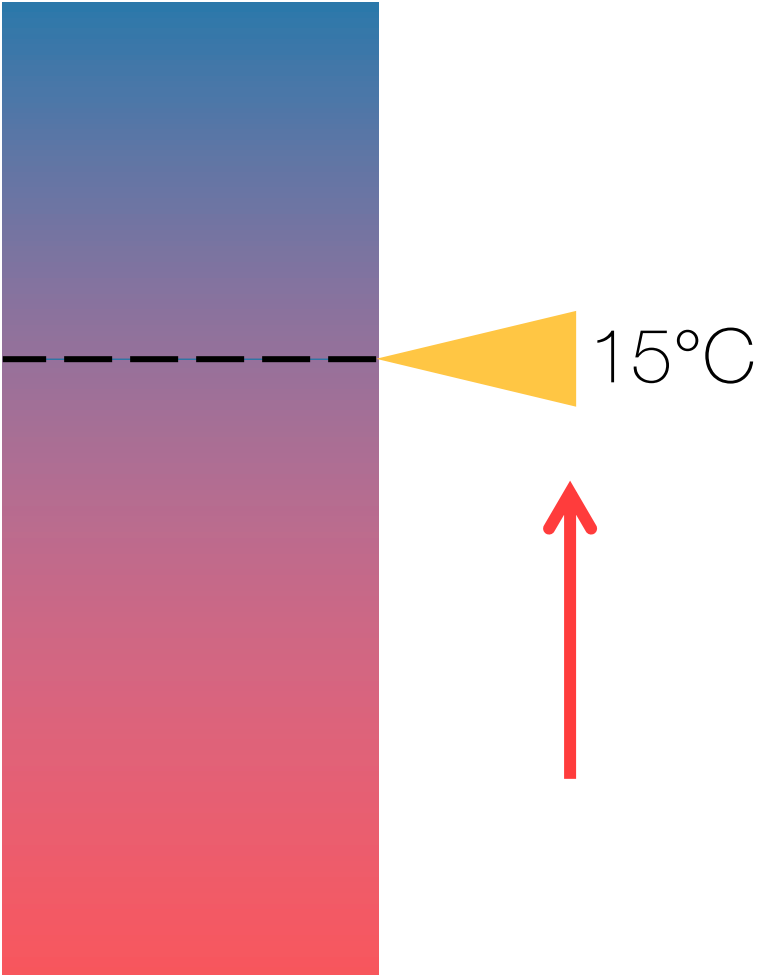
# Many species, many directions



# Climate velocity helps explain shifts

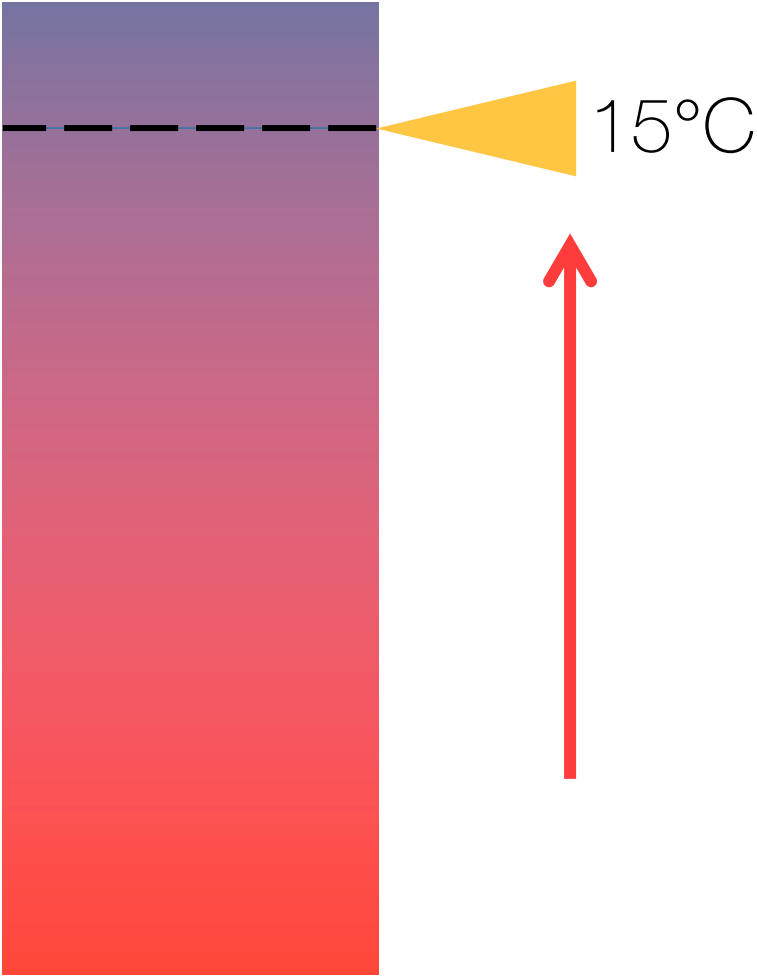


# Climate velocity helps explain shifts



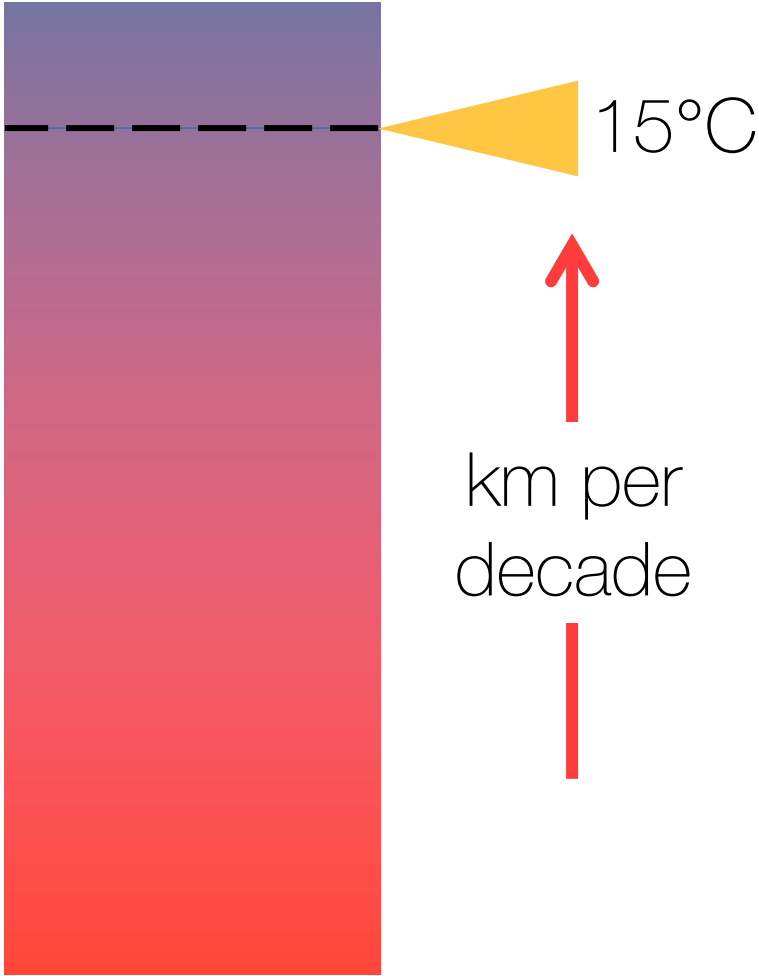
Pinsky *et al.*  
2013 *Science*

# Climate velocity helps explain shifts



Pinsky *et al.*  
2013 *Science*

# Climate velocity helps explain shifts



Pinsky *et al.*  
2013 *Science*

# To hear more about climate impacts

---



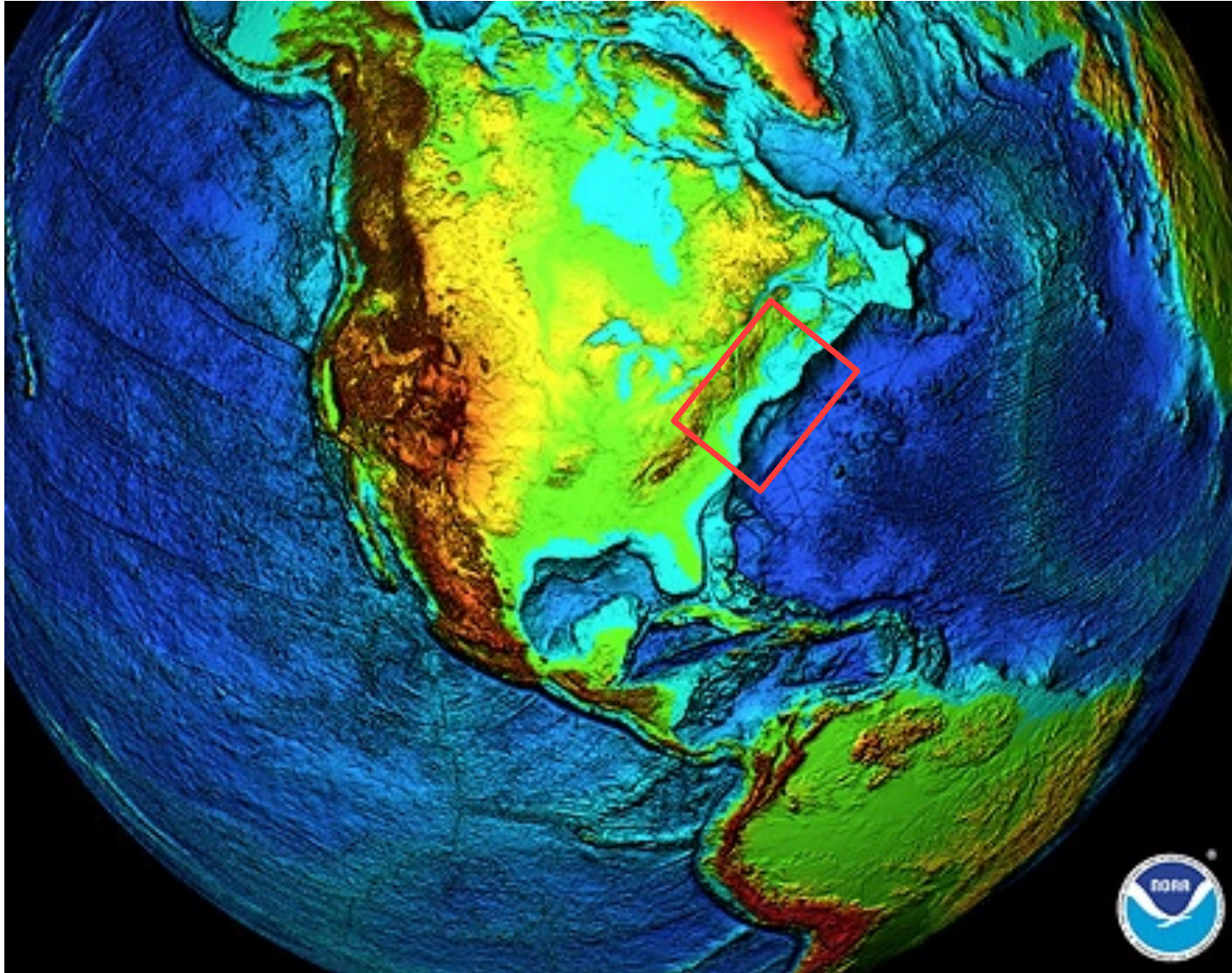
Synchrony  
Joyce Ong  
today  
S7 posters



Depth constraints  
Hailey Conrad  
11:00 am  
Friday  
S11



# Fishery responses



# Bottom-up fishery adaptation

---

- Travel further



# Bottom-up fishery adaptation

---

- Travel further
- Switch ports





# Bottom-up fishery adaptation

---

- Travel further
- Switch ports
- Switch species



# Bottom-up fishery adaptation

---

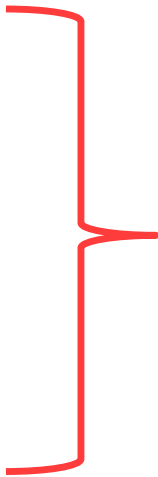
- Travel further
- Switch ports
- Switch species
- Leave fishing



# Bottom-up fishery adaptation

---

- Travel further
- Switch ports
- Switch species
- Leave fishing



**Regulations  
Economics  
Technology**



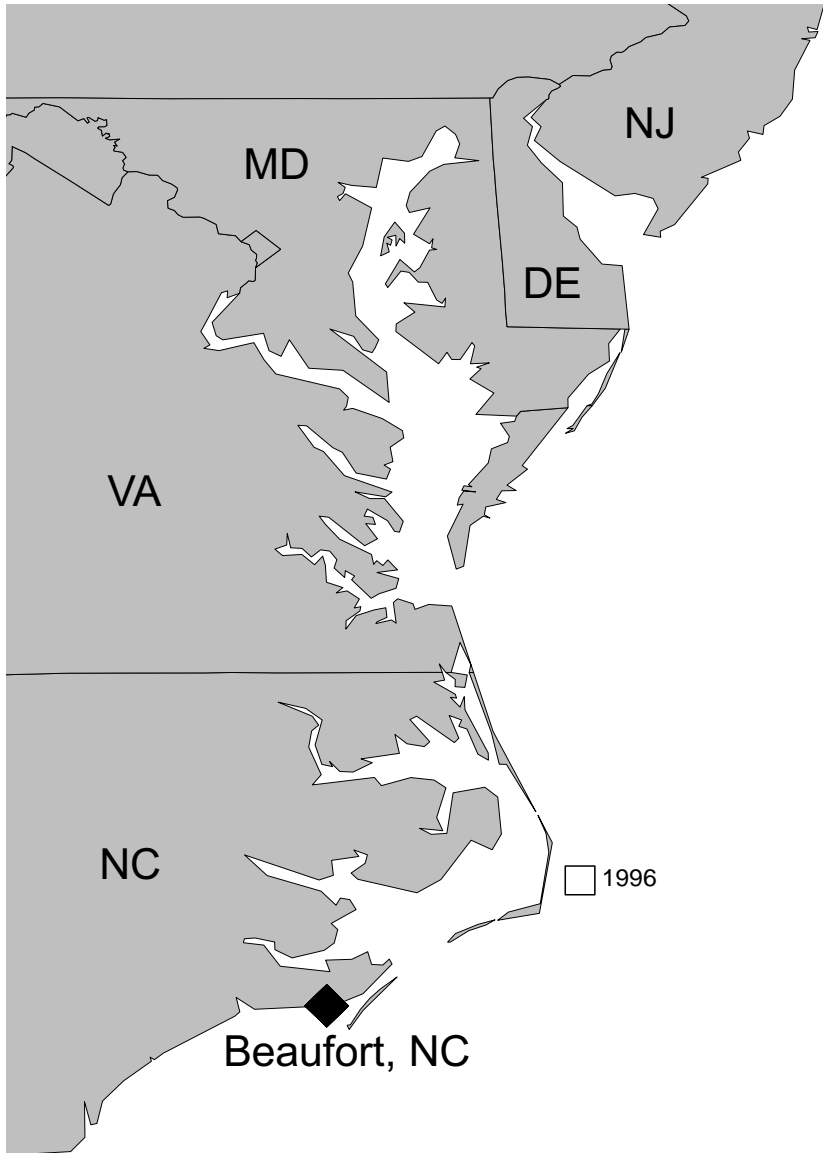
# Bottom-up fishery adaptation

---

- Travel further
- Switch ports
- Switch species
- Leave fishing



# Longer fishing trips

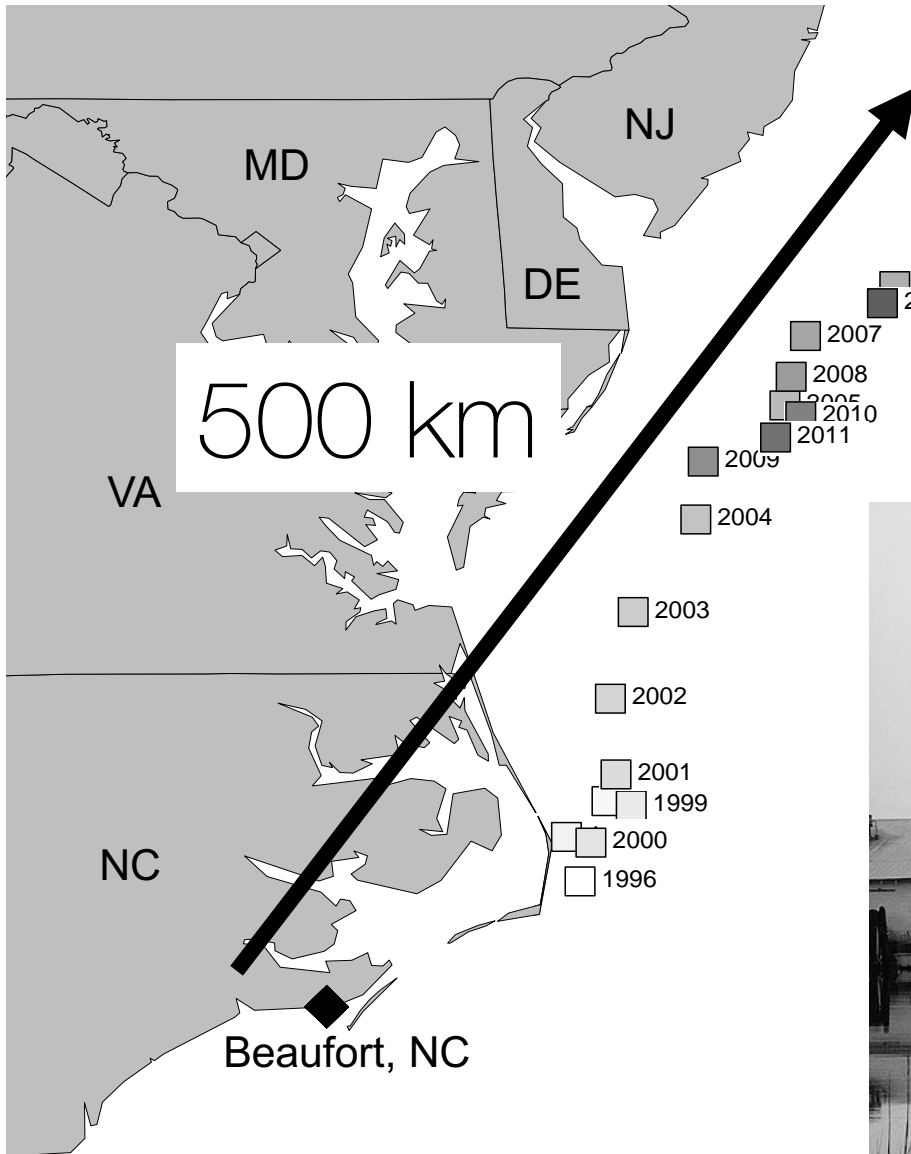


1996

From Vessel Trip Reports



# Longer fishing trips

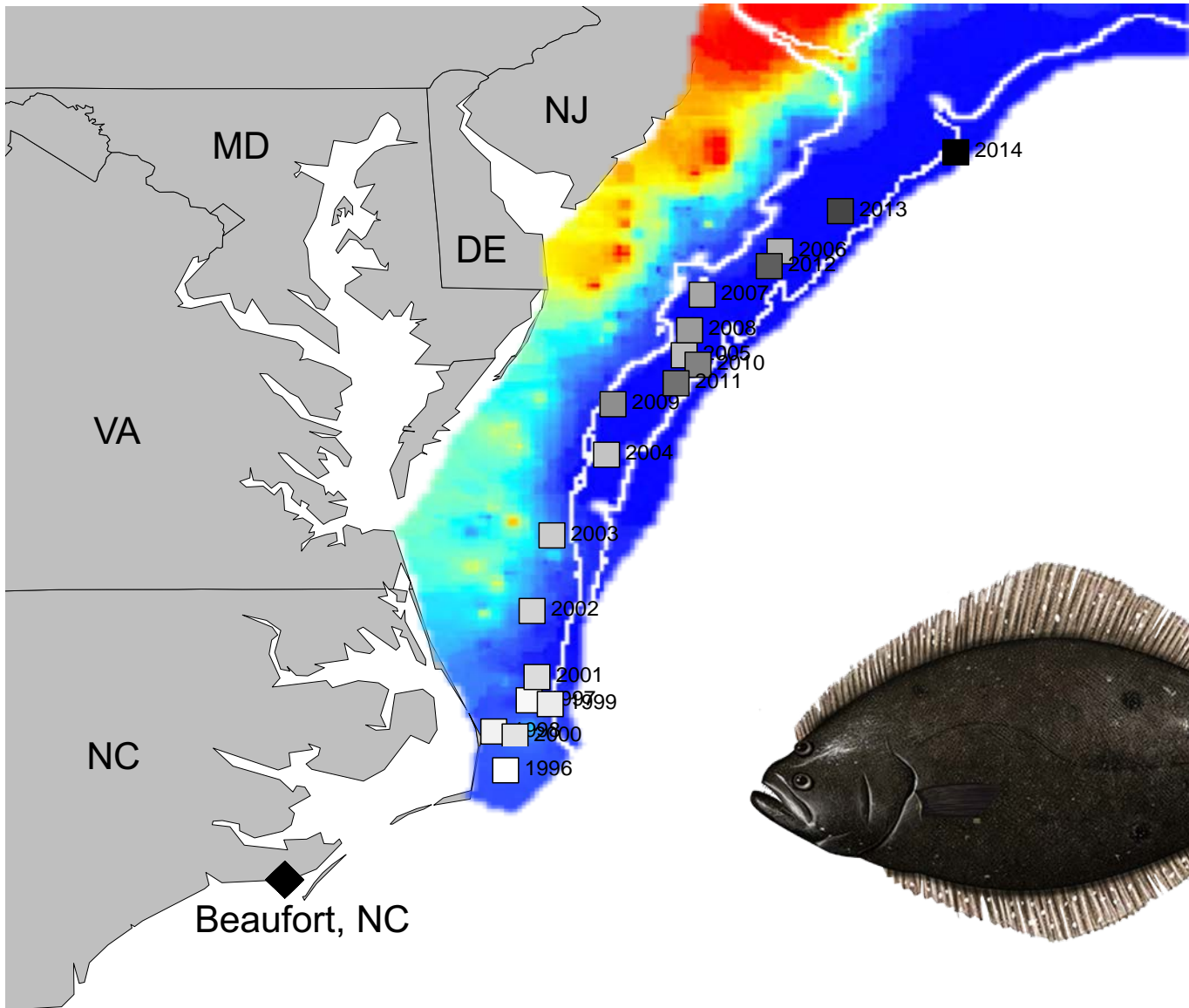


2014

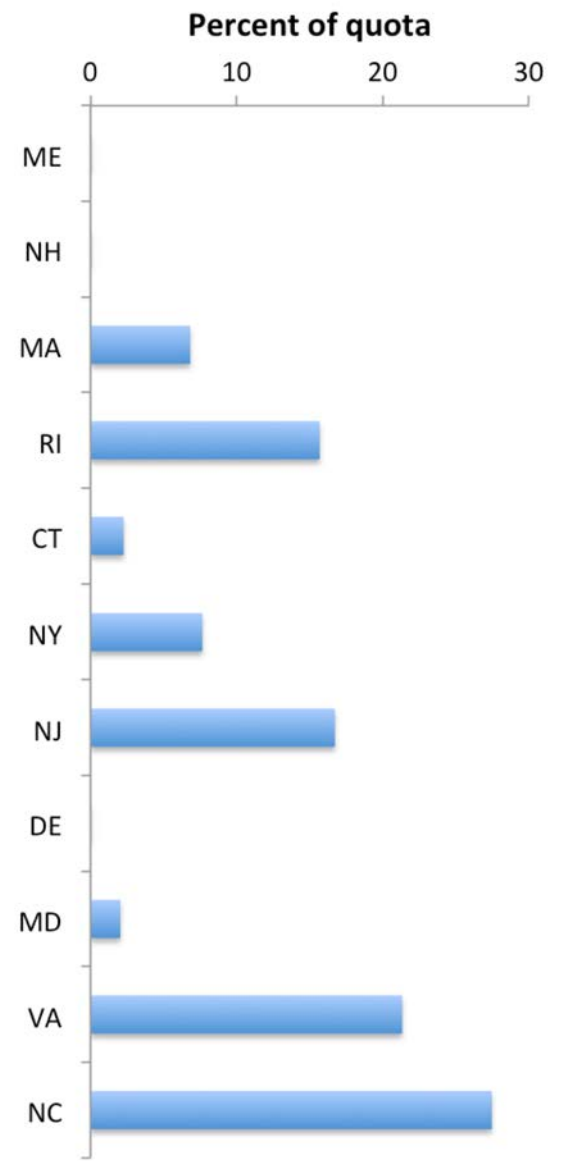
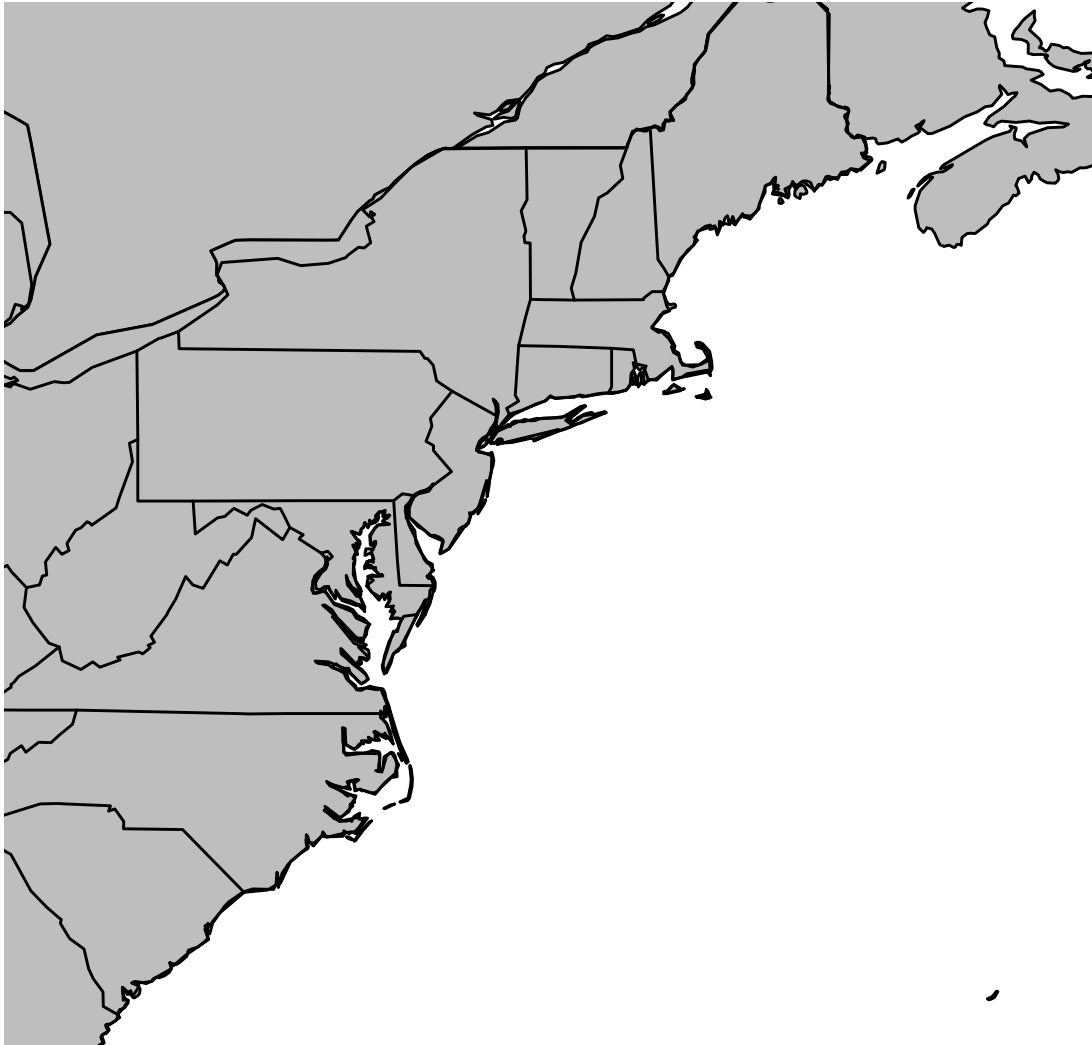
From Vessel Trip Reports



# Specialist fishers in a changing world



# Summer flounder: allocation of landings



# To hear more about fishery responses



West Coast  
Becca Selden  
16:20 pm  
today  
S10



East Coast interviews  
Eva Papaioannou  
11:00 am  
Friday  
S14



# Adapting to species on the move

---

- Regulations incentivize fishery responses in unintended ways
- Where are there pitfalls?
- (How) can we adapt?

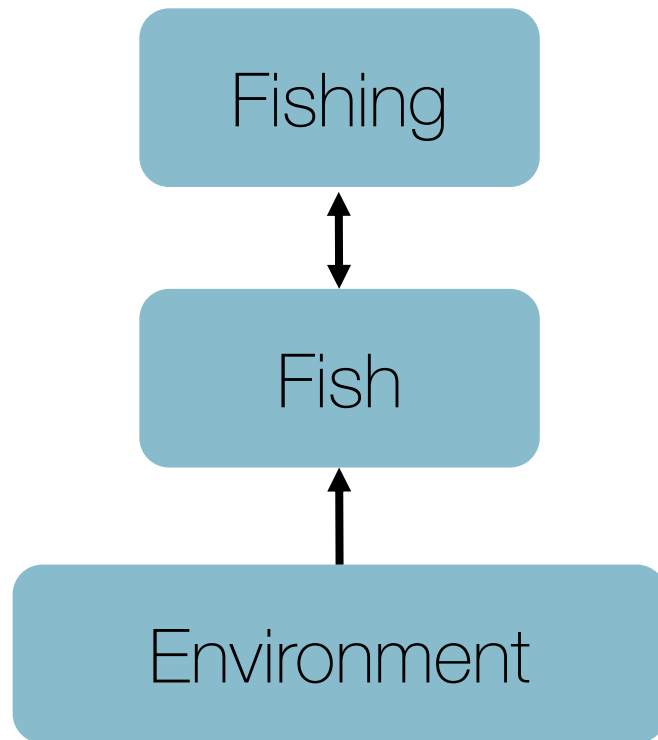
# Adapting to species on the move

---

- Regulations incentivize fishery responses in unanticipated ways
- Where are there pitfalls?
- (How) can we adapt?

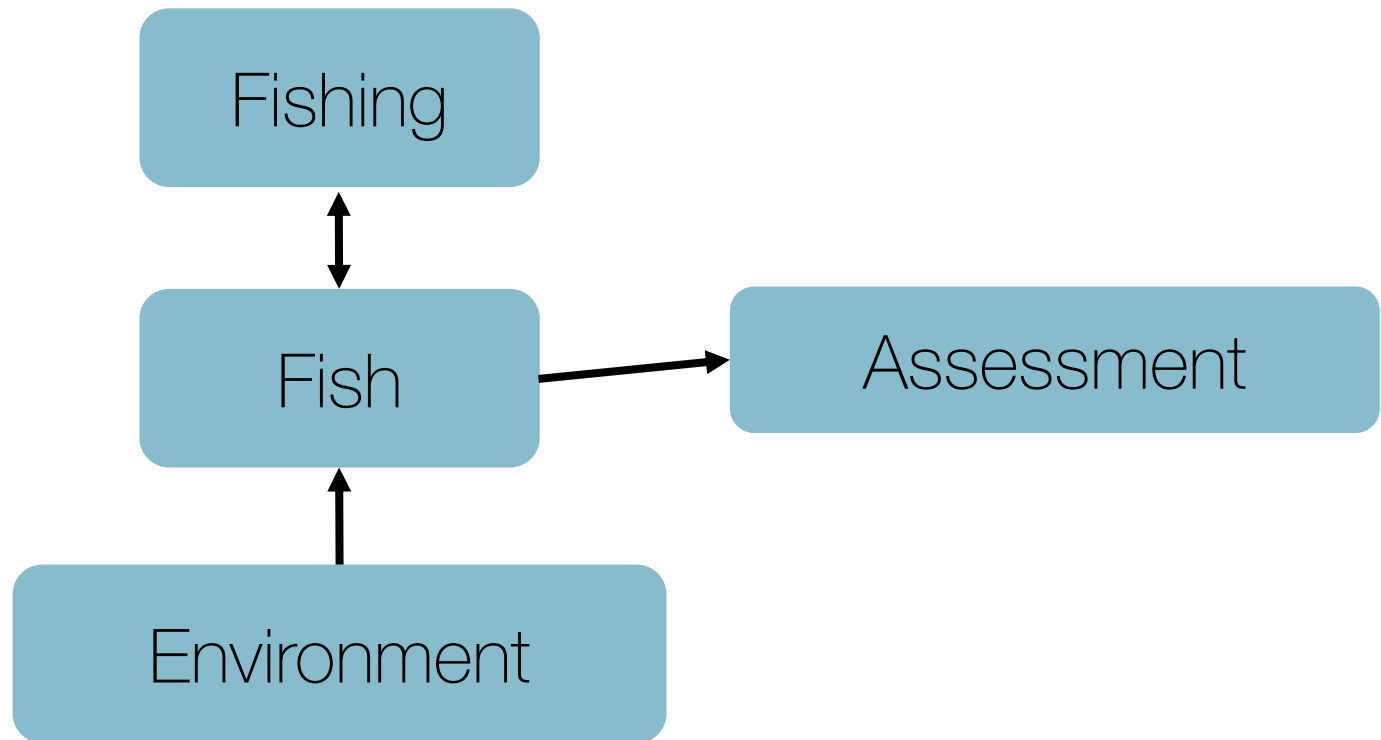
# Standard model

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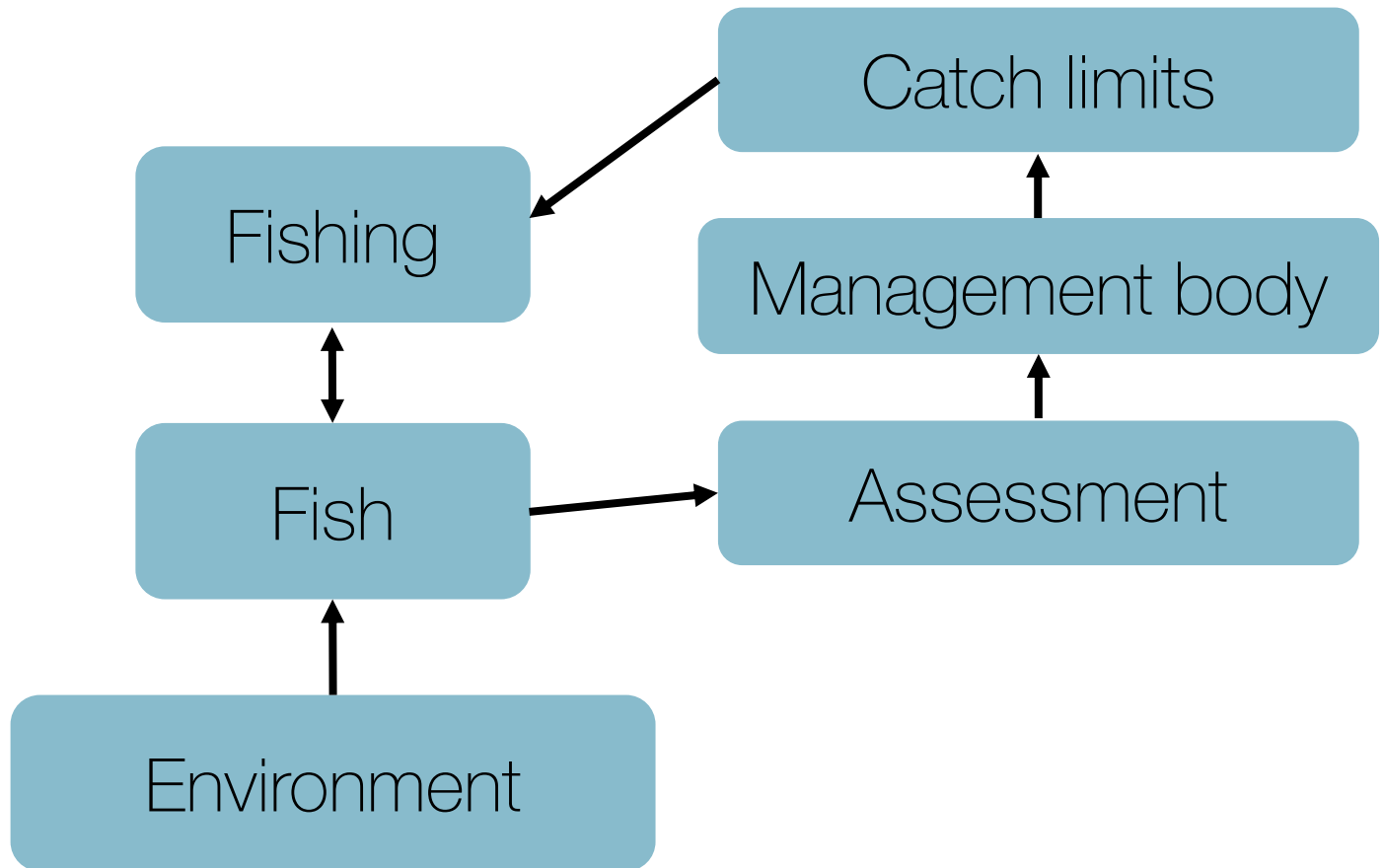
# Standard model

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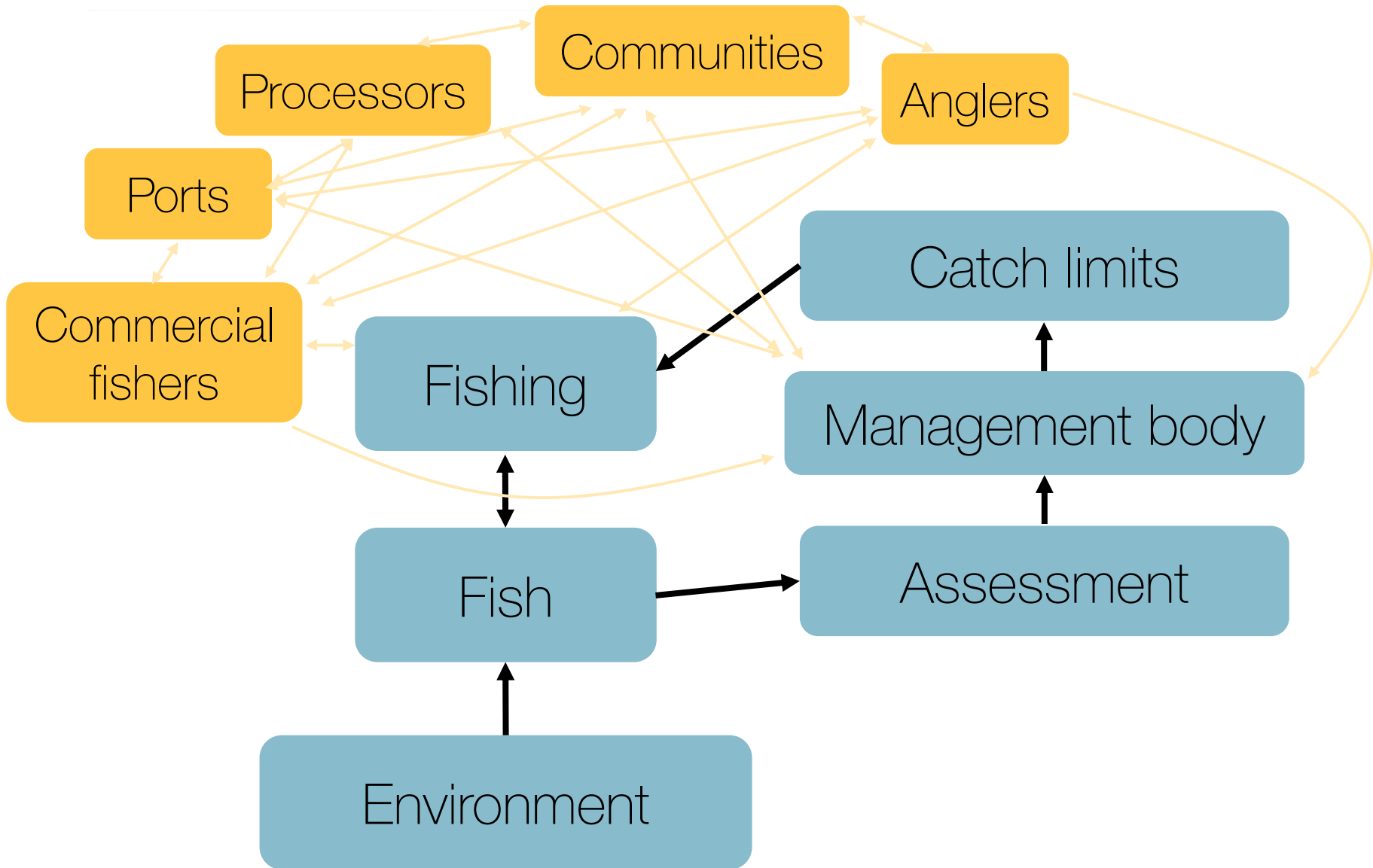


# Standard model

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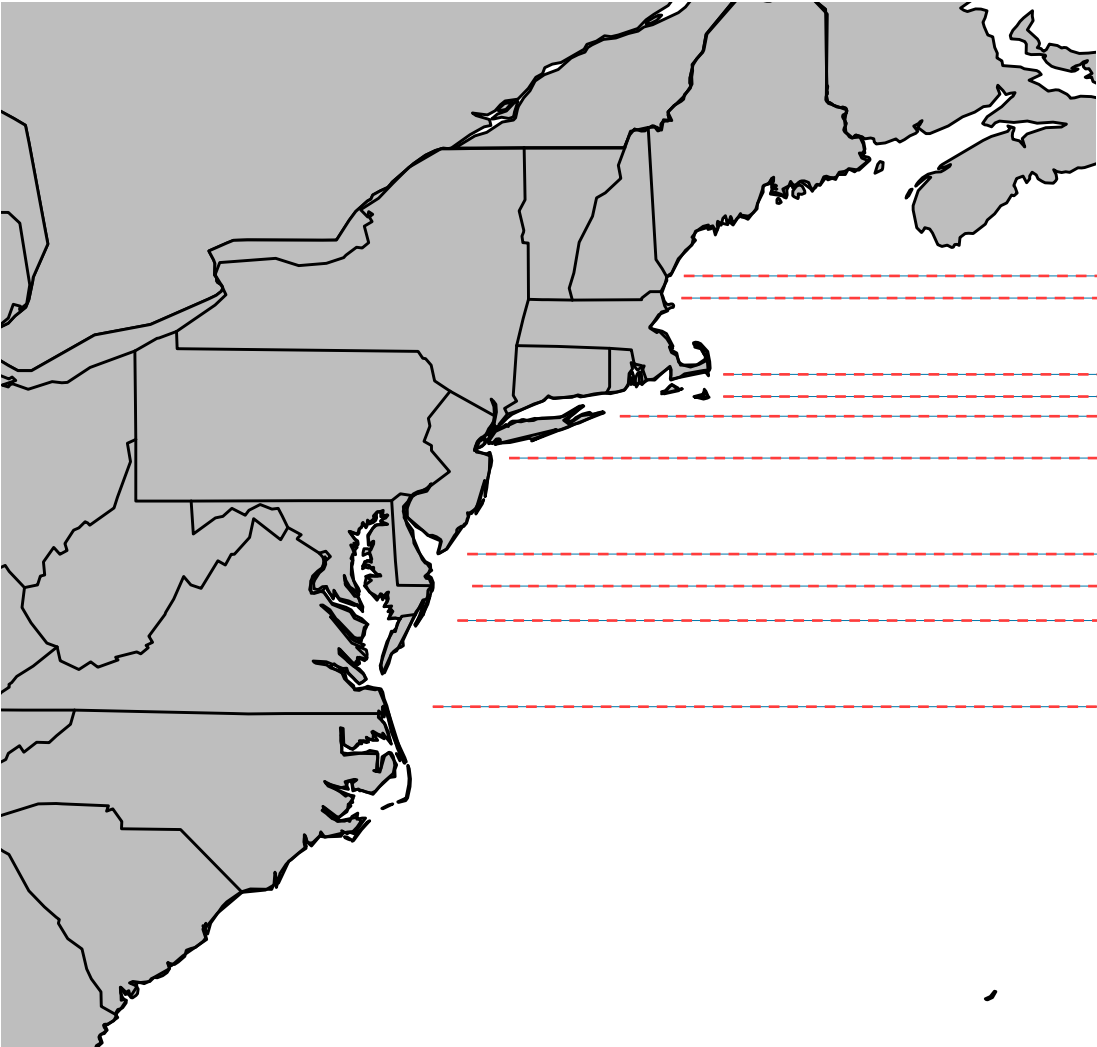


# Coupled social-ecological system





# Challenges from crossing boundaries

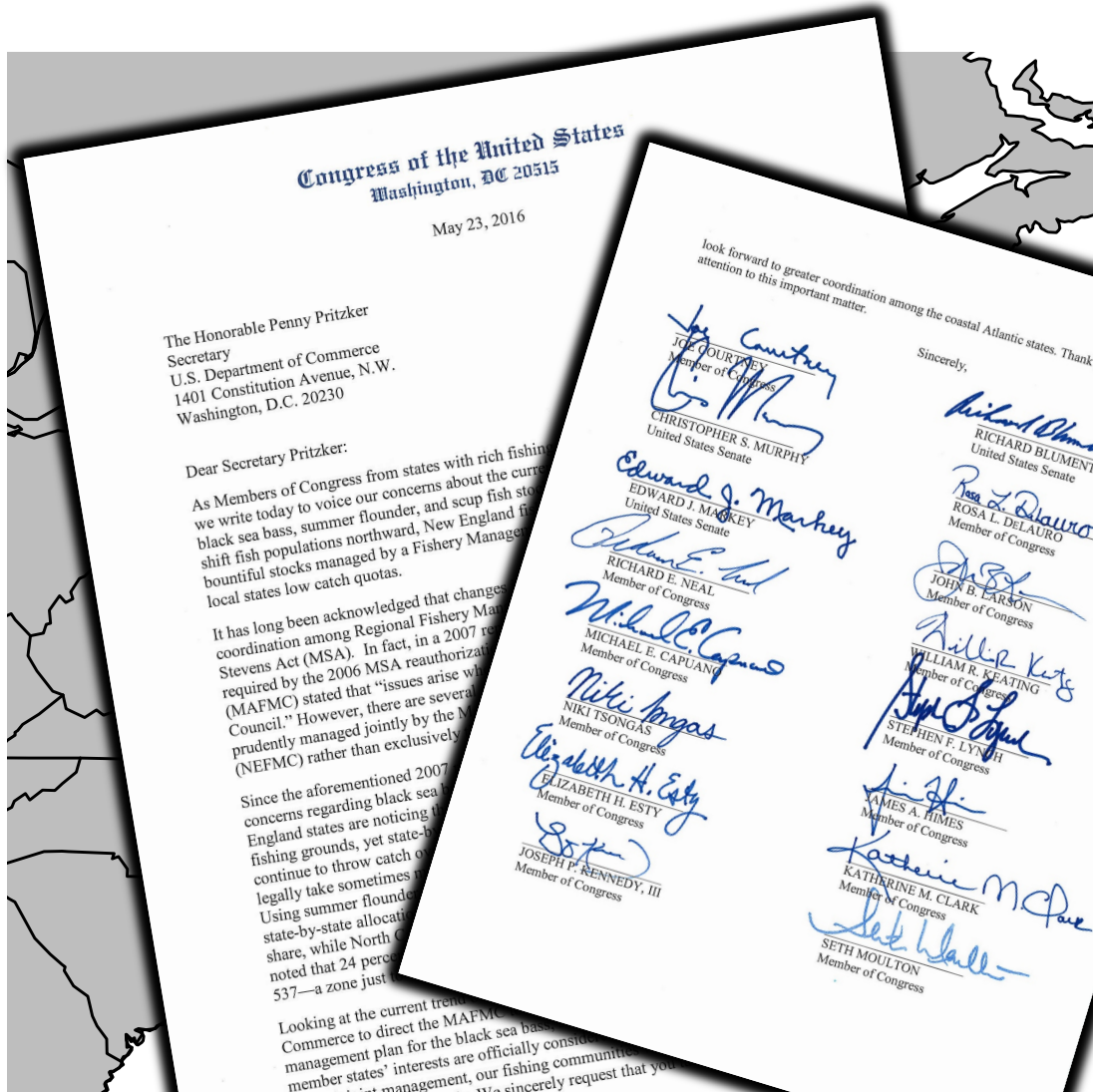


Summer flounder  
*Paralichthys dentatus*



# Challenges from crossing boundaries

Summer flounder  
*Paralichthys dentatus*  
 2016



Congress of the United States  
 Washington, DC 20515

May 23, 2016

The Honorable Penny Pritzker  
 Secretary  
 U.S. Department of Commerce  
 1401 Constitution Avenue, N.W.  
 Washington, D.C. 20230

Dear Secretary Pritzker:

As Members of Congress from states with rich fishing grounds, we write today to voice our concerns about the current management of summer flounder and scup fish stocks. The shift in fish populations northward, New England fishery-dependent communities' loss of bountiful stocks managed by a Fishery Management Plan, and local states' low catch quotas.

It has long been acknowledged that changes in fishery management require coordination among Regional Fishery Management Councils. The Stevens Act (MSA). In fact, in a 2007 reauthorization of the MSA required by the 2006 MSA reauthorization, the MAFMC Council. However, there are several issues that have not been prudently managed jointly by the MAFMC Council (NEFMC) rather than exclusively.

Since the aforementioned 2007 reauthorization, concerns regarding black sea bass and summer flounder in the New England states are not being addressed. The states are not continuing to throw catch quotas at the states that legally take sometimes more than their share. Using summer flounder state-by-state allocation, while North Carolina has noted that 24 percent of the total catch is 537—a zone just

Looking at the current trends in the fishery, the U.S. Department of Commerce to direct the MAFMC to develop a management plan for the black sea bass fishery that recognizes the member states' interests are officially constituted through joint management, our fishing communities through joint management. We sincerely request that you update the allocation formula. We sincerely request that you

look forward to greater coordination among the coastal Atlantic states. Thank you for your attention to this important matter.

Sincerely,

Thank you for your attention to this important matter.

*Joe Courtney*  
 JOE COURTOY  
 Member of Congress  
 CHRISTOPHER S. MURPHY  
 United States Senate

*Edward J. Markey*  
 EDWARD J. MARKEY  
 United States Senate

*Richard E. Neal*  
 RICHARD E. NEAL  
 Member of Congress

*Michael E. Capuan*  
 MICHAEL E. CAPUAN  
 Member of Congress

*Niki Tsongas*  
 NIKI TSONGAS  
 Member of Congress

*Elizabeth H. Esty*  
 ELIZABETH H. ESTY  
 Member of Congress

*Joseph P. Kennedy, III*  
 JOSEPH P. KENNEDY, III  
 Member of Congress

*James A. Himes*  
 JAMES A. HIMES  
 Member of Congress  
 KATHERINE M. CLARK  
 Member of Congress  
 SETH MOULTON  
 Member of Congress

*Richard Blumenthal*  
 RICHARD BLUMENTHAL  
 United States Senate

*Rosa L. DeLauro*  
 ROSA L. DELAURO  
 Member of Congress

*John B. Larson*  
 JOHN B. LARSON  
 Member of Congress

*William R. Keating*  
 WILLIAM R. KEATING  
 Member of Congress

*Stephen F. Lynch*  
 STEPHEN F. LYNCH  
 Member of Congress

*James A. Himes*  
 JAMES A. HIMES  
 Member of Congress

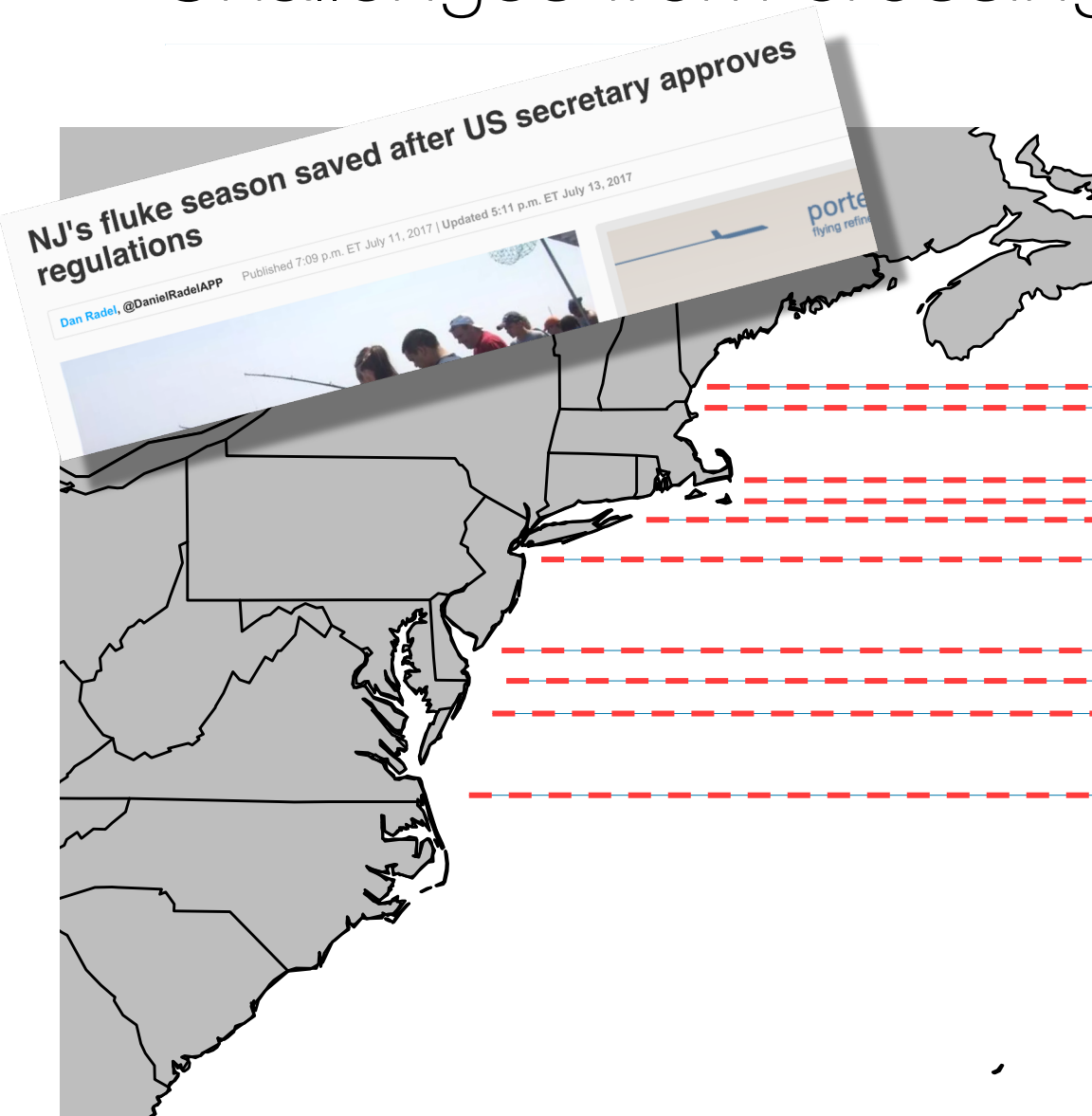
*Katherine M. Clark*  
 KATHERINE M. CLARK  
 Member of Congress

*Seth Moulton*  
 SETH MOULTON  
 Member of Congress



FishWatch.gov

# Challenges from crossing boundaries



Summer flounder  
*Paralichthys dentatus*  
2017



# Challenges from crossing boundaries

**NJ's fluke season saved after US secretary approves regulations**  
Dan Radel, @DanielRadelAPP | Published 7:09 p.m. ET July 11, 2017 | Updated 5:11 p.m. ET July 13, 2017

HOME ABOUT US HEALTHY OCEANS NEW

**marine fish conservation network**

**Commerce Department's Summer Flounder Decision Undermines ASMFC's Authority To Manage Fish Stocks**

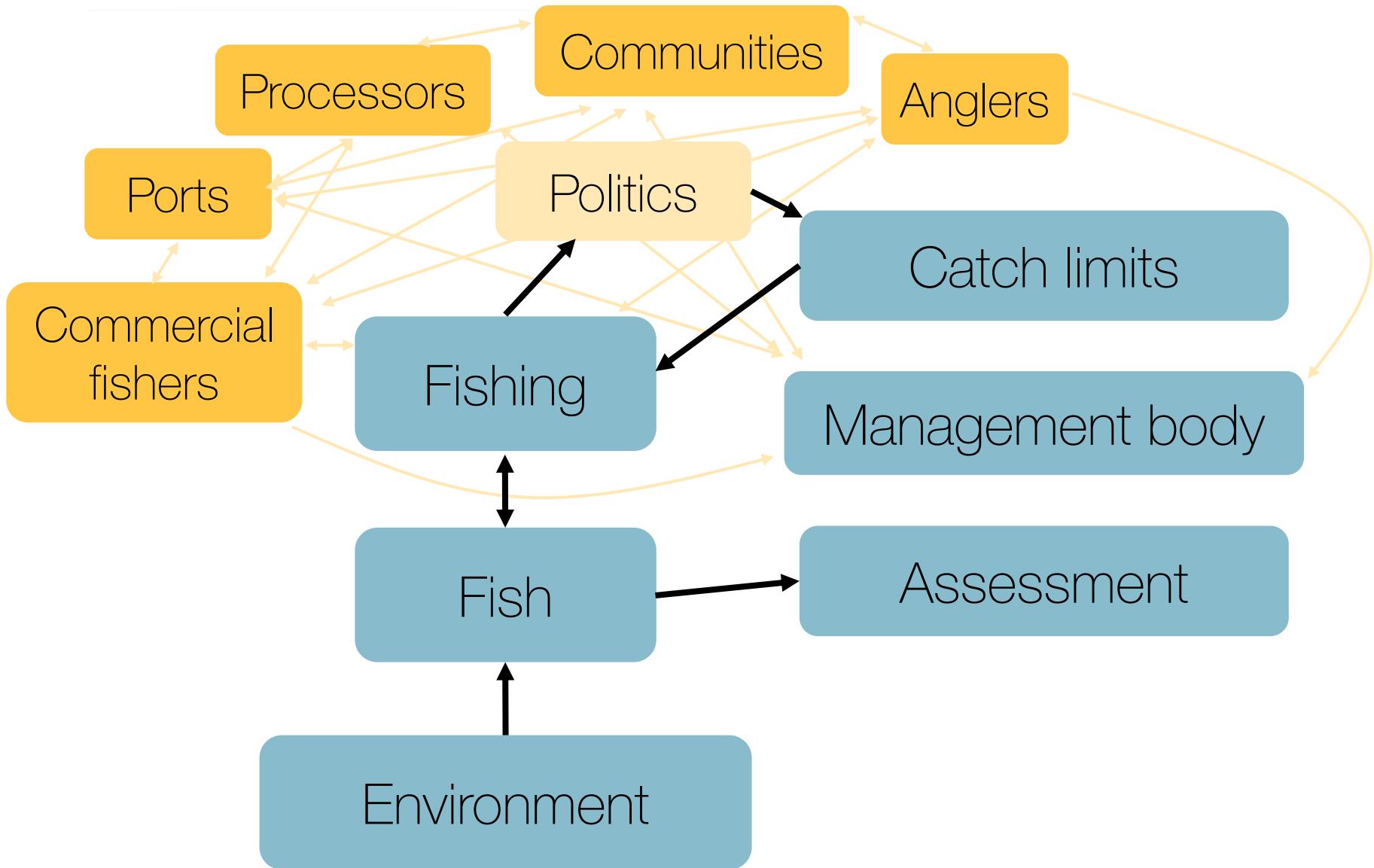
Posted by Charles Witek | Jul 18, 2017 | Featured, Policy | Leave a Comment

TELL CONGRESS! OPPOSE H.R. 200

Summer flounder  
*Paralichthys dentatus*  
2017



# Coupled social-ecological system



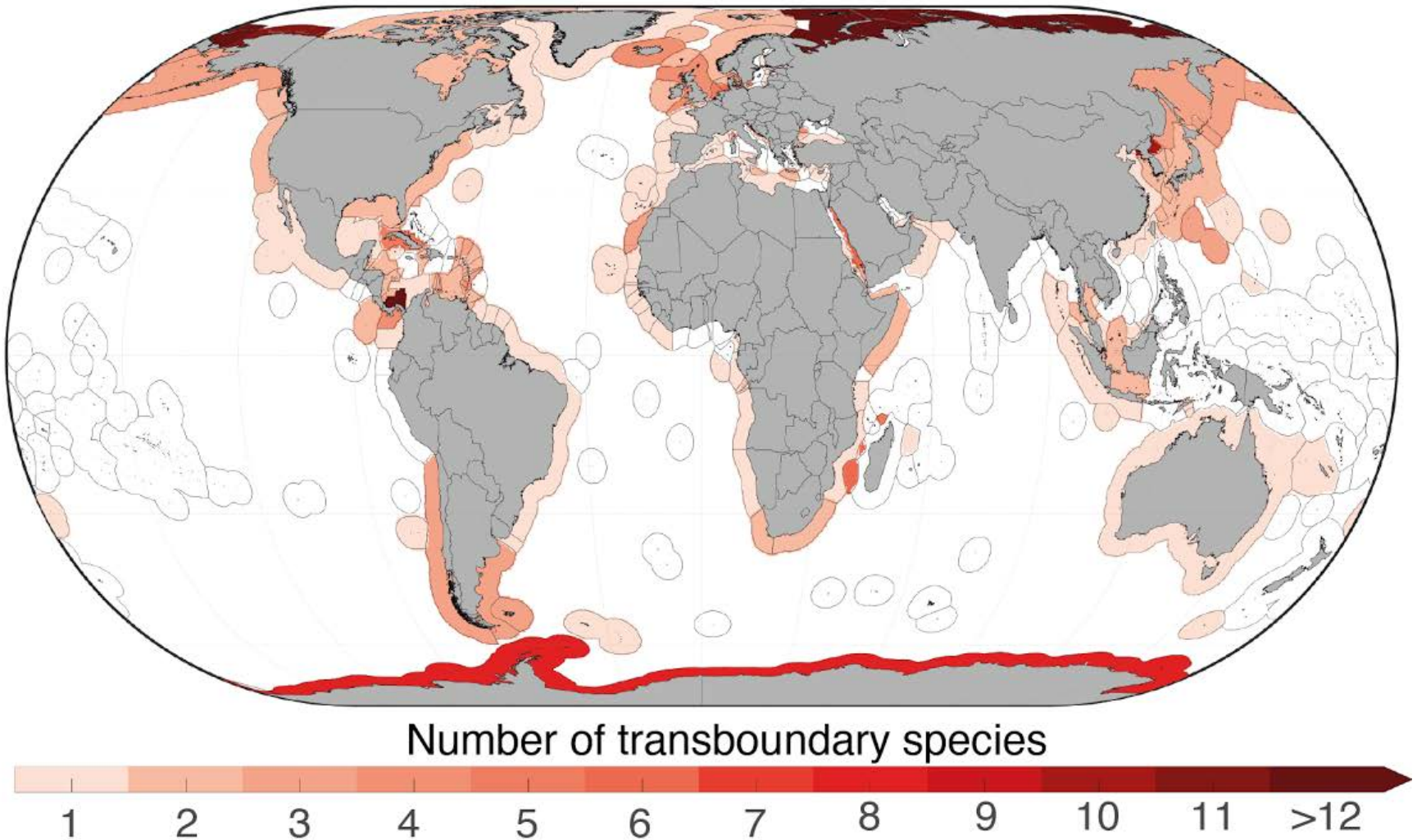


# International: Mackerel wars



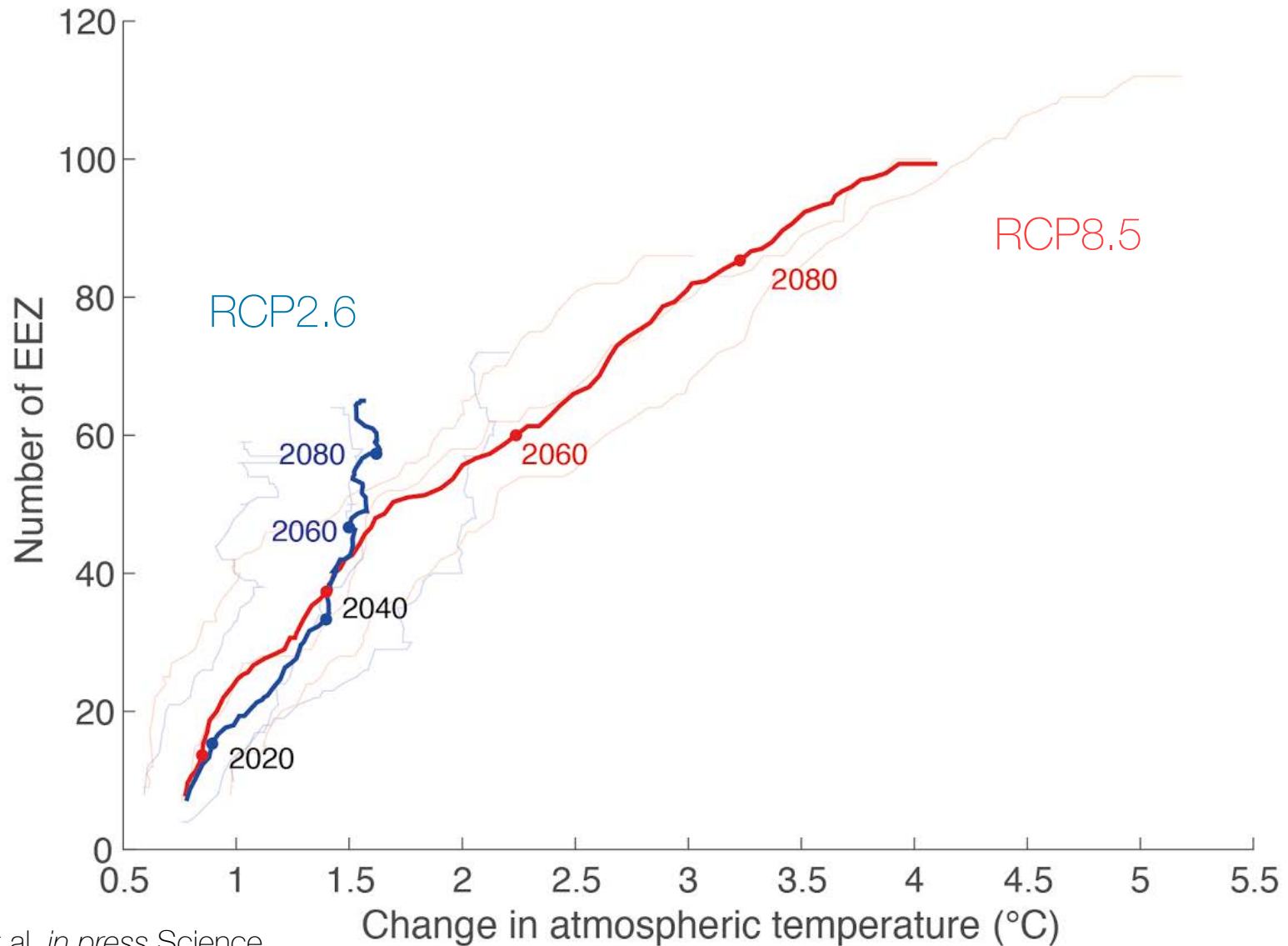
# New transboundary stocks by 2100

**A**





# Less potential conflict with lower emissions





# Adapting to species on the move

---

- Regulations incentivize fishery responses in unintended ways
- We are not ready for species on the move across political boundaries
- (How) can we adapt?

# Adapting to species on the move

---

- Regulations incentivize fishery responses in unintended ways
- We are not ready for species on the move across political boundaries
- (How) can we adapt?

# Timescales of fishery decisions

---

Assessments

Reference points

Spatial regulations



# Timescales of fishery decisions

---

Assessments

Reference points

Spatial regulations

Emerging fisheries



# Timescales of fishery decisions

---

Assessments

Reference points

Spatial regulations

Emerging fisheries

Investment



# Timescales of fishery decisions

---

Assessments

Cooperation

Reference points

Stakeholder representation

Spatial regulations

Emerging fisheries

Investment

Annual

Decadal

Multi-decadal



# Timescales of fishery decisions

---

Assessments

Cooperation

Reference points

Stakeholder representation

Spatial regulations

Emerging fisheries

Investment

Annual

Decadal

Multi-decadal



# Current state and trends

<http://oceanadapt.rutgers.edu>

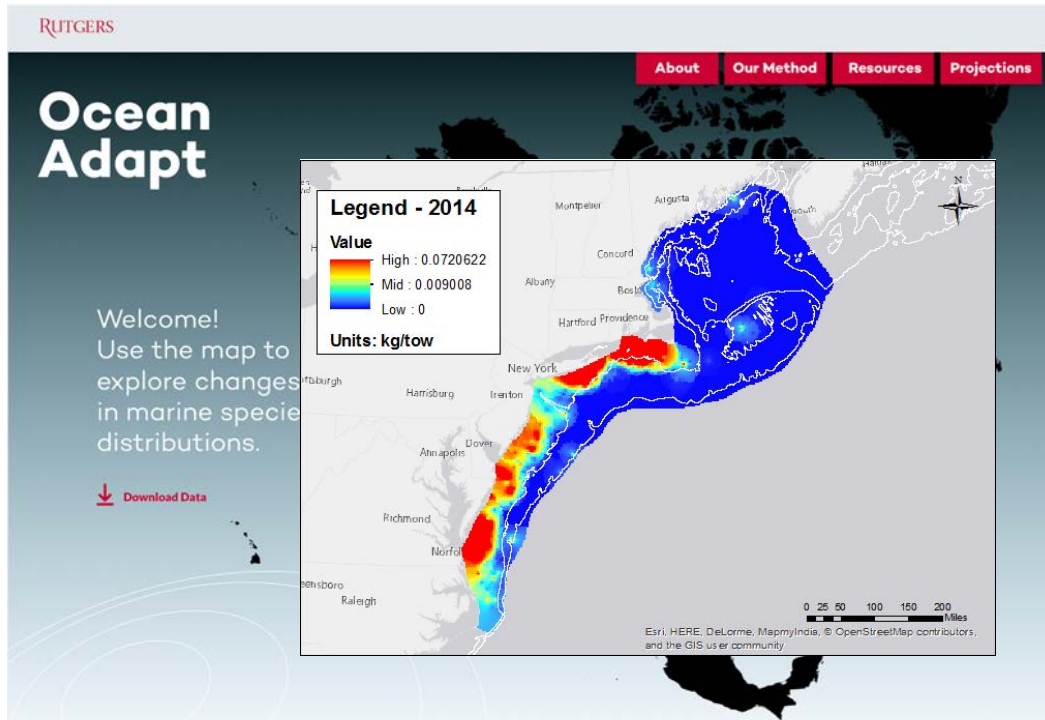


The screenshot shows the "Ocean Adapt" website interface. At the top left, the "RUTGERS" logo is visible. Below it, the title "Ocean Adapt" is displayed in large white font. A navigation menu at the top right includes links for "About", "Our Method", "Resources", and "Projections". The main content area features a map of the United States with several red location pins. A white circular callout labeled "Northeast" is positioned over the Northeast region. On the left side of the map, there is a welcome message: "Welcome! Use the map to explore changes in marine species distributions." Below this message is a "Download Data" button with a downward arrow icon. The background of the map area is a dark teal color.



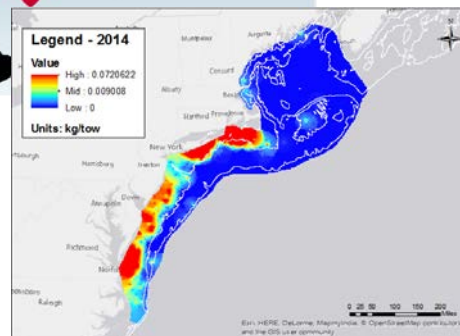
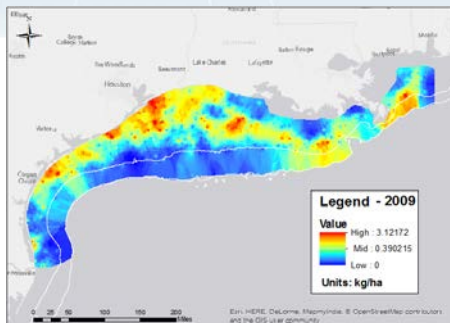
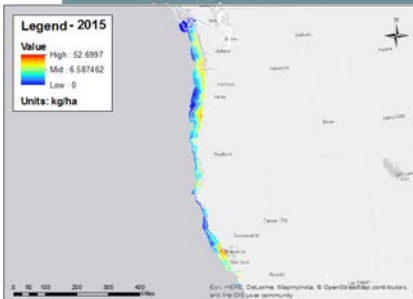
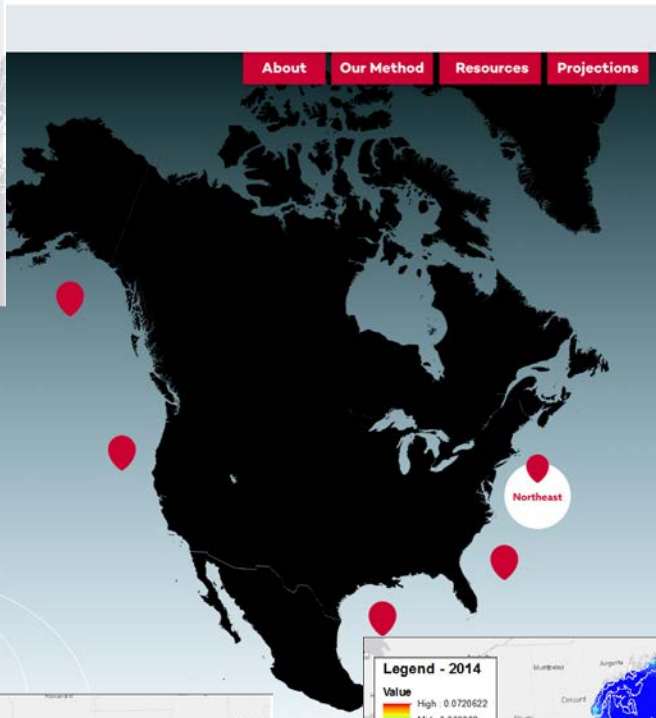
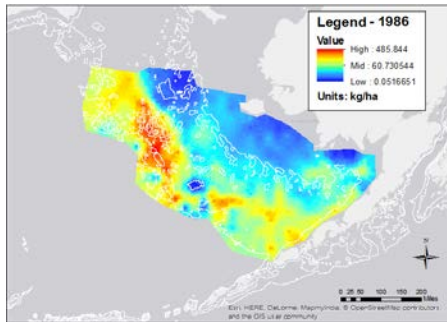
# Current state and trends

<http://oceanadapt.rutgers.edu>



# Current state and trends

<http://oceanadapt.rutgers.edu>



665 species

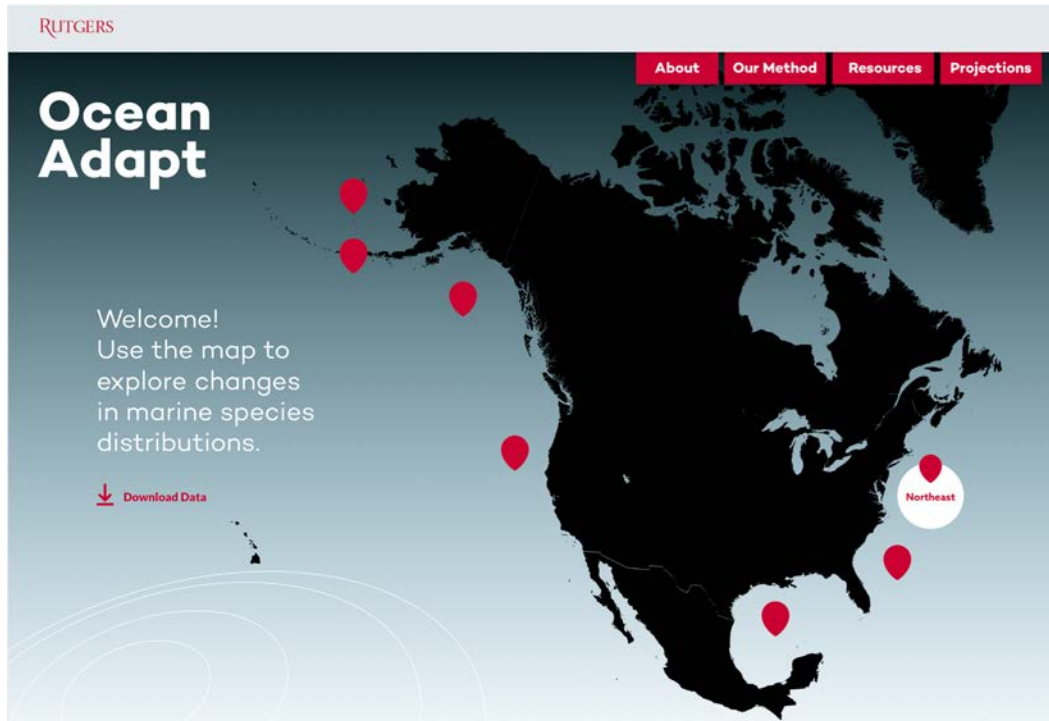
11 surveys

7 regions

1433 maps

# Current state and trends

<http://oceanadapt.rutgers.edu>



# Timescales of fishery decisions

Assessments

Cooperation

Reference points

Stakeholder representation

Spatial regulations

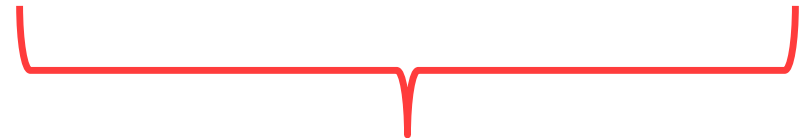
Emerging fisheries

Investment

Annual

Decadal

Multi-decadal



RESEARCH ARTICLE

# Projecting shifts in thermal habitat for 686 species on the North American continental shelf

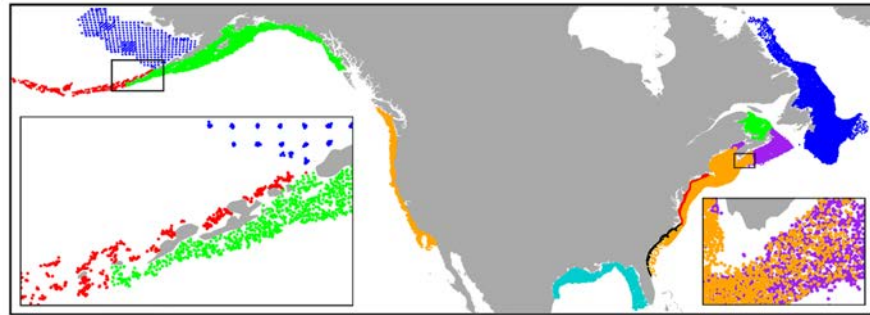
James W. Morley<sup>1\*</sup>, Rebecca L. Selden<sup>1</sup>, Robert J. Latour<sup>2</sup>, Thomas L. Frölicher<sup>3,4</sup>, Richard J. Seagraves<sup>5</sup>, Malin L. Pinsky<sup>1</sup>



Jim Morley

RESEARCH ARTICLE

# Projecting shifts in thermal habitat for 686 species on the North American continental shelf

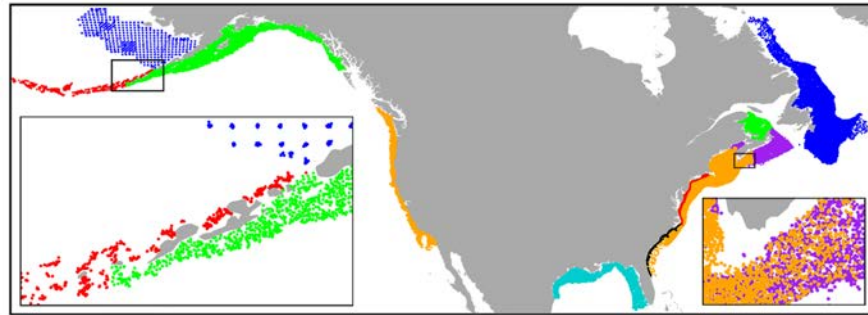


136,044 tows  
686 species

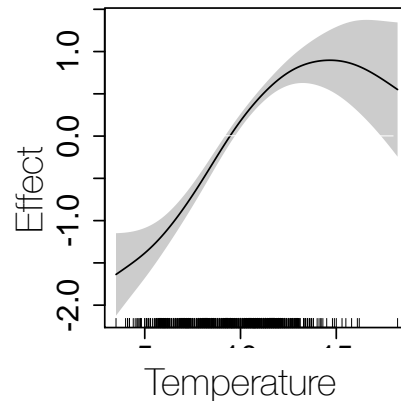
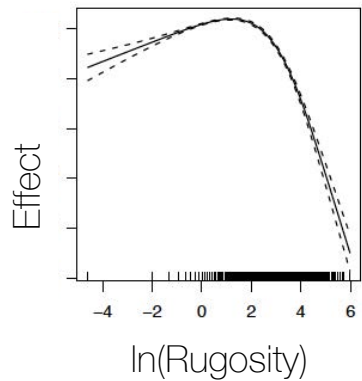


RESEARCH ARTICLE

# Projecting shifts in thermal habitat for 686 species on the North American continental shelf



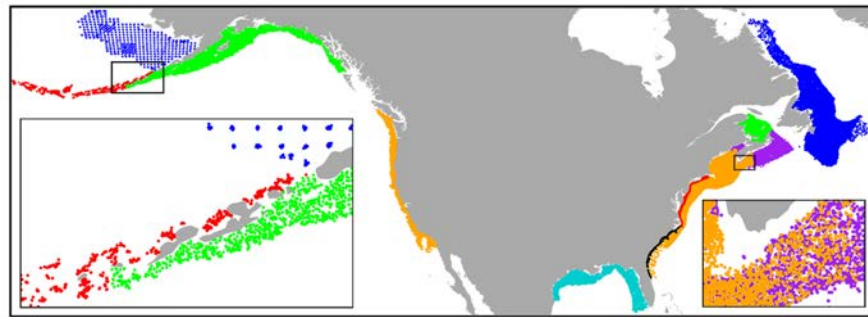
Seasonal surface temperature  
 Previous summer surface max  
 Previous winter surface min  
 Same for bottom temperatures  
 Seafloor rugosity  
 Sediment grain size





RESEARCH ARTICLE

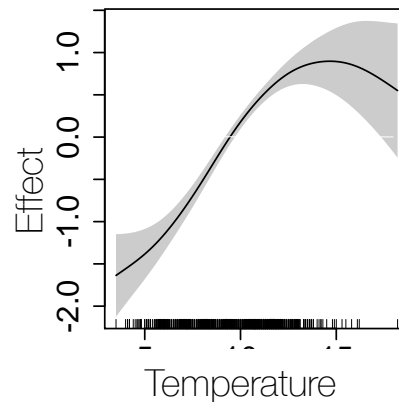
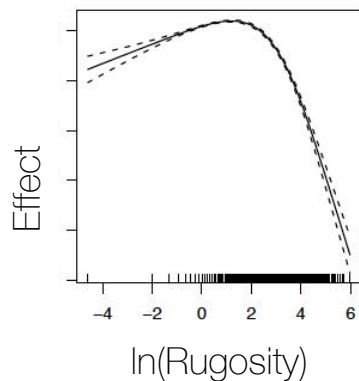
# Projecting shifts in thermal habitat for 686 species on the North American continental shelf



Seasonal surface temperature  
 Previous summer surface max  
 Previous winter surface min  
 Same for bottom temperatures  
 Seafloor rugosity  
 Sediment grain size



GAMs  
 Out-of-sample testing

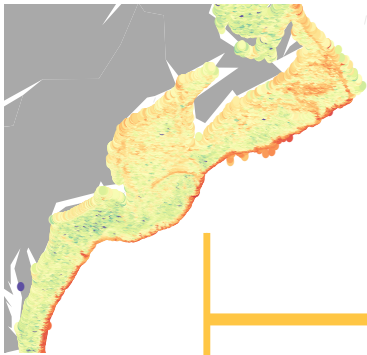




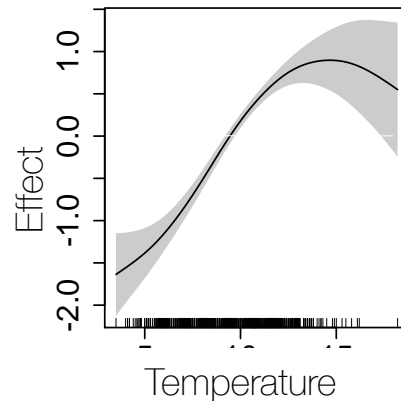
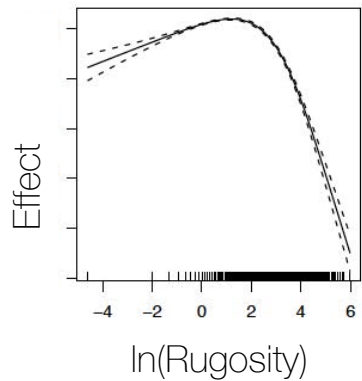
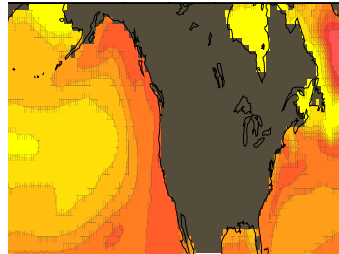
RESEARCH ARTICLE

# Projecting shifts in thermal habitat for 686 species on the North American continental shelf

Bottom habitat



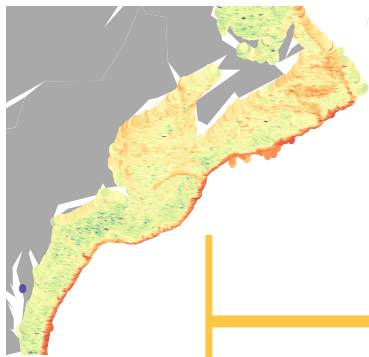
Climate projections



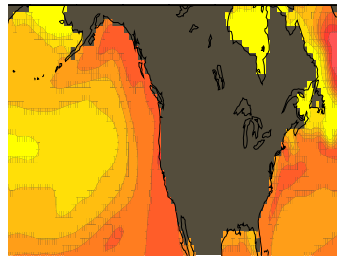
RESEARCH ARTICLE

# Projecting shifts in thermal habitat for 686 species on the North American continental shelf

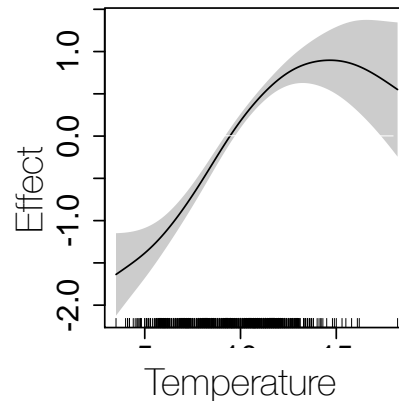
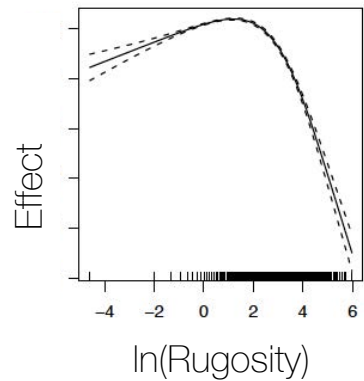
Bottom habitat



Climate projections



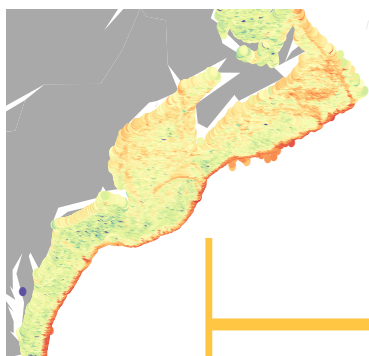
RCP2.6 and 8.5  
16 climate models



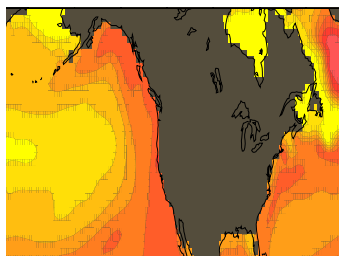
RESEARCH ARTICLE

# Projecting shifts in thermal habitat for 686 species on the North American continental shelf

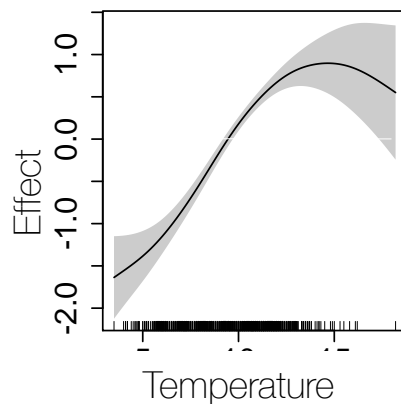
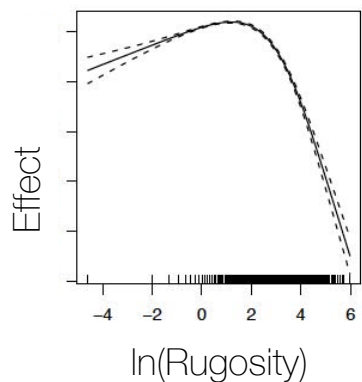
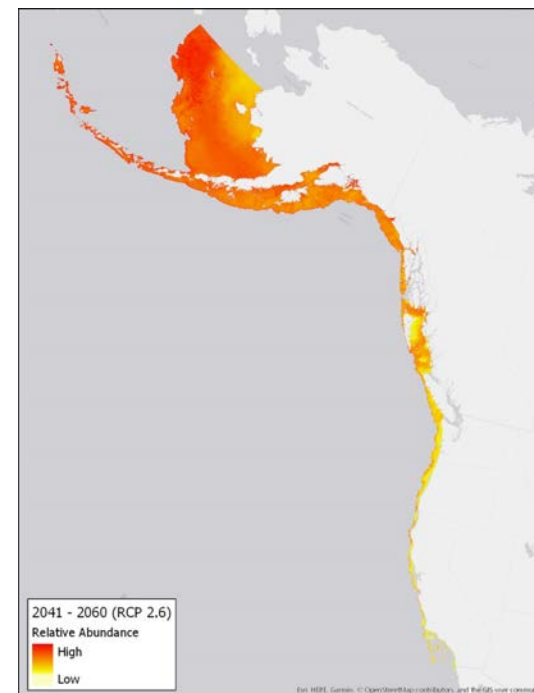
Bottom habitat



Climate projections



109,760  
Species Habitat  
Projections



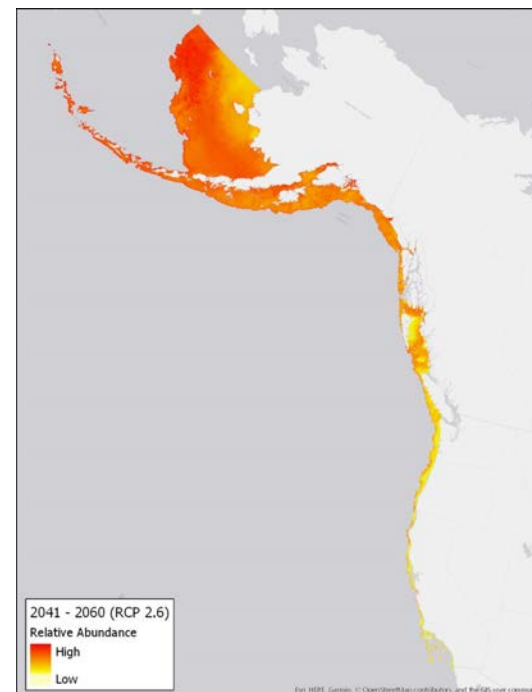
How to use them?

RESEARCH ARTICLE

# Projecting shifts in thermal habitat for 686 species on the North American continental shelf

- Projections all online
- Maps on OceanAdapt  
<http://oceanadapt.rutgers.edu>

109,760  
Species Habitat  
Projections

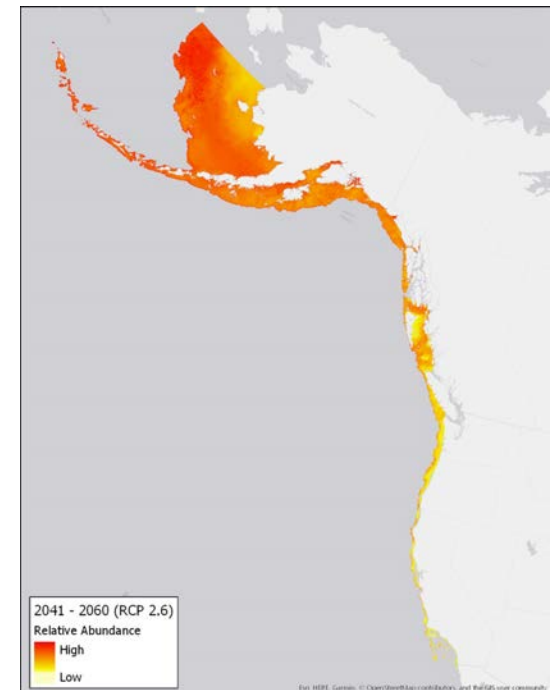


RESEARCH ARTICLE

# Projecting shifts in thermal habitat for 686 species on the North American continental shelf

- Projections all online
- Maps on OceanAdapt
- Emerging fisheries?

109,760  
Species Habitat  
Projections

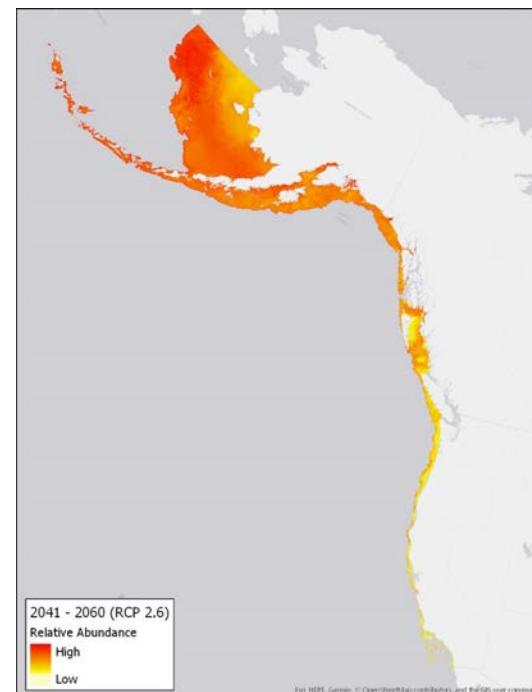


RESEARCH ARTICLE

# Projecting shifts in thermal habitat for 686 species on the North American continental shelf

- Projections all online
- Maps on OceanAdapt
- Emerging fisheries
  - Dungeness crab in Alaska?
  - Summer flounder in New England?
  - Many others...

109,760  
Species Habitat  
Projections



To hear more about emerging fisheries

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Emily Moberg

Poster

today

S10

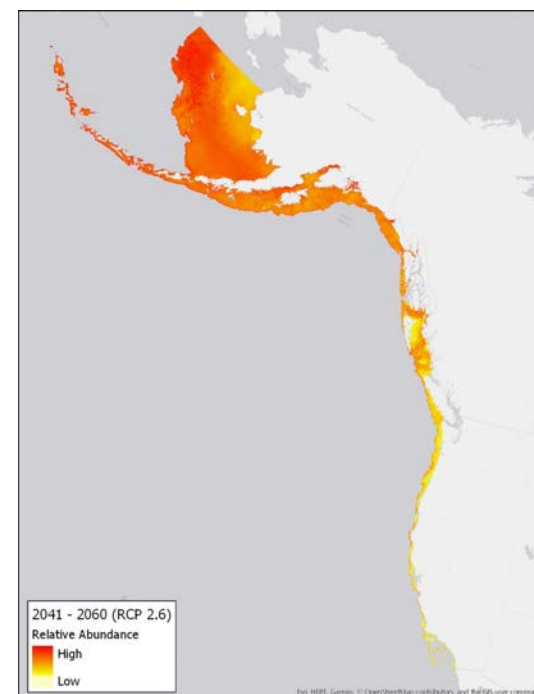


RESEARCH ARTICLE

# Projecting shifts in thermal habitat for 686 species on the North American continental shelf

- Projections all online
- Maps on OceanAdapt
- Emerging fisheries
- Future shared fisheries

109,760  
Species Habitat  
Projections

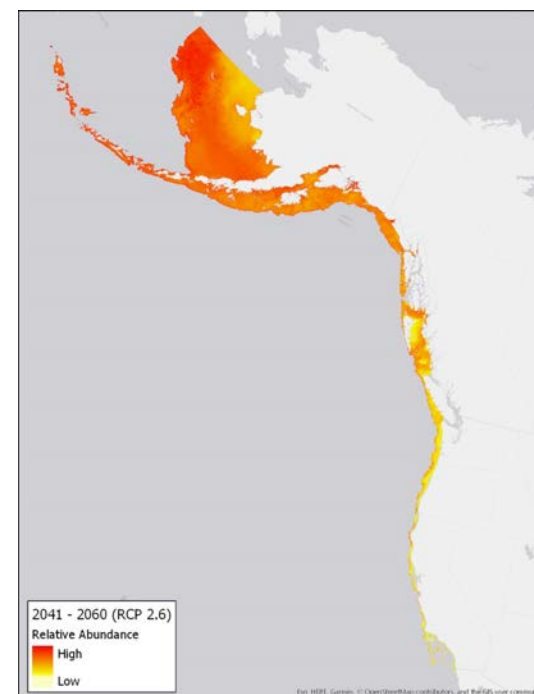


RESEARCH ARTICLE


# Projecting shifts in thermal habitat for 686 species on the North American continental shelf

- Projections all online
- Maps on OceanAdapt
- Emerging fisheries
- Future shared fisheries
  - US-Canada
  - Mid-Atlantic to New England
  - Etc.

109,760  
Species Habitat  
Projections



# Sharing stocks

A wide, shallow wetland or marsh landscape. The foreground and middle ground are dominated by patches of tall, golden-brown grasses interspersed with shallow, light blue water. The water reflects the overcast, grey sky. In the distance, a line of trees and a low horizon are visible under a heavy, cloudy sky.

- Cooperate on shared knowledge

# Sharing stocks



- Cooperate on shared knowledge
- Mechanisms for reciprocity
  - Side payments
  - Tradeable permits

# Next steps

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- Uncertainty in the habitat projections
- Process-based species distribution models
- Planning for fishing and other ocean uses (EBM)

# Summary

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- Underprepared for species on the move across political boundaries

# Summary

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- Underprepared for species on the move across political boundaries
- Motivate adaptation with open data and tools

# Summary

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- Underprepared for species on the move across political boundaries
- Motivate adaptation with open data and tools
- Projections to identify slower activities, like emerging fisheries or shared stocks



# Acknowledgments

Jim Morley

William Cheung

Gabriel Reygondeu

Juliano Palacios-Abrantes

Jessica Spijkers

Richard Caddell

Talia Young

Emma Fuller

Becca Selden

Thomas Frölicher

Rob Latour

Rich Seagraves

Eli Fenichel

Kevin St. Martin

Eva Papaioannou

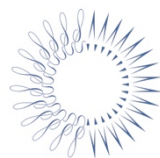
Kaycee Coleman

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## Pinsky Lab



Society for Conservation Biology



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GORDON AND BETTY  
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FOUNDATION

# Summary

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- Underprepared for species on the move across political boundaries
- Motivate adaptation with open data and tools
- Projections to identify slower activities, like emerging fisheries or shared stocks