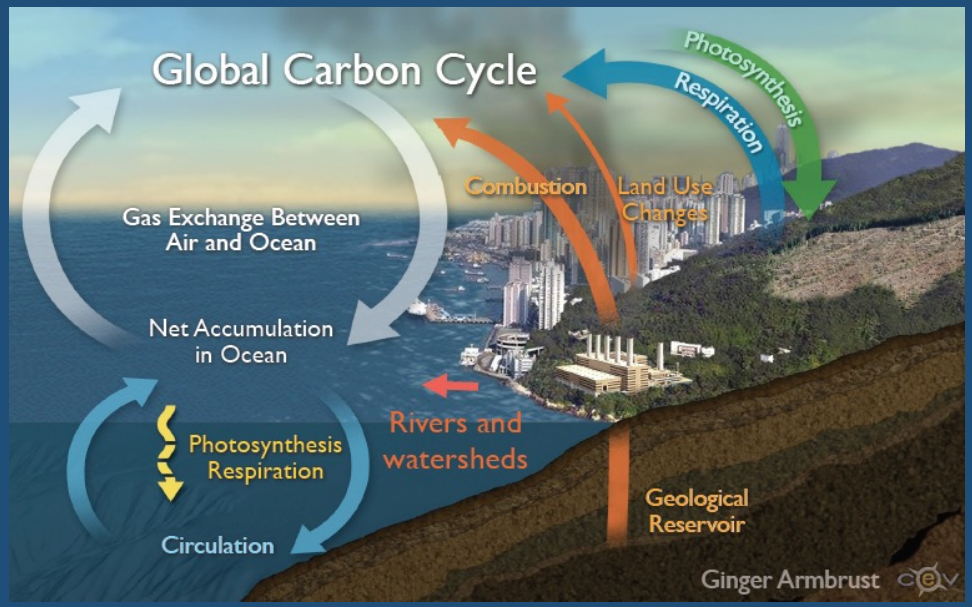
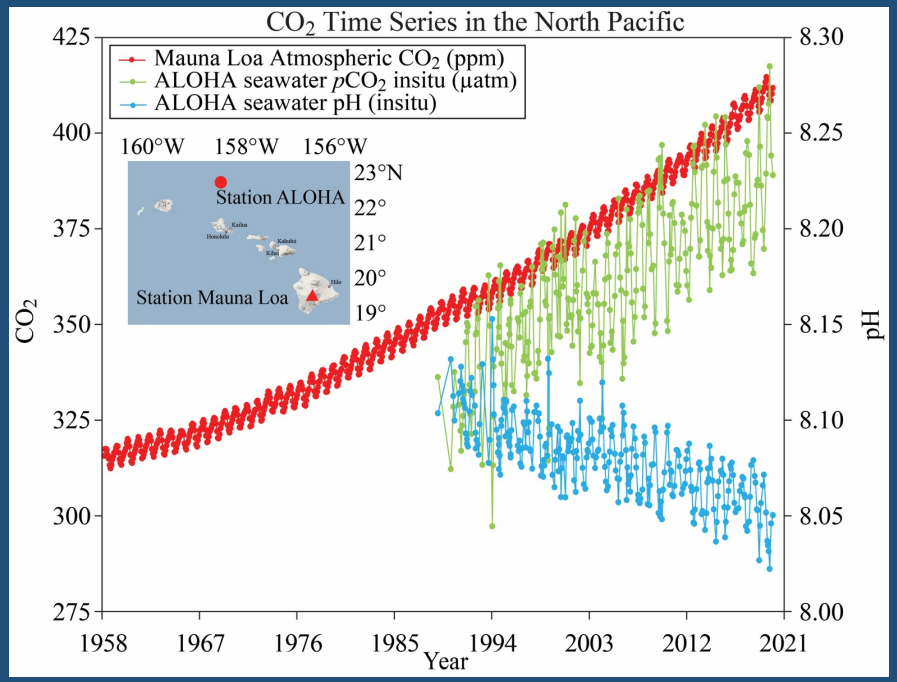
Climate Change Impacts on New Jersey: Ocean Acidification

Grace Saba, Rutgers University
NJCMP OA Team

Ocean Acidification

Driven by the ocean's absorption of increasing atmospheric carbon dioxide (CO_2)



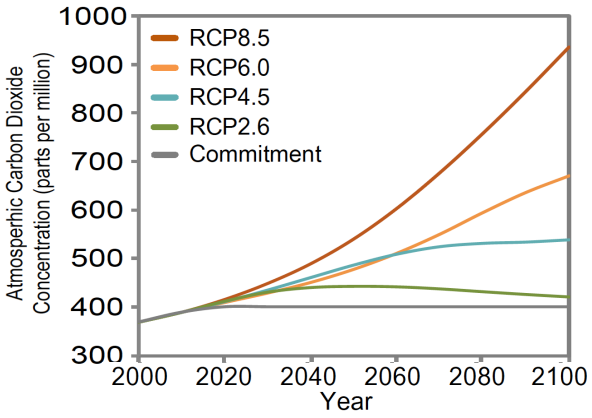


Atmospheric CO_2 increased 40% since 1800s

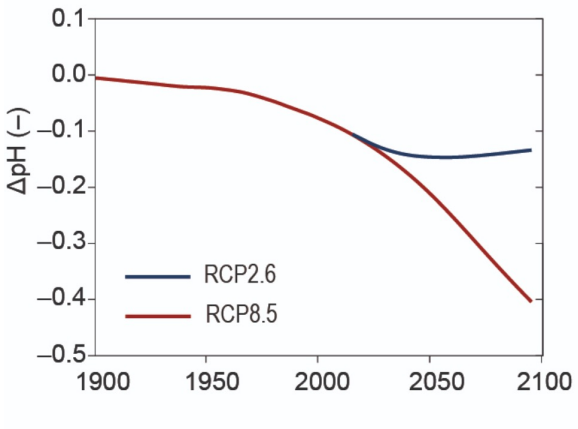
- Drop of 0.1 pH unit
- 28% increase in ocean acidity
- Projected 100-150% increase by 2100

Data:
Mauna Loa: ftp://aftp.cmdl.noaa.gov/products/trends/co2/co2_mm_mlo.txt
ALOHA: http://hahana.soest.Hawaii.edu/hot/hog-dogs/bextraction.html

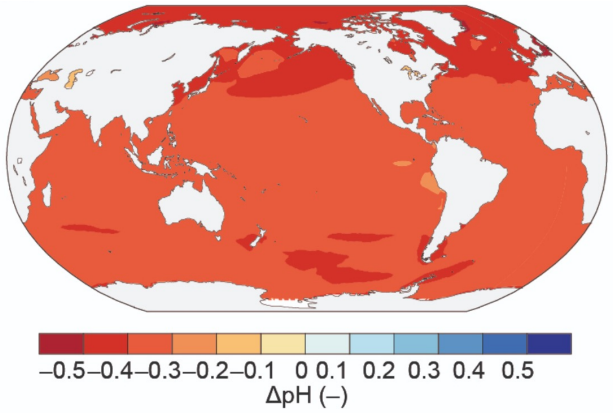
Projections of Ocean Acidification: pH



Fourth National Climate Assessment, 2017



IPCC Special Report on Climate Change, 2019



IPCC Special Report on Climate Change, 2019

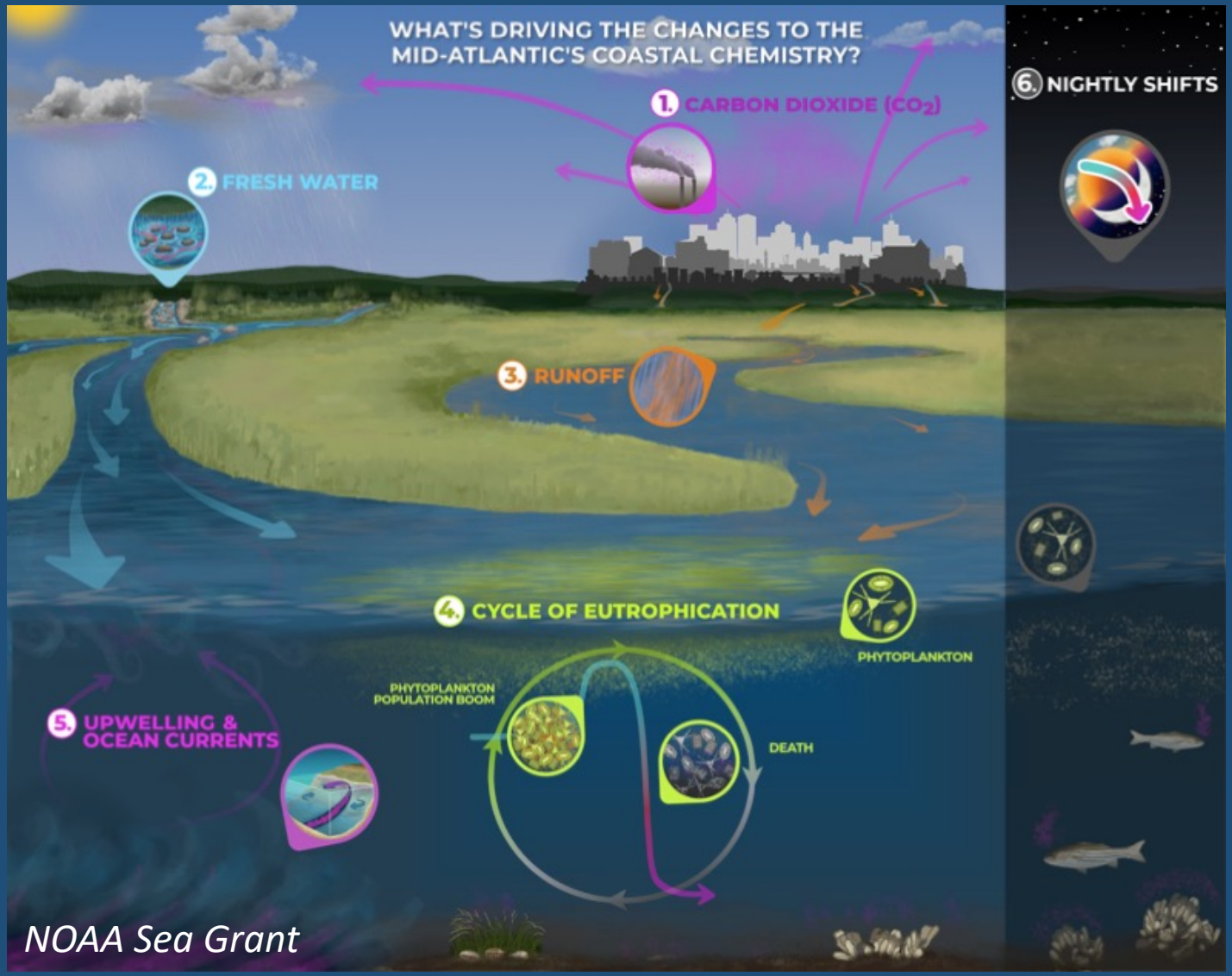
CO_2 is projected to double by 2100 (IPCC)

- Additional drop of 0.2-0.3 pH units
- Equivalent to 100-150% increase in ocean acidity

↓ pH ↓ CO_3^{2-} ↓ Ω_{arag}

Coastal & Ocean Acidification

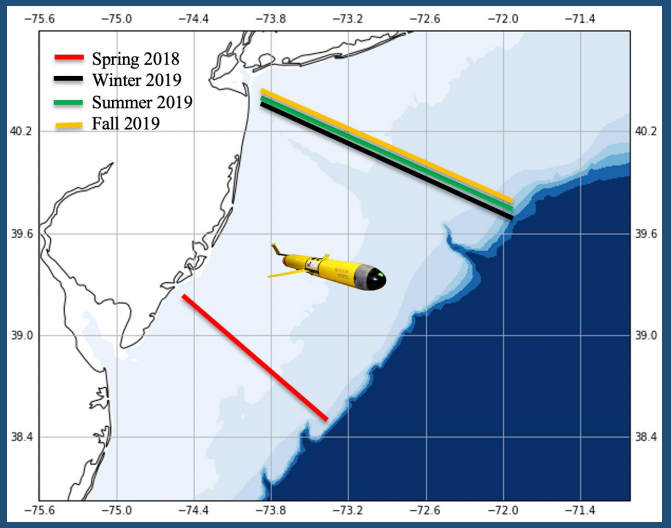
High variability and complexity in coastal shelf systems



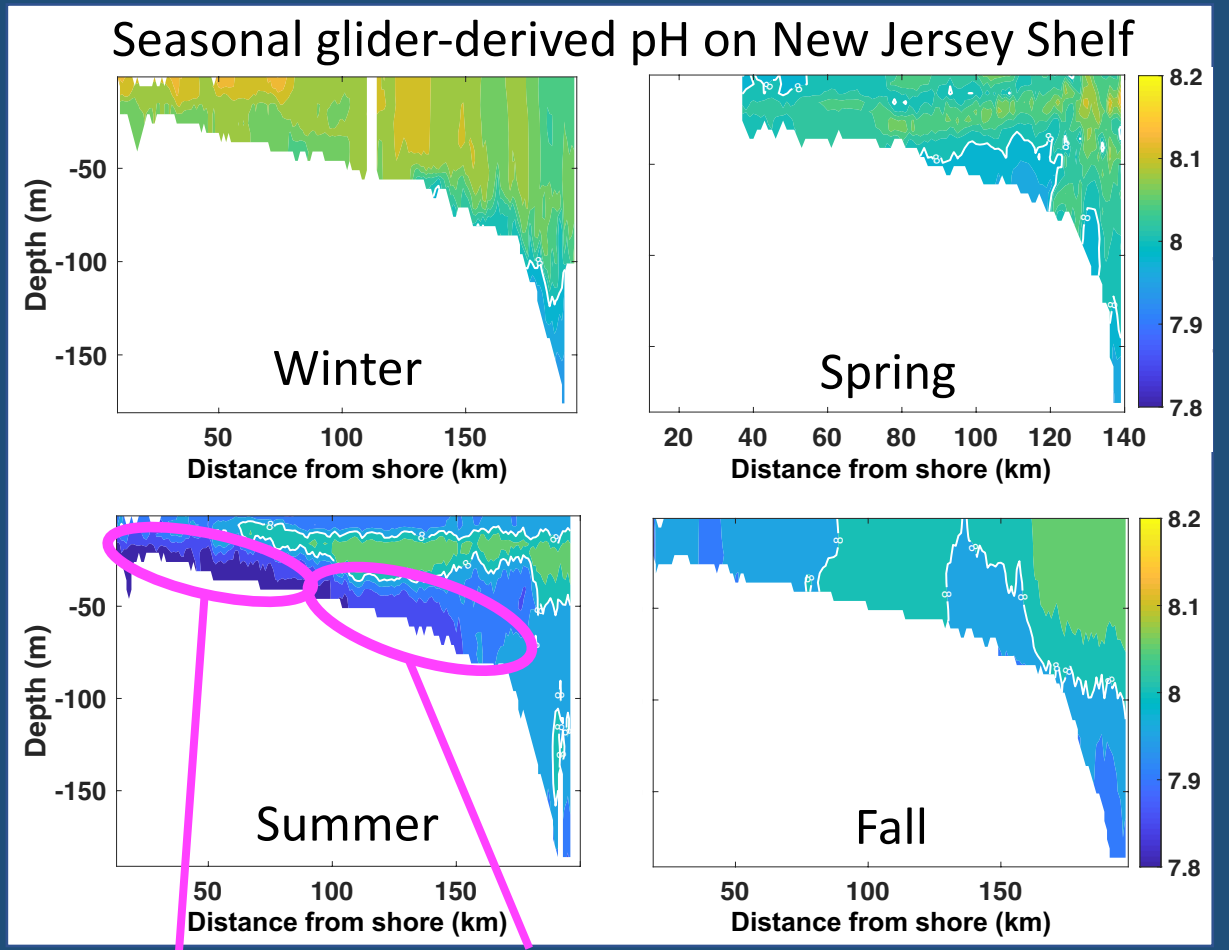
Acidification Impacts on Organisms

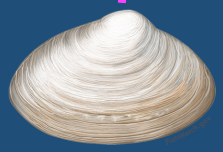
- Mortality
- Decreased calcification
- Decreased growth
- Impaired development
- Changes in energy allocation

NJ Observations - Gliders



- Understand the baseline/climatology of OA conditions
- What are the seasonal conditions in known shellfish habitats?





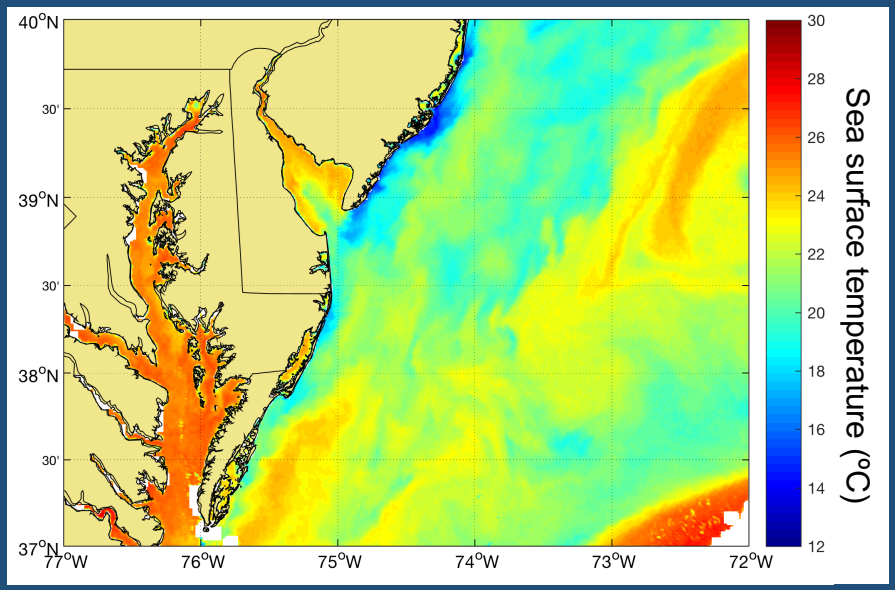
Atlantic Surfclam
Spisula solidissima

Atlantic Sea Scallop
Placopecten magellanicus

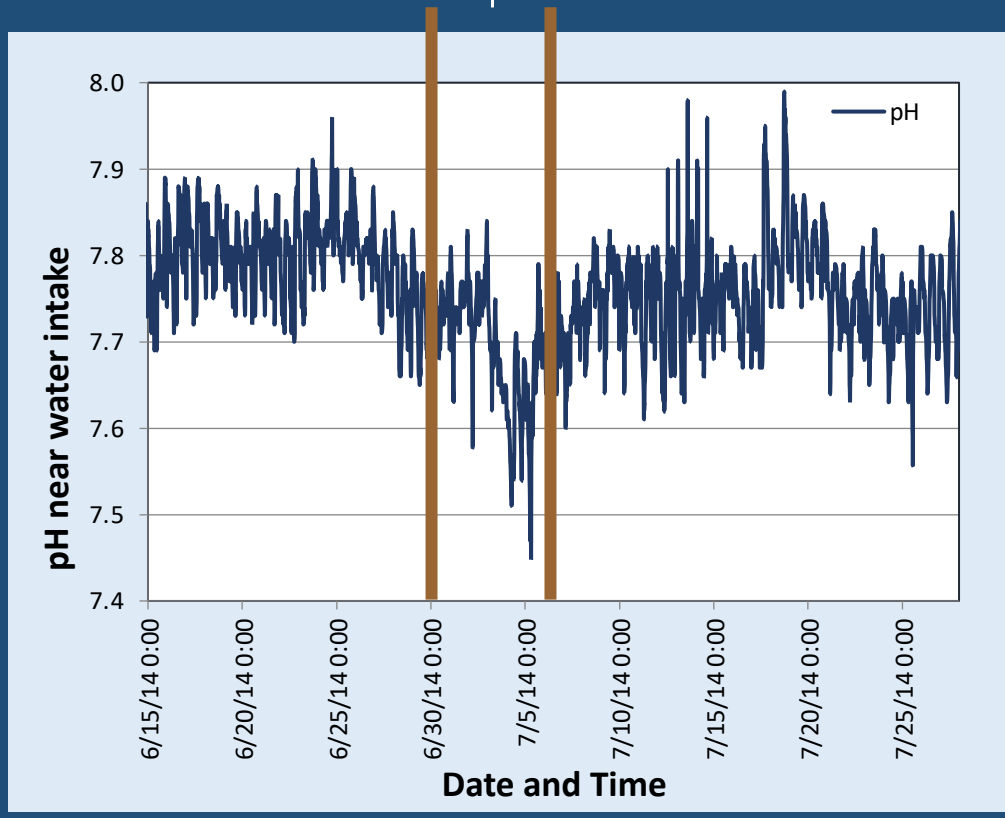
Saba et al., 2019

Wright-Fairbanks et al., 2020

Upwelling in MAB

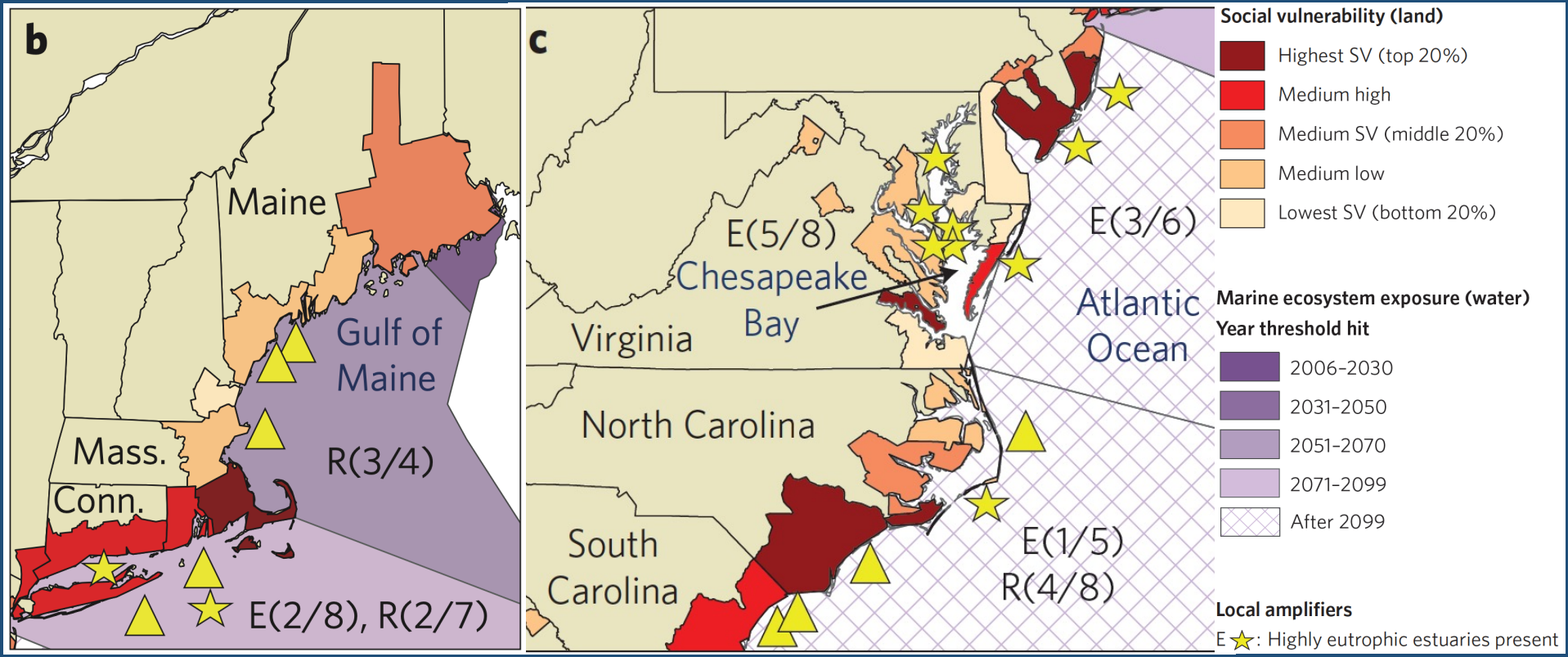


July 2014
Sustained South/Southwest Winds & Upwelling



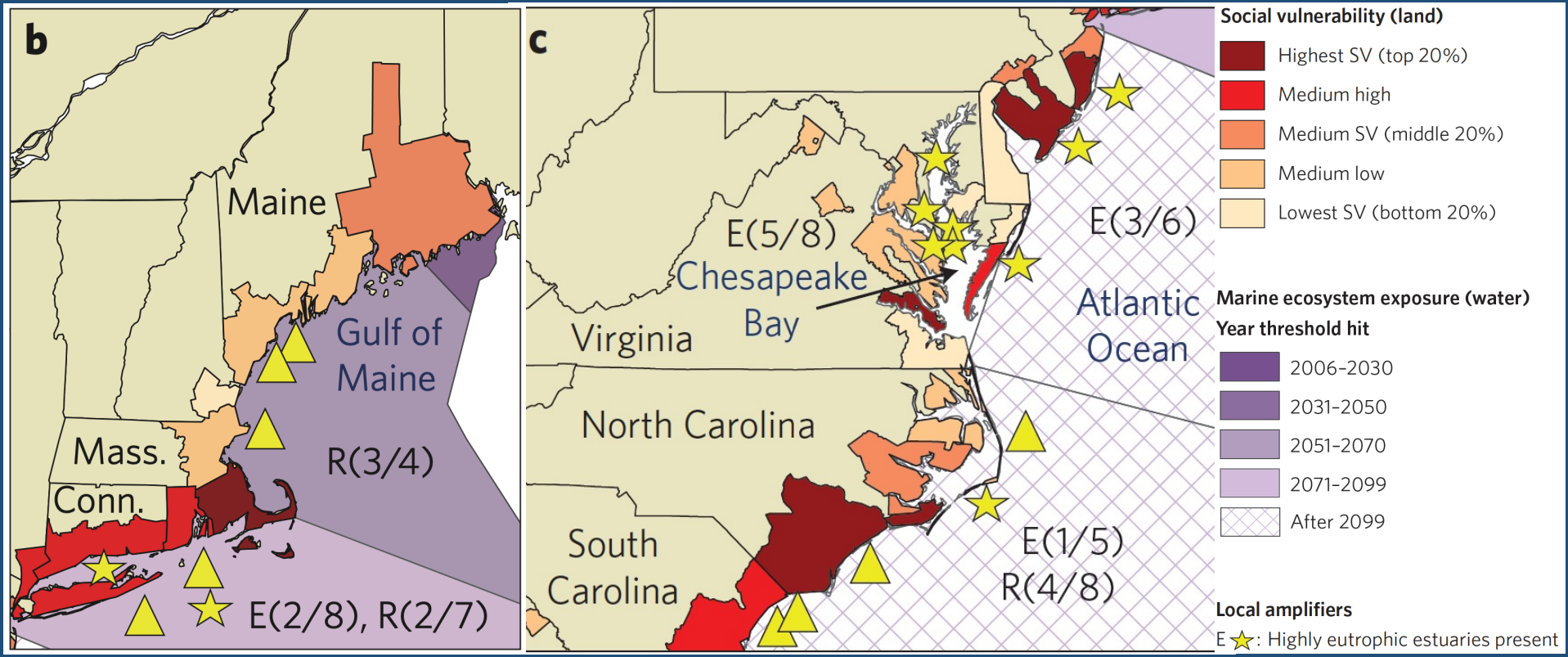
Daphne Munroe & Sarah Borsetti (Rutgers), Matthew Poach (NOAA), Ian Abrahamsen (Univ. of Pittsburgh)

High Regional Social Vulnerability



Ekstrom et al. 2015

High Regional Social Vulnerability



Ekstrom et al. 2015

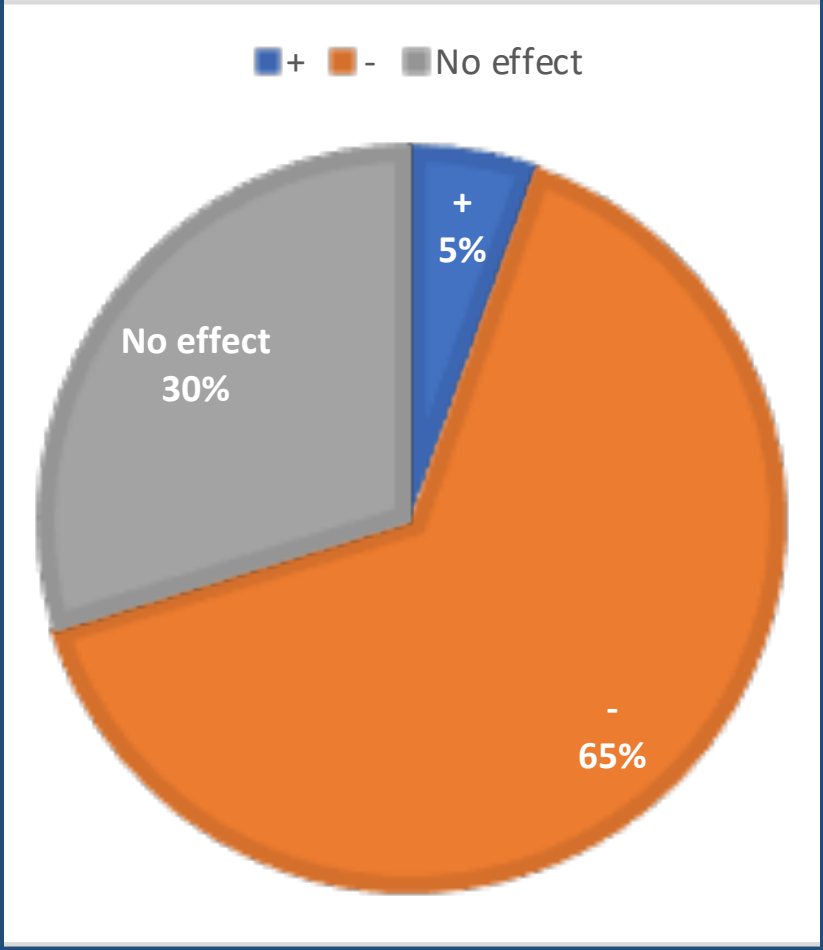
- NJ is predicted to be at high risk of economic harm from OA conditions.
- Southern NJ counties rank 2nd in the U.S. in economic dependence on shellfish, which could suffer from increasing ocean acidity.

Potential Impacts on Mid-Atlantic Species

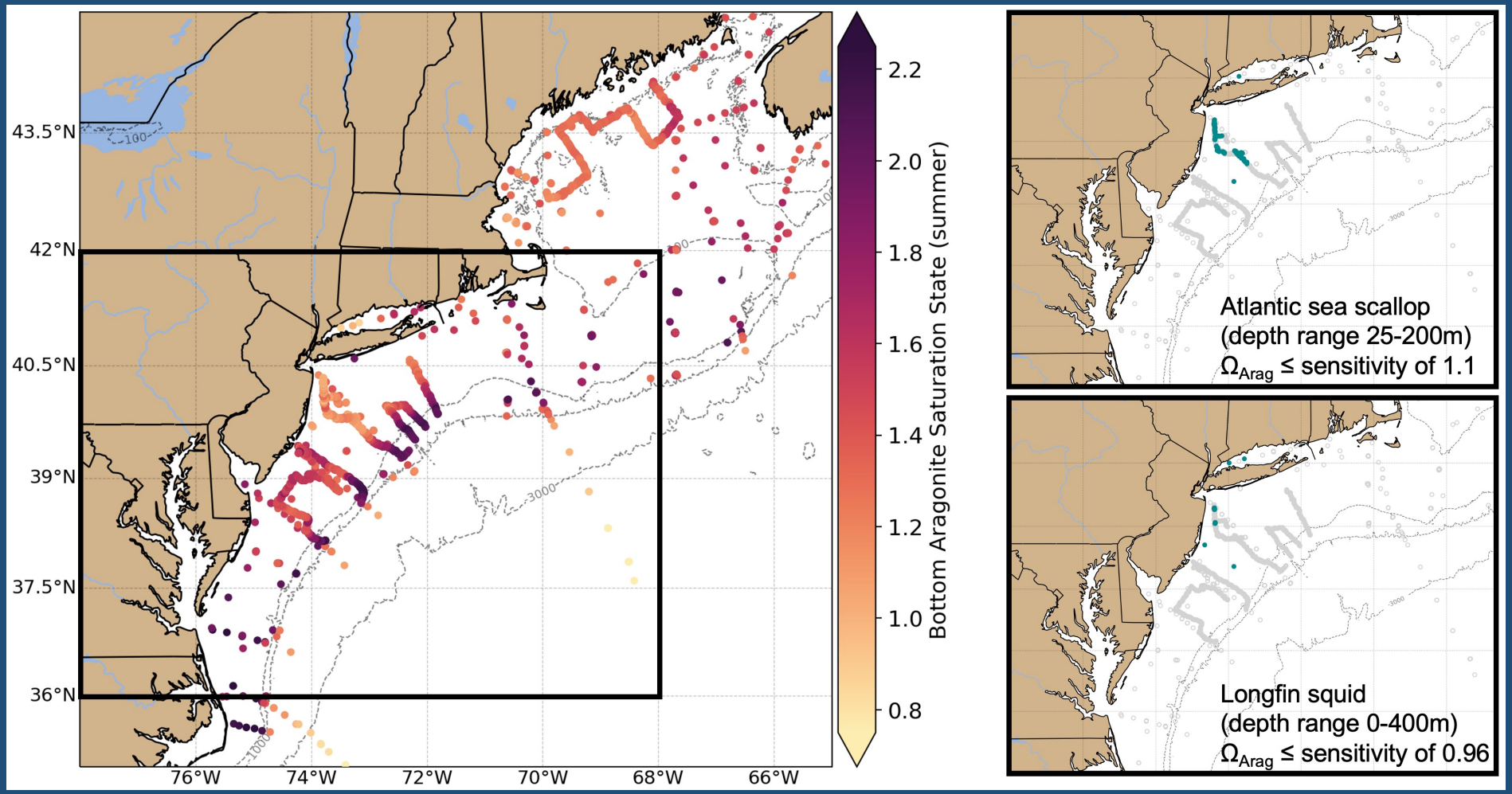
Saba et al., 2019: Estuarine, Coastal and Shelf Science

Data compiled from a review of acidification and multi-stressor studies conducted on economically important groups and species in the Mid-Atlantic:

- 18 species comprising of crustaceans, mollusks, finfish and elasmobranchs (from 59 studies)
- Species managed by MAFMC, ASMFC, NEFMC, NOAA and/or States
- Wide range of response variables

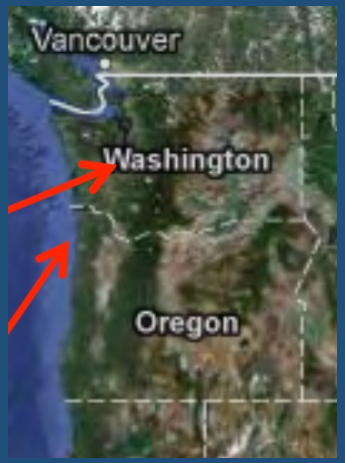


We are already seeing potentially impacted habitats

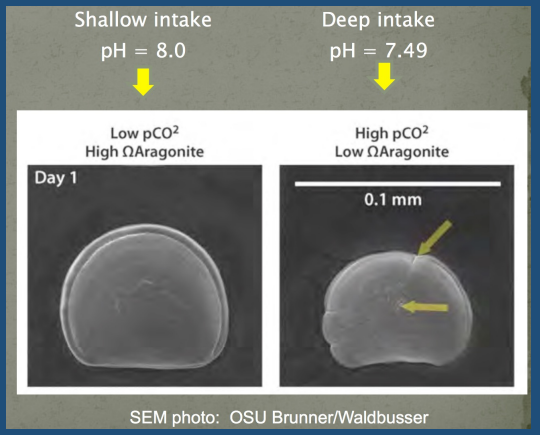


NOAA State of the Ecosystem 2023: Mid-Atlantic
(report for MAFMC)

Industry Need Leads to Policy Actions

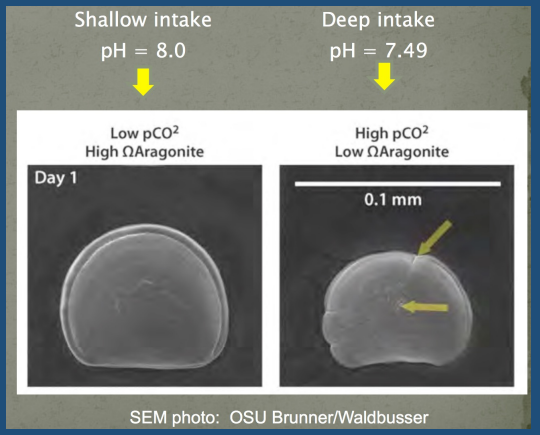


80% decrease in oyster production in 2008/2009 linked to ocean acidification



Industry Need Leads to Policy Actions

80% decrease in oyster production in 2008/2009 linked to ocean acidification



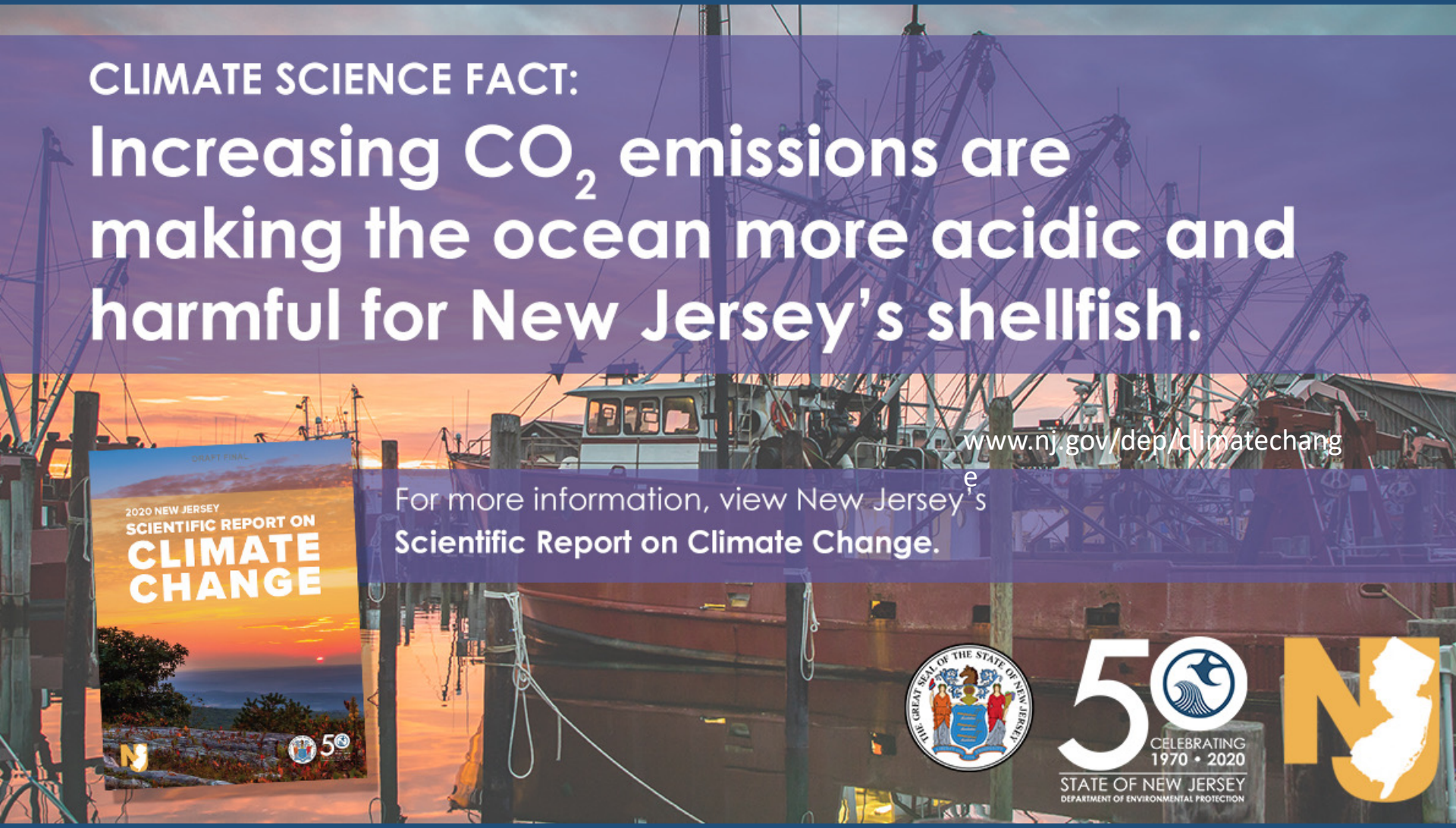
Ocean Acidification Blue Ribbon Panel

A panel of science and policy experts to address the effects of OA on WA's shellfish resources

In March, Gov. Chris Gregoire convened an Ocean Acidification Blue Ribbon Panel, the first of its kind in the nation.

- Convened in 2012
- Identified 42 actions toward increasing "capacity to understand, reduce, remediate, and where possible adapt to the consequences of ocean acidification" – First state OA Action Plan
- Region-wide impact led to multi-state Pacific Coast Collaborative

New Jersey's climate change and ocean acidification efforts were advanced by Executive Order 89 which was signed into law by Governor Murphy in 2019



NJDEP-Rutgers collaborative efforts toward developing an OA Action Plan

- Bureau of Climate Resilience Planning and Bureau of Marine Water Monitoring form NJCMP's OA Team
- NJCMP OA Team Engages with Rutgers
- Goals of collaborative efforts:
  - Learn about OA Action Plan efforts in other coastal states (2020)
  - Identify knowledge gaps for State regarding OA science (2020)
  - Outline elements to use in future NJ OA Action Plan (2021-present)
- NJ joined the OA Alliance in April 2021

NJDEP-Rutgers collaborative efforts toward developing an OA Action Plan

- Bureau of Climate Resilience Planning and Bureau of Marine Water Monitoring form NJCMP's OA Team
- NJCMP OA Team Engages with Rutgers
- Goals of collaborative efforts:
  - Learn about OA Action Plan efforts in other coastal states (2020)
  - Identify knowledge gaps for State regarding OA science (2020)
  - Outline elements to use in future NJ OA Action Plan (2021-present)
- NJ joined the OA Alliance in April 2021

Elements for future OA Action Plan

1. ***Advance Scientific Understanding:*** Improve the understanding of OA through support of research and observations
   - Development of an OA Statewide Monitoring Network

2. ***Reduce Causes of OA:*** Implement actions that will prevent or slow OA

3. ***Build Adaptation and Resiliency:*** Implement actions to assist ocean-dependent communities and industries, and marine ecosystems to adapt

4. ***Expand Public Awareness:*** Engage policy makers, scientists, and the public

5. ***Build Sustained International Support:*** Secure sustained funding, nationally and regionally, for ongoing, enhanced, and coordinated research and OA observation systems

Thanks!

saba@marine.rutgers.edu

RUTGERS | NJ Climate Change Resource Center

NJ COASTAL MANAGEMENT PROGRAM

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

https://njclimateresourcecenter.rutgers.edu
(Research, Opportunities to address ocean acidification impacts in New Jersey)

NJCMP OA Team:
Megan Rutkowski
Russell Babb
Helaine Barr
Lauren Drumm
Heather Genievich
Karl Hartkopf
Kevin Hassell
Megan Kelly
Elizabeth Lange
Bob Schuster
Katherine Todoroff

Rutgers/other collaborators:
Jeanne Herb
Janine Barr
Brooke Schwartzman
Kirstin Wakefield