

Defining and Mapping Mid-Atlantic Ocean and Coastal Acidification Hotspots

Teresa Schwemmer, Ph.D.
Postdoctoral Scientist, MACAN

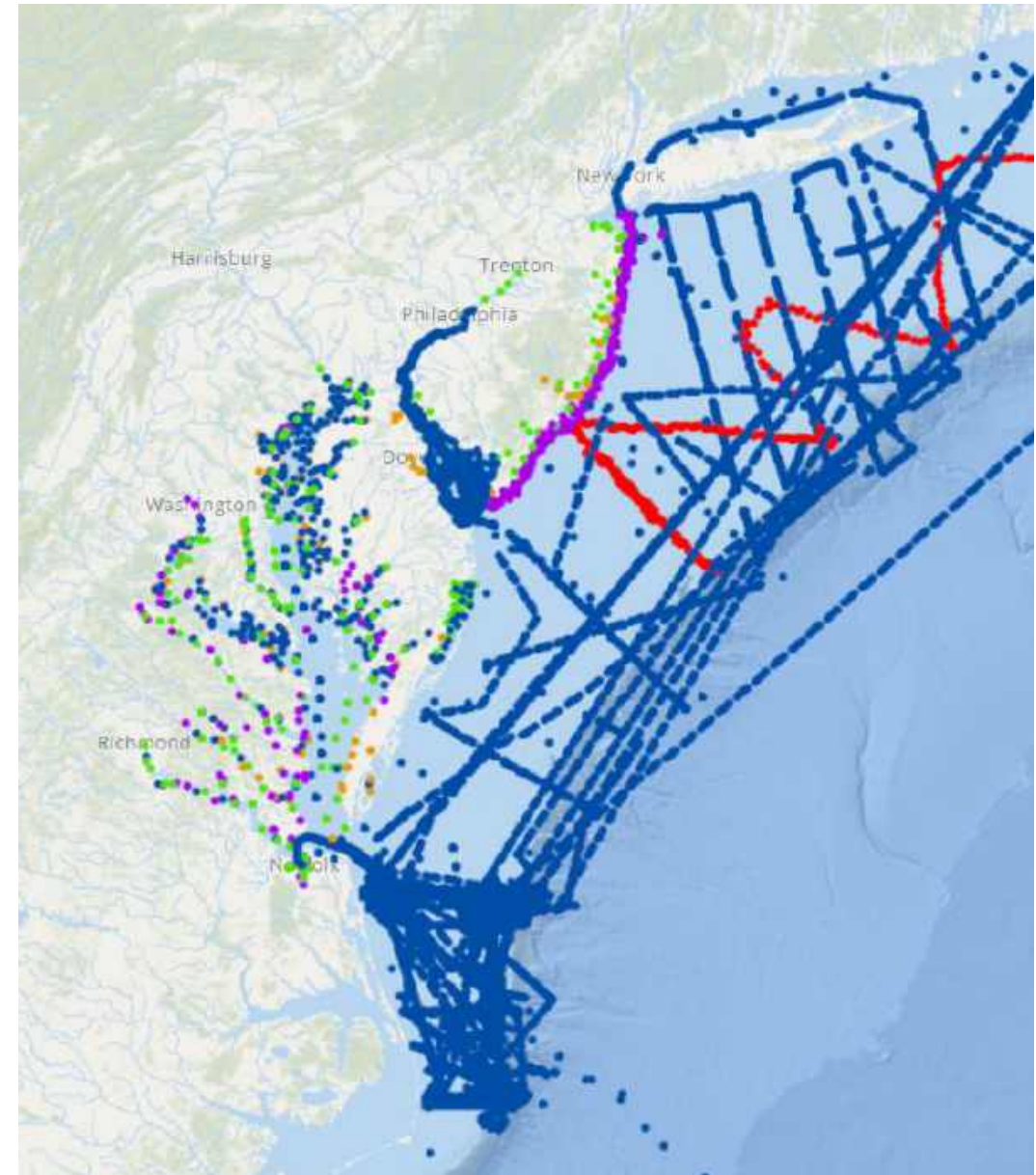
Session: “Monitoring, Technology, and Data Products to Inform Decision-Making”

Project Overview

- Develop an OCA hotspot map layer on MARCO Ocean Data Portal
 - Analyze regional carbonate chemistry data
 - Locations at a high risk for, and vulnerable to, acidification events
- Identify stakeholder needs and provide outreach tools

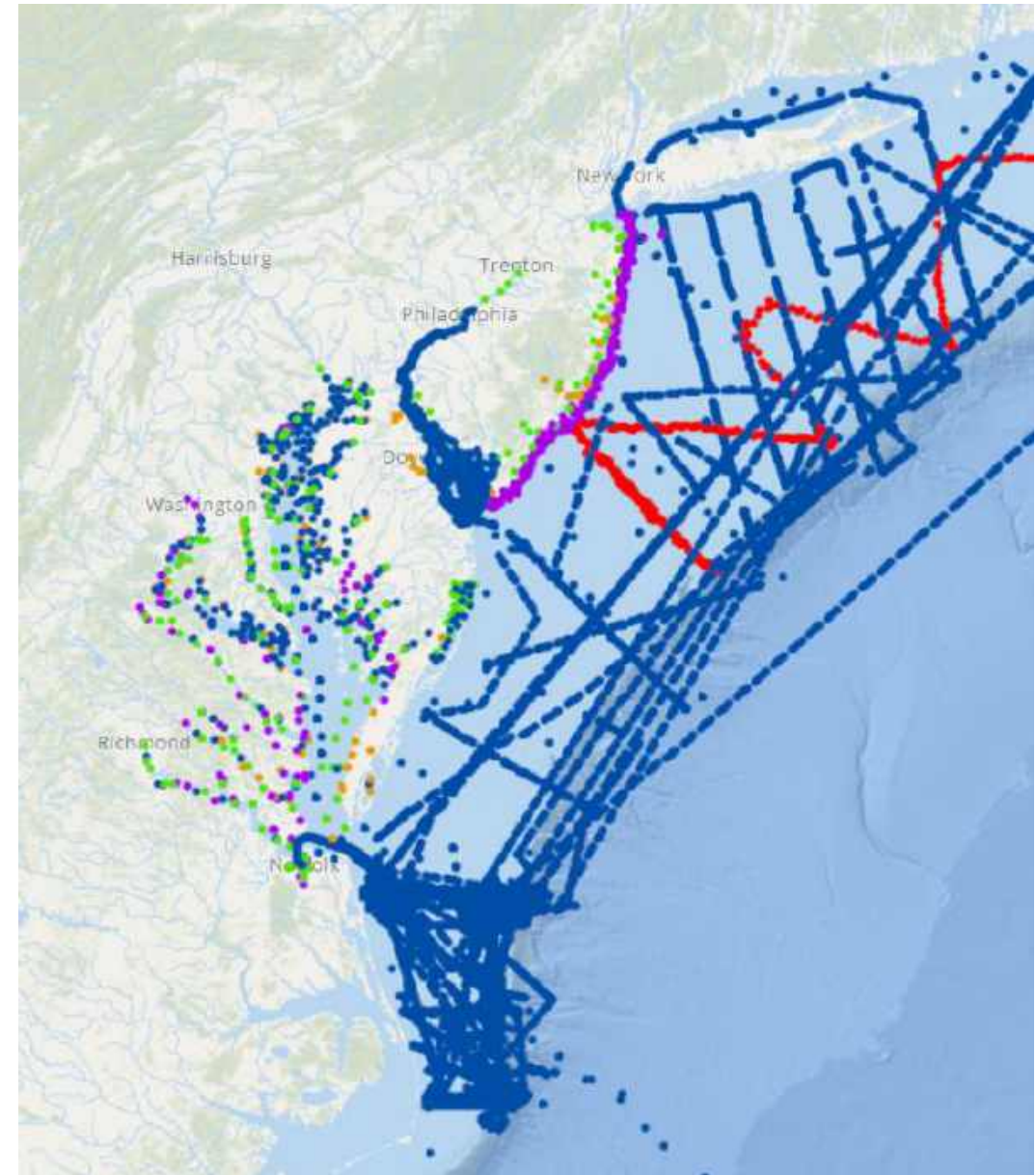
Carbonate Chemistry Data

- Mid-Atlantic coastal waters and estuaries
- Ship, glider, moored sensor, ongoing sampling sites
- Parameters needed to calculate Ω_{arag} , $p\text{CO}_2$, and pH
- Surface and subsurface



Carbonate Chemistry Data

- Open ocean data sources
 - ECOA cruises
 - SOCAT
 - CODAP-NA
 - State agencies
- Estuary data sources
 - NERRs
 - Chesapeake Bay Program
 - State agencies



What is a “hotspot”?

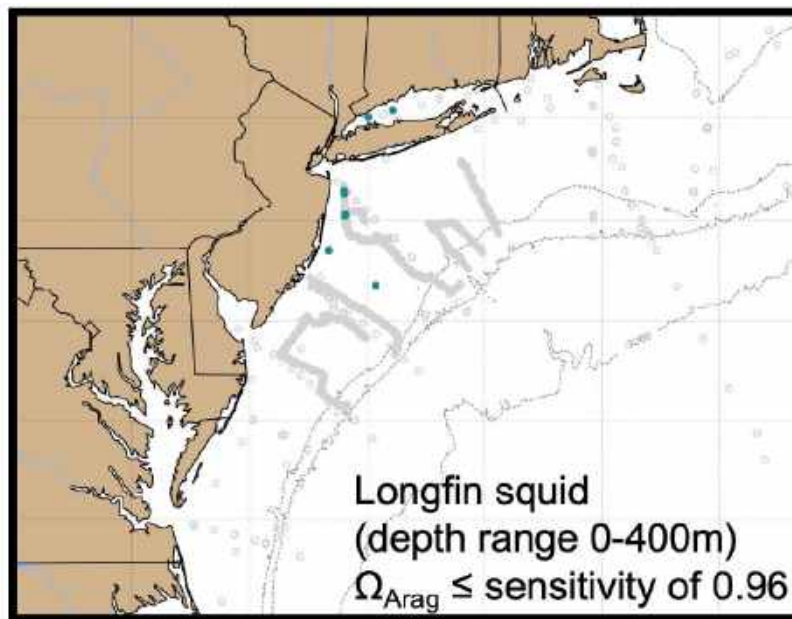
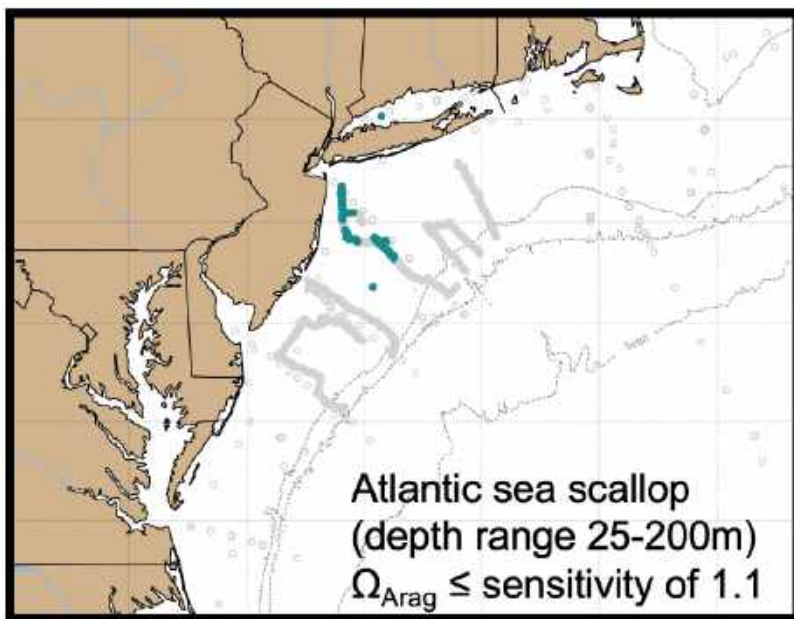
1. Intersection of exposure and vulnerability
2. Locations with highest rates of change

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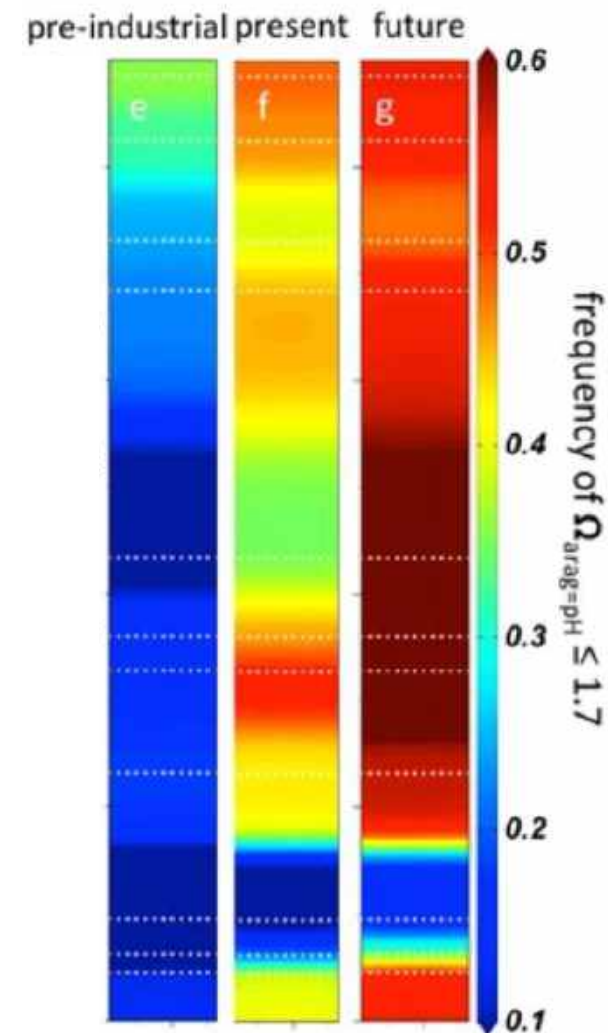
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1. Exposure and Vulnerability

- Method: set threshold(s) based on species sensitivity



Example: 2023 State of the Ecosystem report shows where glider data detected Ω_{Arag} below species-specific thresholds in green.



Example: Chan et al. (2017) latitudinal frequency of $\Omega_{Arag} \geq 1.7$ along West Coast

1. Exposure and Vulnerability

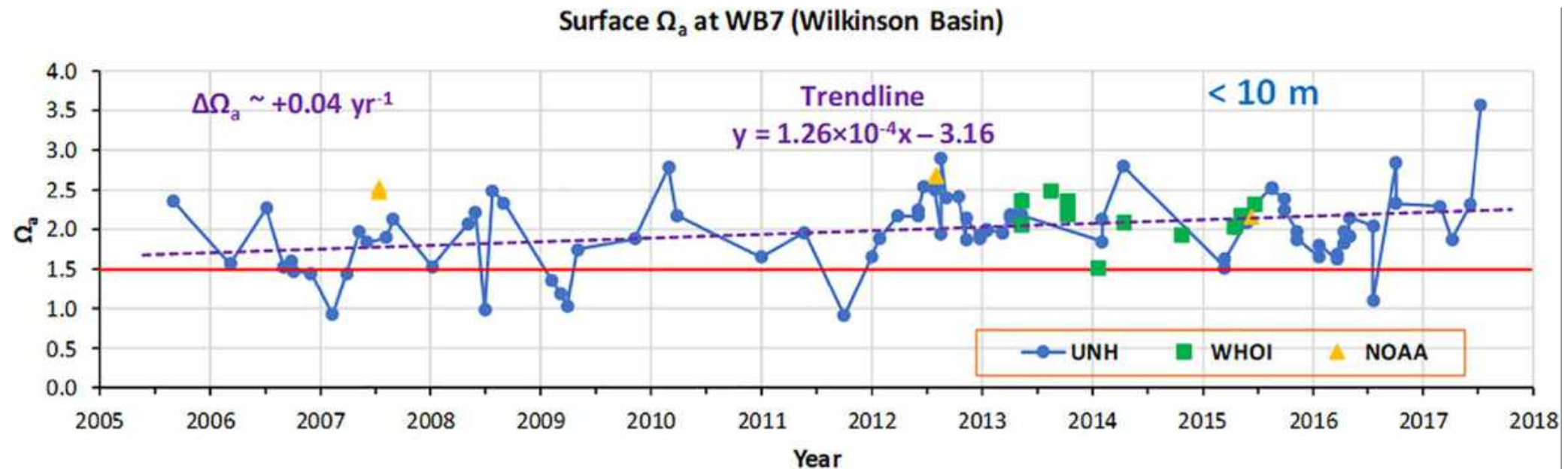
- Method: set threshold(s) based on species sensitivity
- Literature review of commercially, recreationally, and ecologically important species sensitivities
- For each location, use most sensitive species present there as threshold
- Have a pH-based and Ω_{arag} -based threshold

What is a “hotspot”?

1. Intersection of exposure and vulnerability
2. Locations with highest rates of change

2. Rates of Change

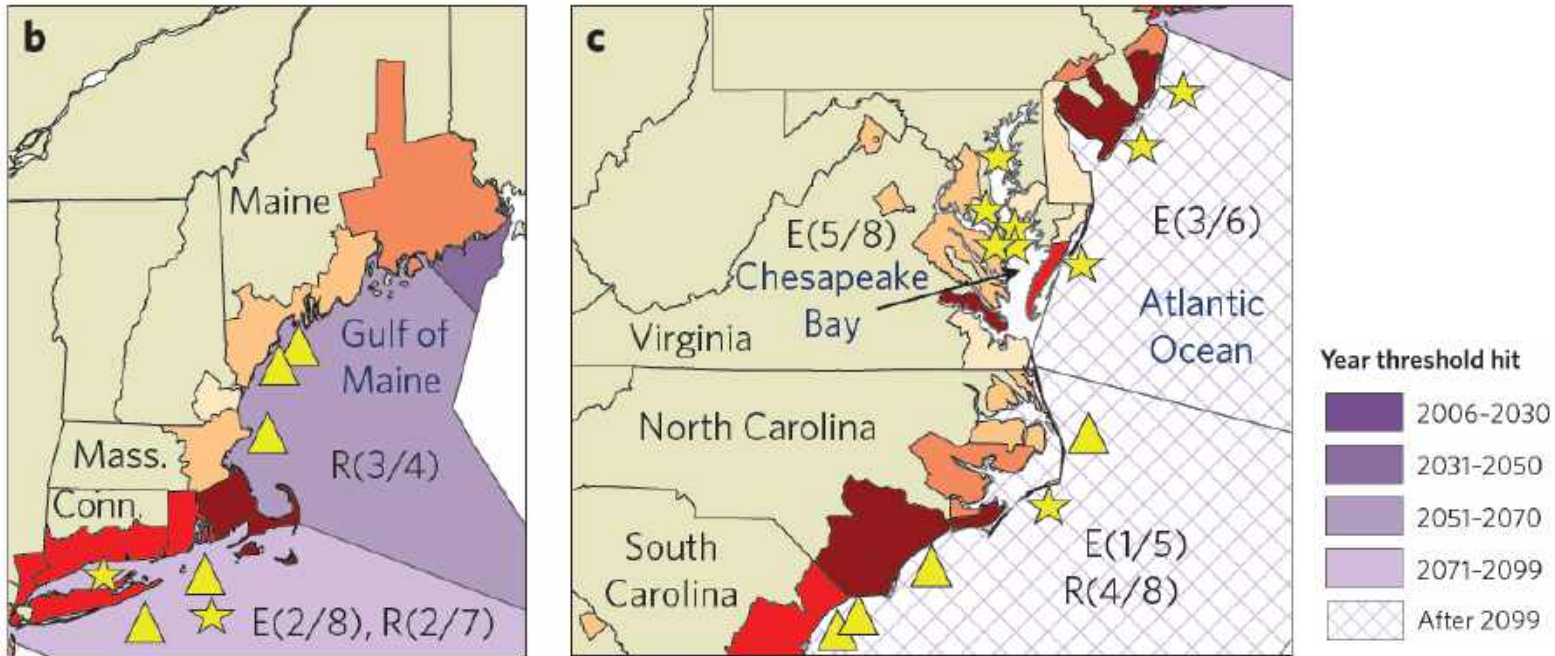
- Method: highlight locations with greatest rate of change



Example: Siedlecki et al. (2021) shows time series with slope from regression line

2. Rates of Change

- Method: highlight locations with greatest rate of change



Example: Ekstrom et al. (2015) shows how soon sublethal thresholds for bivalve larvae will be reached

2. Rates of Change

- Method: highlight locations with greatest rate of change
- For locations with >5 years data, what is rate of change in pH and Ω_{arag} ?
- Can we use data on speed of species adaptation to set threshold?
Or use global predictions and average carbonate chem trends to set threshold?
- Alternative: Map all rates of change with no additional context

2. Rates of Change

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Ω_{ara}

- Can

Or u

set

- Alternative: Map all rates of change with no additional context

PLOS ONE

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RESEARCH ARTICLE



Quantifying Rates of Evolutionary Adaptation in Response to Ocean Acidification

Jennifer M. Sunday , Ryan N. Crim, Christopher D. G. Harley, Michael W. Hart

Published: August 9, 2011 • <https://doi.org/10.1371/journal.pone.0022881>

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Deliverables

- Map layer for MARCO Ocean Data Portal
 - Adoption plan for updating with future data
- Provide knowledge gaps and recommendations
- Outreach tools, including
 - Video and one-pager on how to access/use hotspots map
 - Story map of how map created, what it means for species
 - Hotspots webpage on MACAN website
 - Webinars, conference presentation
 - Peer-reviewed article with links to data

Timeline

- Project term: Sep. 2023 – Nov. 2024
 - Gathering monitoring data and biological sensitivity levels
 - Refining hotspot definition
 - Analyzing data for temporal and spatial trends, hotspot thresholds
 - Developing map layer with MARCO technical team
 - Developing outreach tools and publication
 - Reporting
 - Monthly team meetings
 - Quarterly MACAN Steering Committee meetings
 - Progress reports for MARCO to NOAA every 6 months

Questions and Comments

- Contact: teresa.schwemmer@gmail.com
- Seeking volunteers to mentor, provide guidance & input

