Developing Indicators of Climate Change Risk in the U.S. Caribbean

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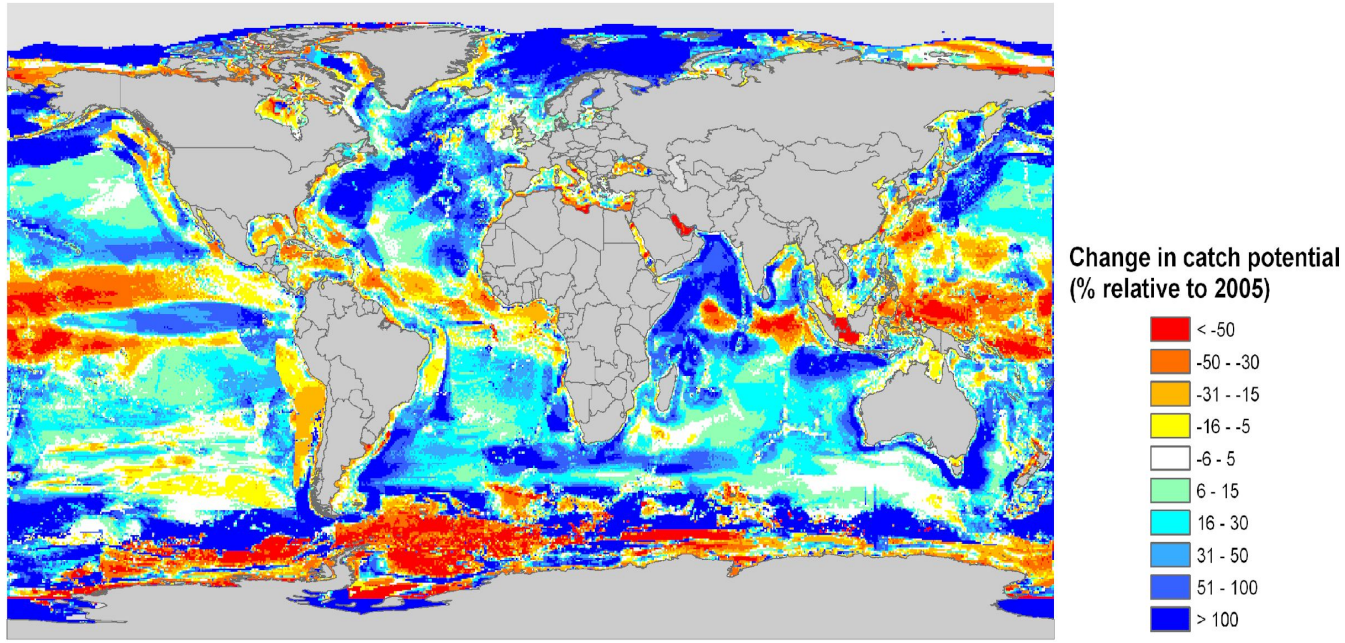
Why do we need community climate change indicators?

Climate change impacts species distribution and productivity of fishery resources.

Fishers and fishing communities will need to adapt to changes in the marine fishery ecosystems.

Include the U.S. Caribbean in National Community Climate Risk project.



https://www.seaaroundus.org/climate-change/climate-change-fisheries/

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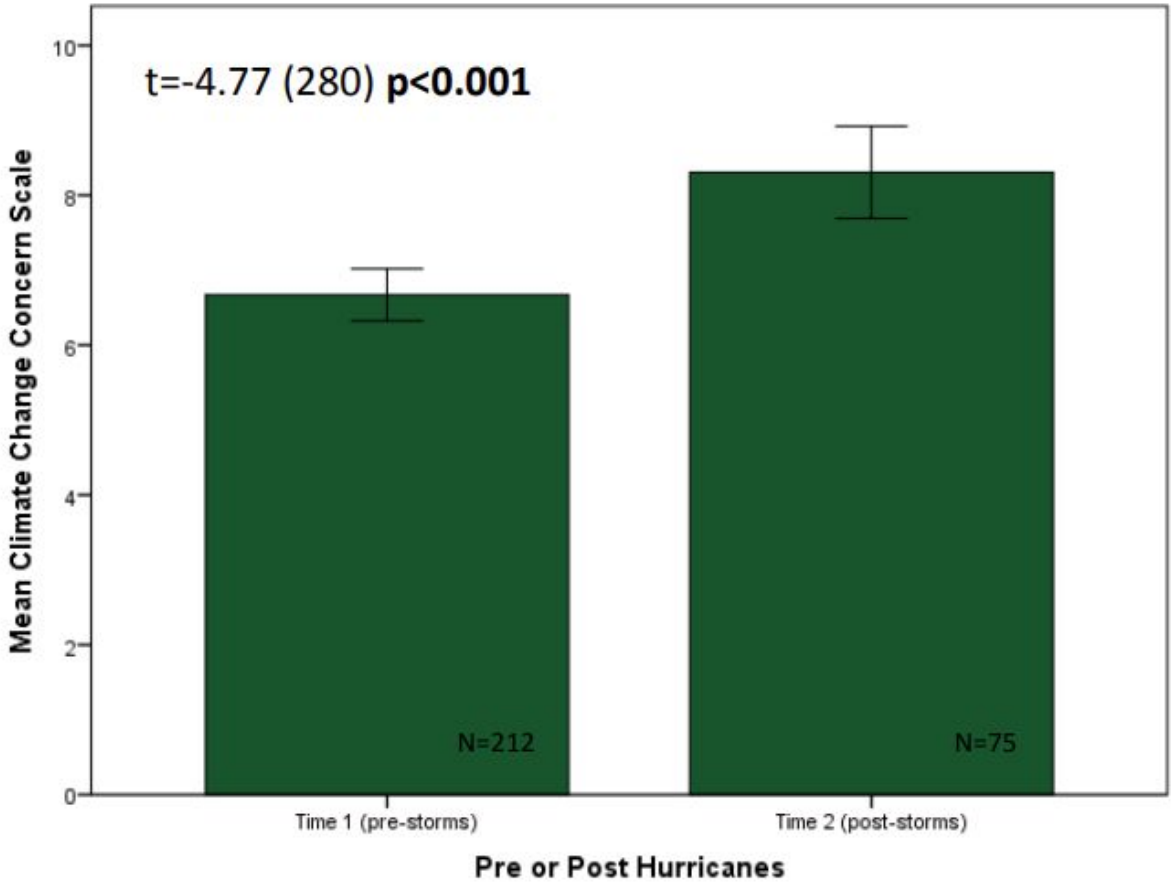
How concerned are you about climate change on a scale of 1 to 10?



Puerto Rico 2016/2018

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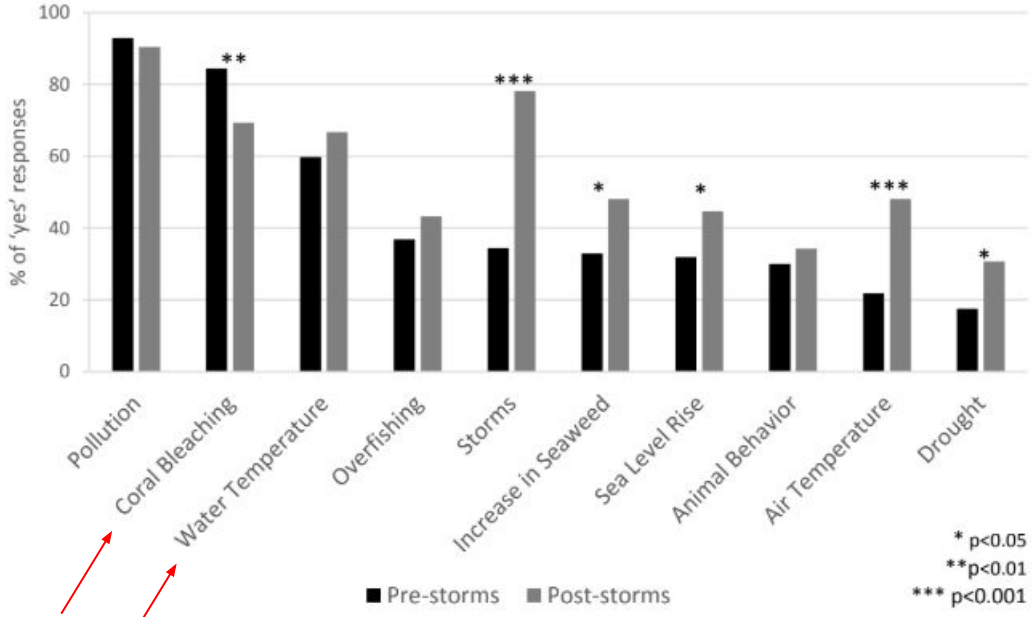

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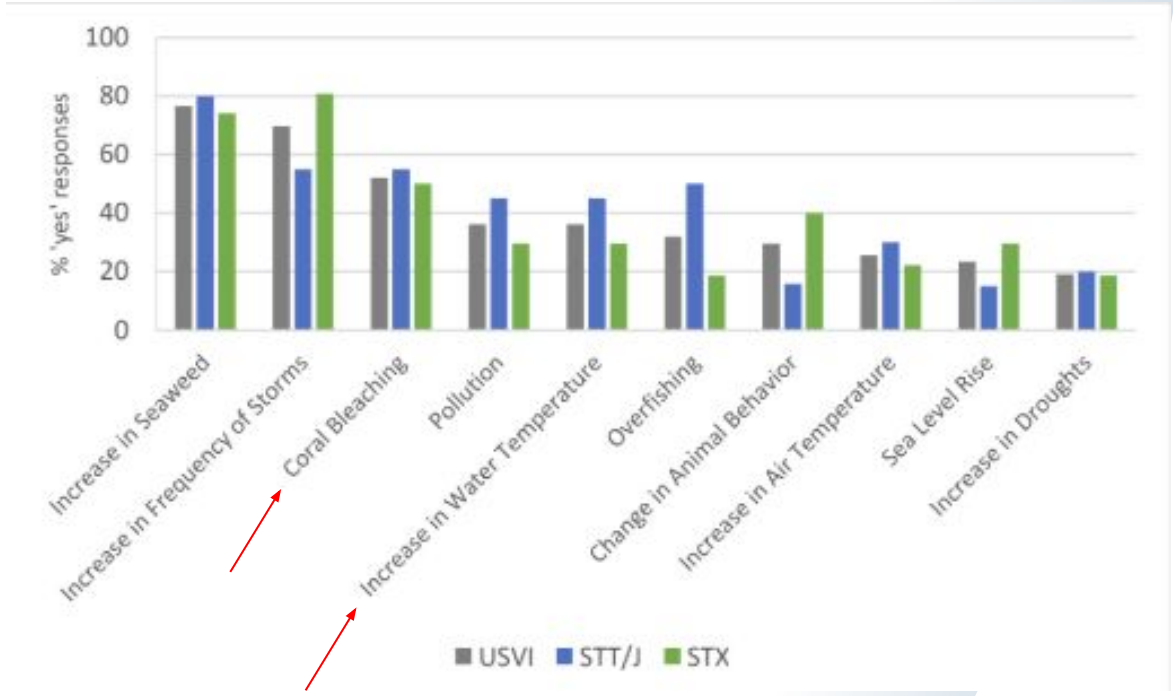

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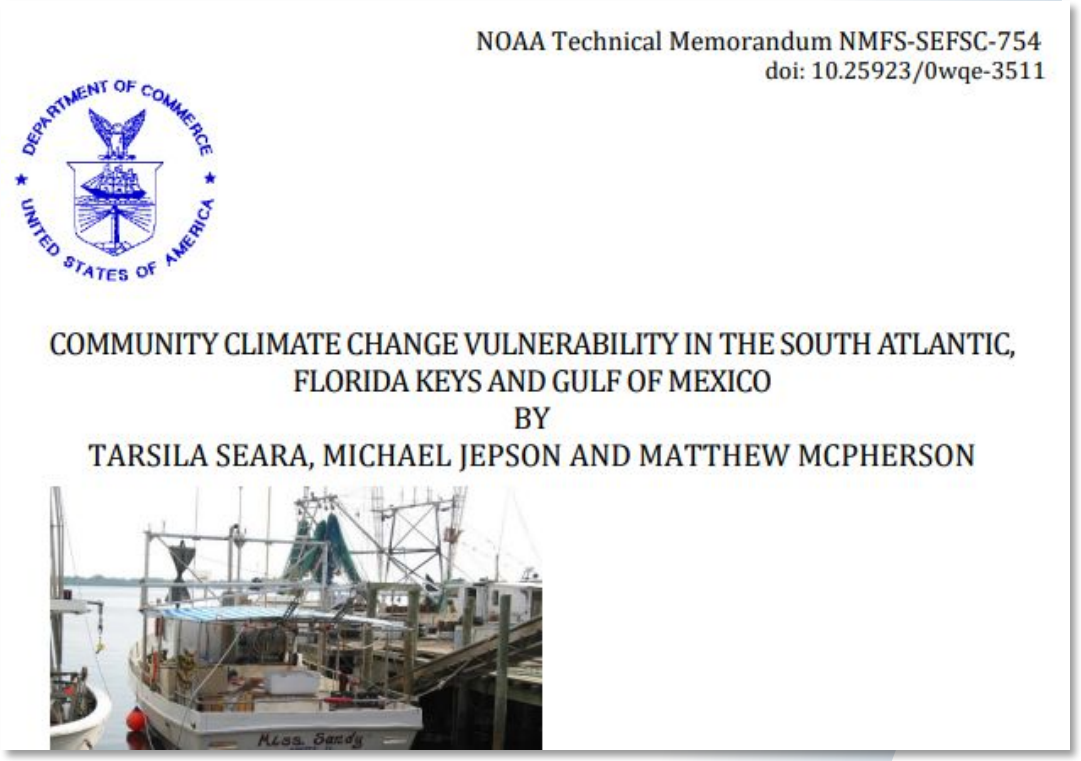
Objectives of this Presentation

- Present indicators of climate change risk at the community level (Seara et al. 2022; Seara et al. *in prep*).
- Exemplify the use of these indicators using a NE fishing community (New Bedford MA).
- Explain steps needed to develop indicators – focusing on the biological vulnerability assessment.
- Discuss CFMC support for developing indicators.



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Outline of the Presentation

- Community Climate Change Risk Indicators outputs and methods
- Climate Vulnerability Assessment (biological) outputs and methods
- Next steps for U.S. Caribbean

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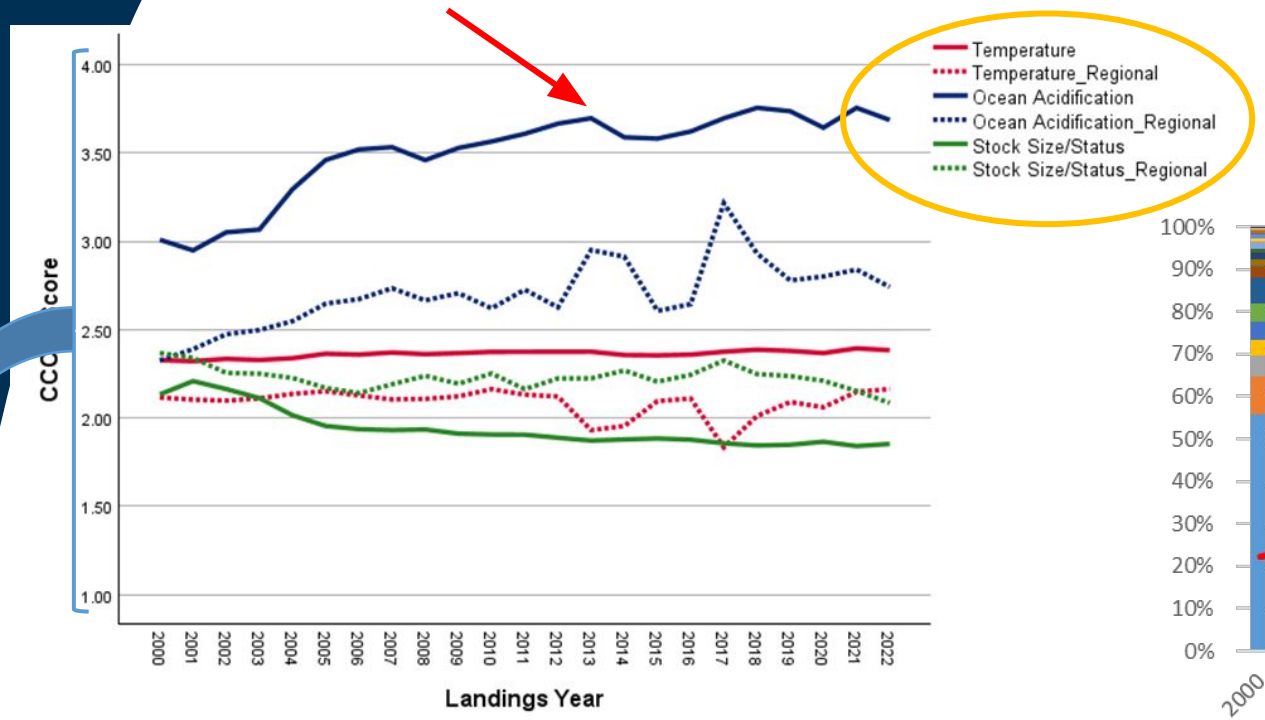
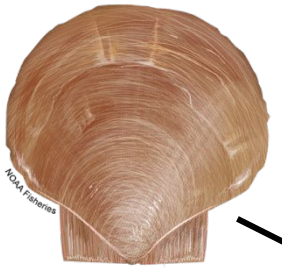
Example: New Bedford MA



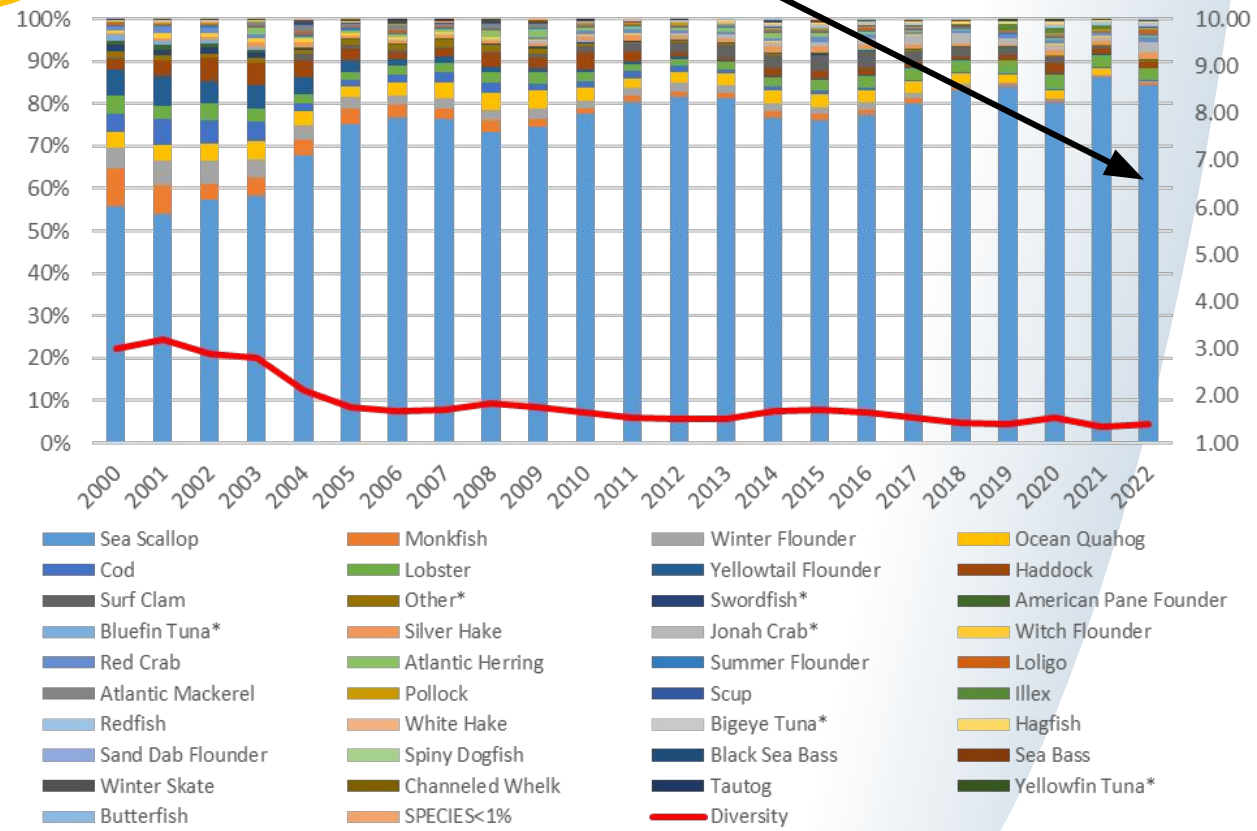
1 – Low
2 – Moderate
3 – High
4 – Very High

=> Consider all landed species $



Atlantic sea scallops:

- Temperature: 2.44
- Stock Size/Status: 1.8
- **Ocean Acidification: 4**



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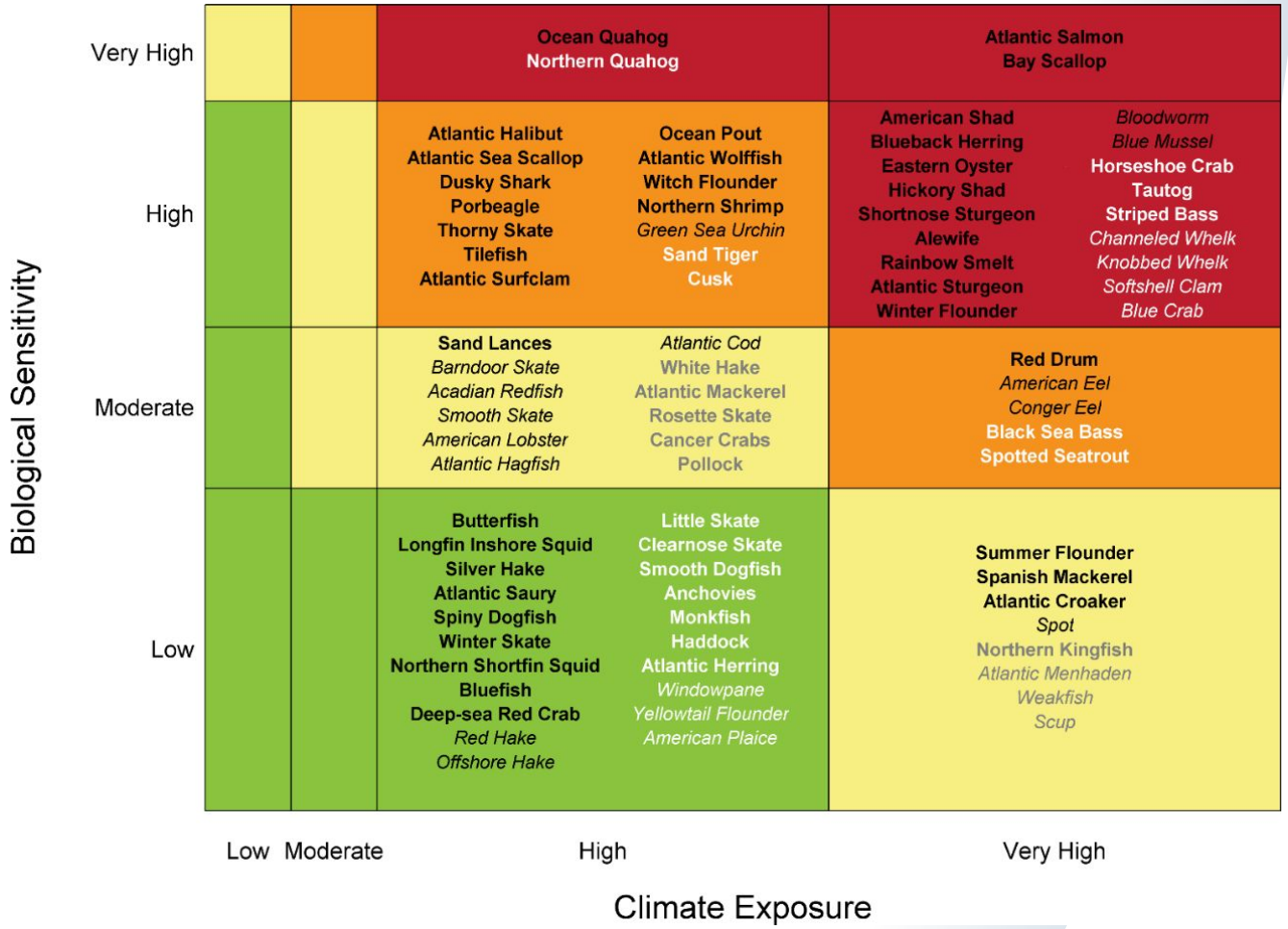
CVA Methods

Community indicators are developed using **species level** climate change vulnerability classification first developed by Hare et al. 2016.

Climate Vulnerability Assessment (CVA).

- NE Region: **82** species
- 12 Exposure Factors + 12 Sensitivity Attributes.
- Scored by species based on expert knowledge.



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CVA Methods

Steps used in the Northeast Fisheries CVA:

Climate Vulnerability Assessment Process

1. Scoping and Planning
- Define Study Area
- Identify Species to Include
- Define Climate Exposure Factors
- Define Sensitivity Attributes
- Identify Participants

2. Assessment Preparation
- Species Profiles
- Climate Projections
- Species Distributions

3. Scoring
- Climate Exposure
- Sensitivity Attributes
- Expert Certainty
- Directional Effect
- Data Quality

4. Analyses
- Estimate of Overall Vulnerability
- Certainty in Vulnerability
- Potential for Distribution Shift
- Importance of Climate Exposure Factors and Sensitivity Attributes
- Functional Group Evaluation
- Species Narratives

Atlantic Sea Scallop – *Placopecten magellanicus*

Overall Vulnerability Rank = High

Biological Sensitivity = High
Climate Exposure = High
Data Quality = 88% of scores ≥ 2

Placopecten magellanicus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Stock Status	1.8	3.0	
Other Stressors	1.8	1.7	
Population Growth Rate	2.0	2.8	
Spawning Cycle	2.0	3.0	
Complexity in Reproduction	1.7	3.0	
Early Life History Requirements	2.2	3.0	
Sensitivity to Ocean Acidification	4.0	2.6	
Prey Specialization	1.4	2.8	
Habitat Specialization	1.2	3.0	
Sensitivity to Temperature	2.4	2.8	
Adult Mobility	3.7	3.0	
Dispersal & Early Life History	2.2	2.8	
Sensitivity Score	High		
Sea Surface Temperature	3.9	3.0	
Variability in Sea Surface Temperature	1.0	3.0	
Salinity	1.8	3.0	
Variability Salinity	1.2	3.0	
Air Temperature	1.0	3.0	
Variability Air Temperature	1.0	3.0	
Precipitation	1.0	3.0	
Variability in Precipitation	1.0	3.0	
Ocean Acidification	4.0	2.0	
Variability in Ocean Acidification	1.0	2.2	
Currents	2.1	1.0	
Sea Level Rise	1.1	1.5	
Exposure Score	High		
Overall Vulnerability Rank	High		

Low
Moderate
High
Very High

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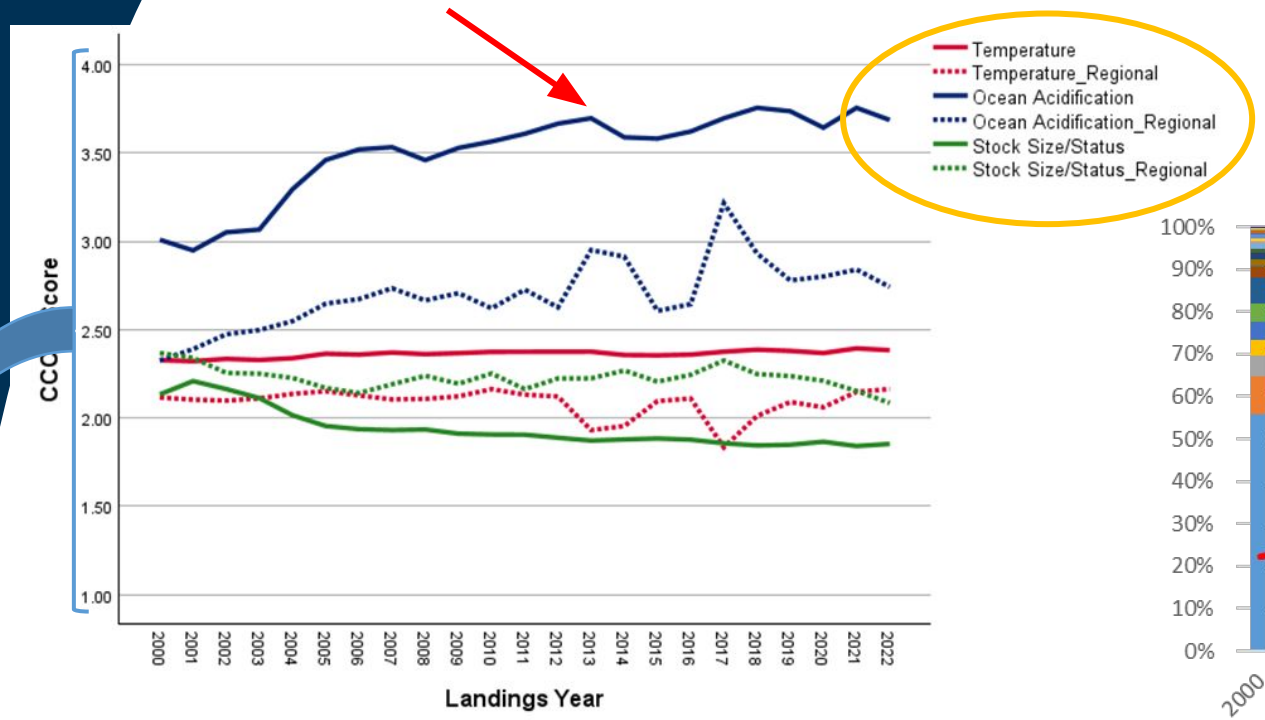
Example: New Bedford MA



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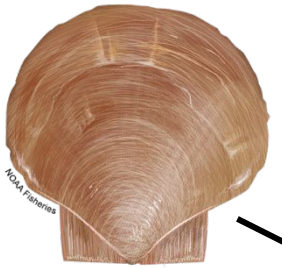

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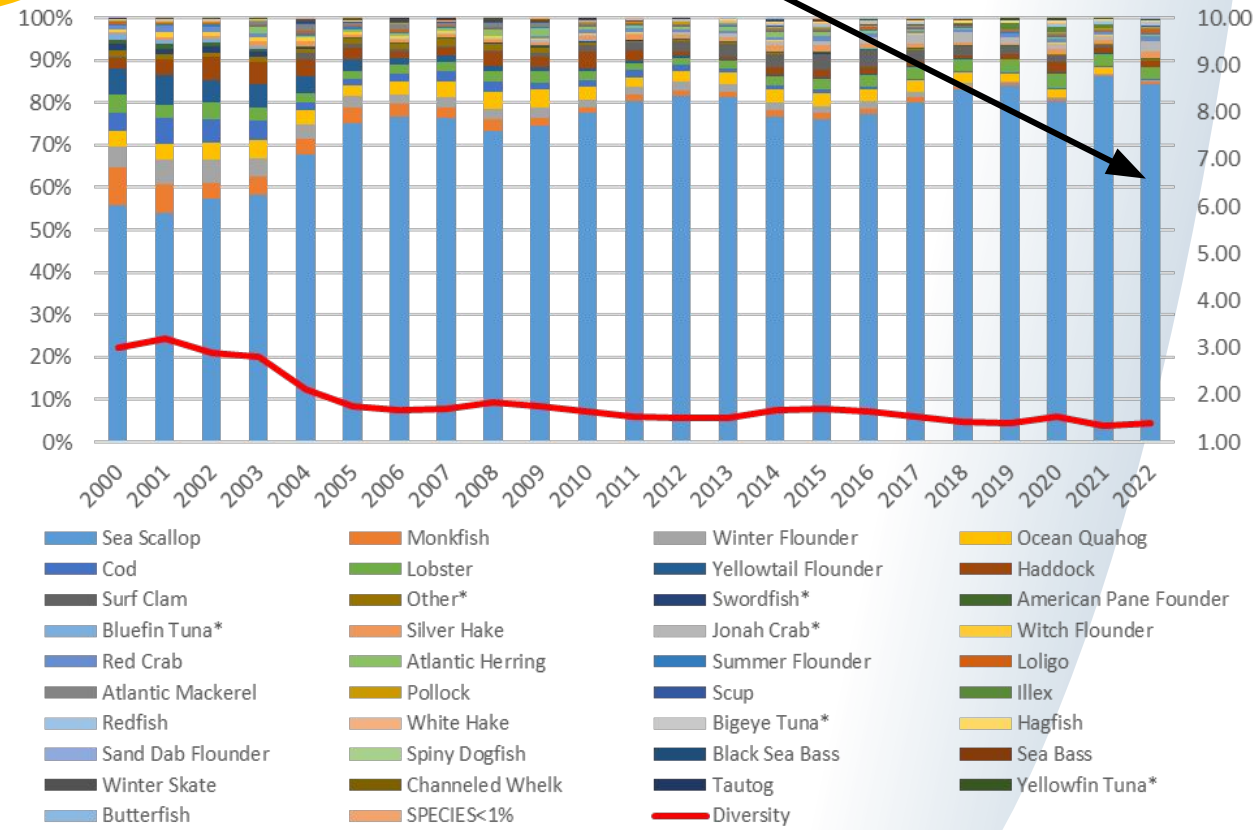

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CCCRI Methods

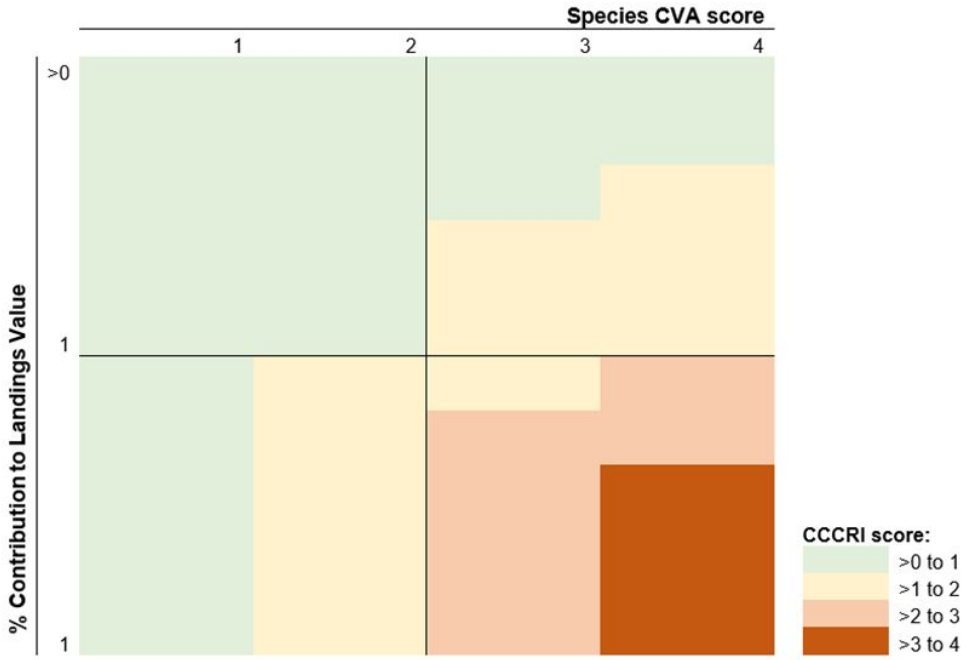
Community **C**limate **C**hange **R**isk **I**ndicators

$$\mathrm{CCCRI}\ (Y_1, \ldots, Y_n) = \sum_{n=1}^{N} a\ x\ b$$

Where,

a = species climate vulnerability score (CVA)

b = % species contribution to total value landed by community



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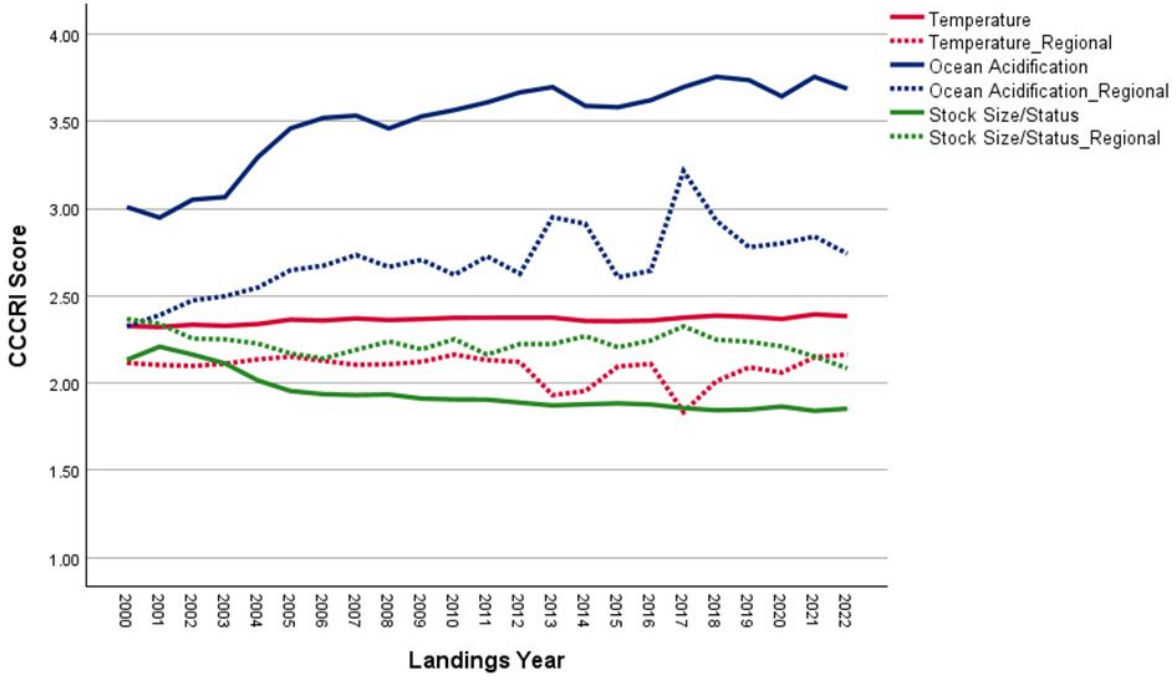

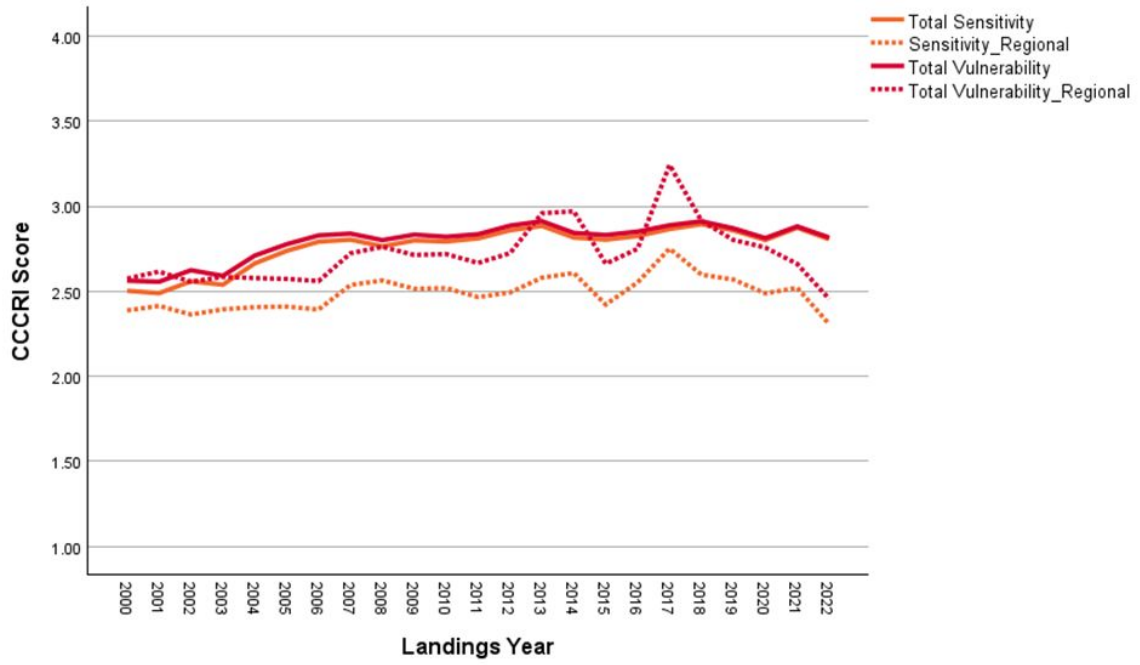

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Next Steps for the U.S. Caribbean

- Conduct Climate Vulnerability Assessments (CVAs) at the species level **using the Hare et al. methodology**, i.e., using expert knowledge scoring for an agreed upon list of commercially, recreationally and ecologically important species.
  - From current CCCRI national project, we can provide coordination, technical support and some funding to support this effort for the Caribbean.
  - Work closely with SEFSC Caribbean Branch to plan and execute project.
  - Support requested from council includes:
    - Create list of species and experts for biological assessment.
    - Assist with meeting organization (virtual).
    - Communicate effort to different stakeholders.

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