Evaluating and enhancing eelgrass resiliency and restoration potential in a changing climate

National Estuarine Research Reserve System
Science Collaborative

Project Team

Research/Collaborative Team

- Dr. Jessie Jarvis – UNCW
- Erin Shields – CBNERR-VA/VIMS
- Cirse Gonzalez – CBNERR-VA/VIMS
- Dr. Stephanie Kamel - UNCW

End User Specialists

- Randy Owen – VMRC
- Brooke Landry – Maryland DNR/CBP

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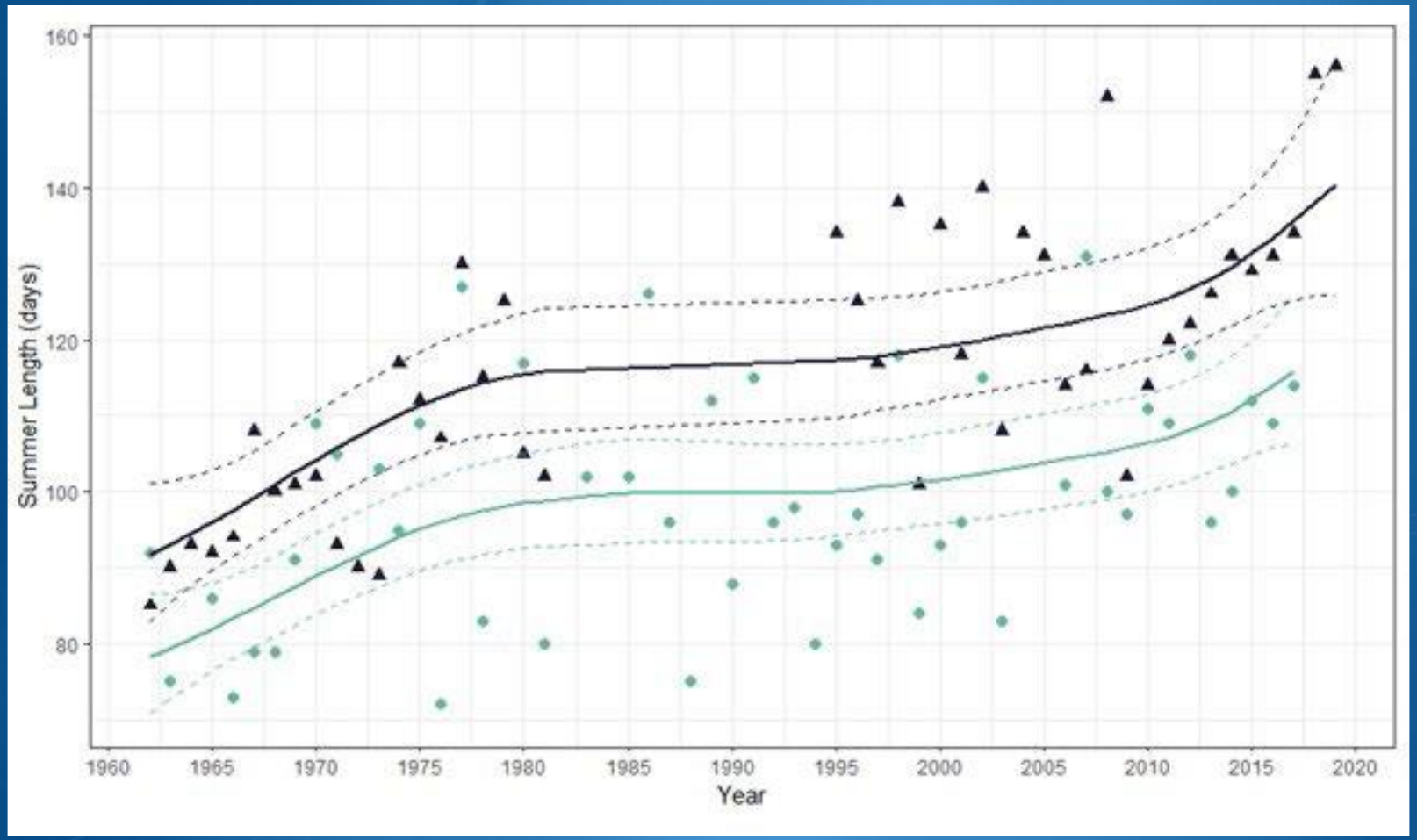
Background

- Elevated water temperatures have resulted in large-scale eelgrass diebacks of entire meadows in the lower Chesapeake Bay, VA
- Eelgrass restoration in VA without considering the resiliency of the meadows to climate change no longer appears to be a viable option for long-term success

- In contrast, populations in Back Sound, NC appear to be more resilient to warming water temperatures



Stressful summer length for *Z. marina* in both Back Sound, NC (dark blue triangles) and York River, VA (teal circles). Solid lines represent mean fitted values from gamma regression with temporal correction factor and dotted lines represent 95% confidence intervals. York River data from Shields et al. (2018).

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Project Objectives

- Compare resiliency traits of eelgrass populations in NC and VA
- Identify specific meadows in NC that could serve as seed donor beds
- Conduct reciprocal test restoration of NC and VA seeds

Provide datasets and analyses needed to better enhance the thermal resiliency of Virginia eelgrass populations, with the goal of informing management decisions related to eelgrass management and restoration within the broader mid-Atlantic region

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CBNERR-VA Management Need

"Evaluate seagrass bed resiliency in response to changes under future climate and water quality scenarios along with innovative ways to facilitate seagrass resilience in the York River estuary and associated small coastal basin systems."

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Collaborative Approach

End User Advisory Group

- Dr. Carl Friedrichs – CBNERR-VA
- Randy Owen – VMRC
- Anne Deaton – NC-DMF
- Brooke Landry – CBP
- Staff – APNEP
- Holly Plaisted – NPS
- Dr. Jonathan Lefcheck - SERC

➢ Work with PIs to ensure ongoing research and restoration efforts are addressing key management and resource issues

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Technical Approach

Focus on 2 components of seagrass resiliency:

- Genomic Diversity – neutral and adaptive

- Sexual Reproduction

Year 1 – Sampling and monitoring for resiliency traits in NC and VA

Year 2 – Performance of selected thermally resilient eelgrass populations under *in situ* stressful conditions

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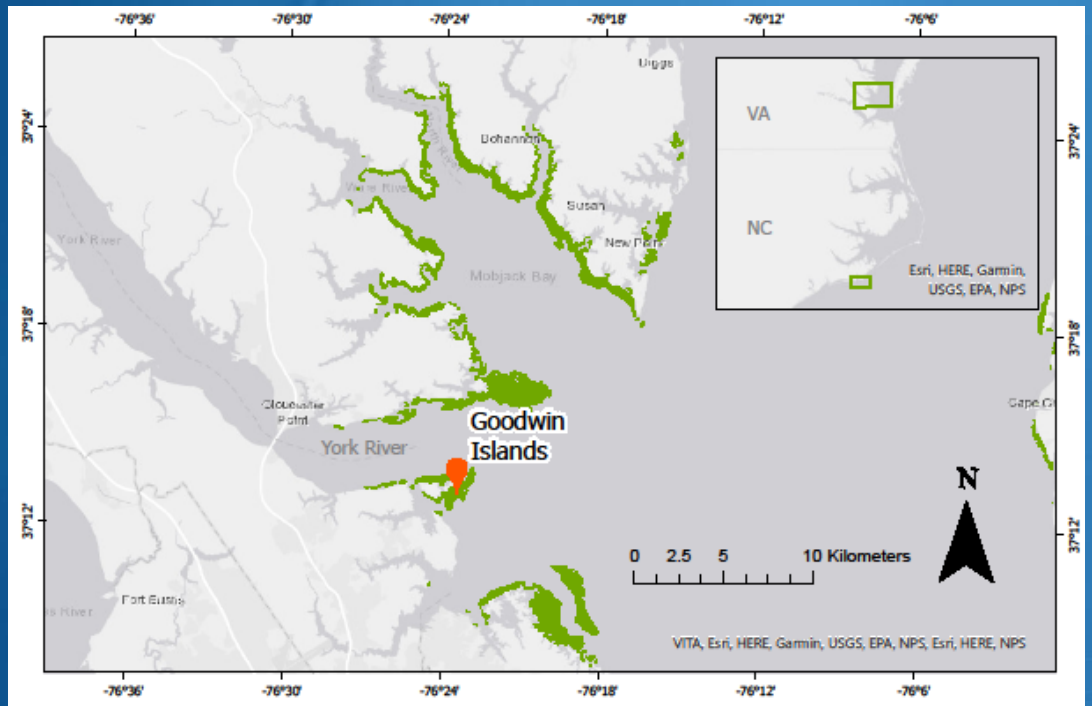

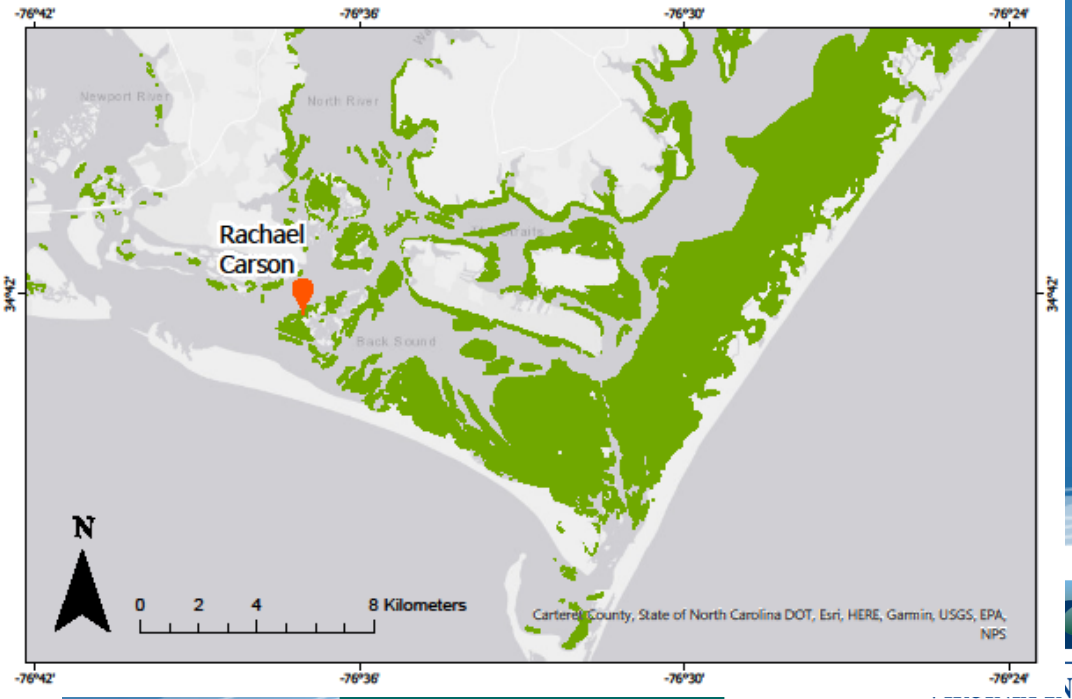

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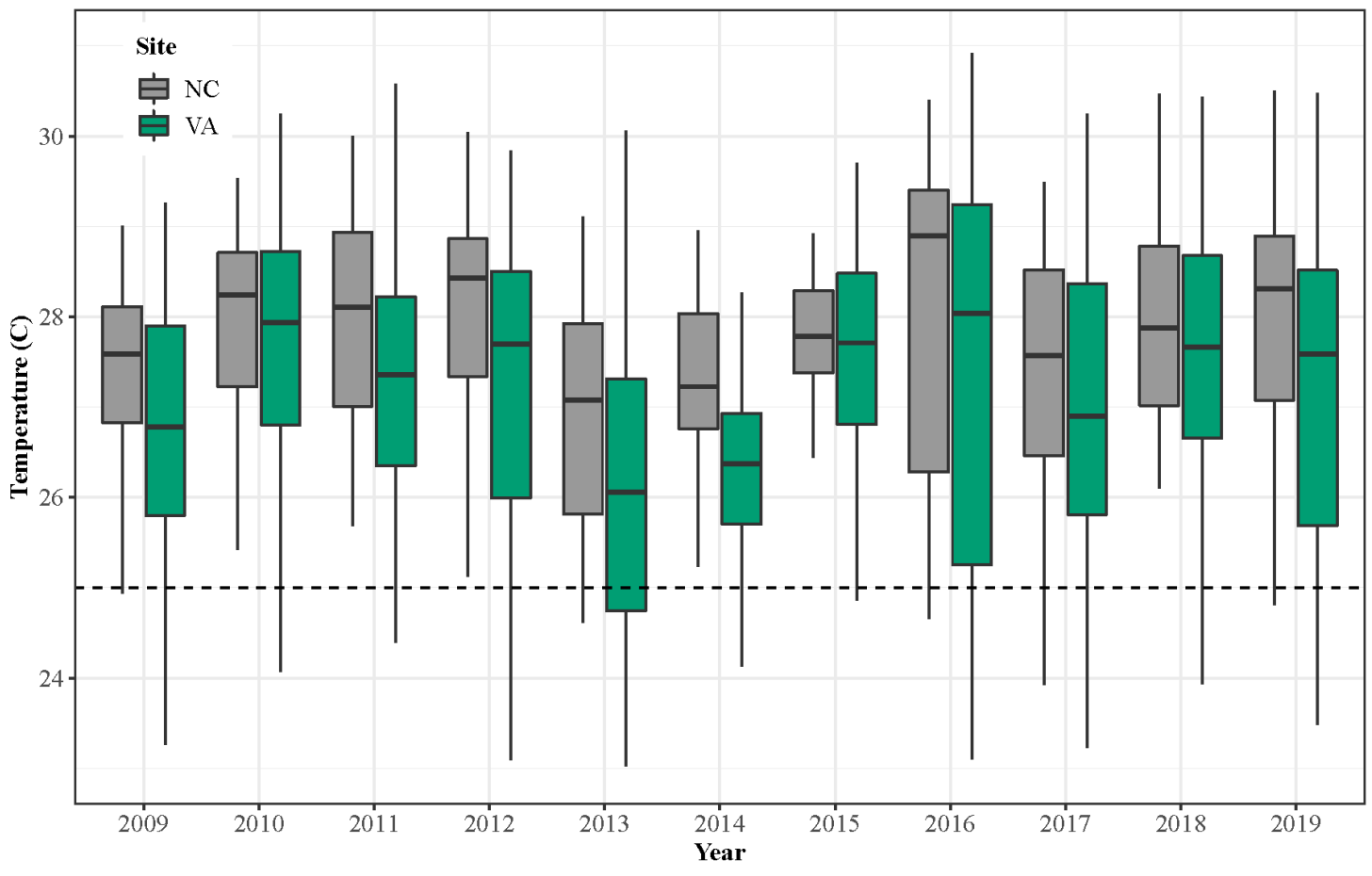

Daily mean water temperatures for Goodwin Islands in VA (green boxes) and the Rachel Carson reserve site in NC (gray boxes) during summer months (June-August). Dashed line is at 25˚C which is the temperature at which *Z. marina* experiences thermal stress.

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Technical Approach

Question 1: Why are NC eelgrass beds more resilient to temperature stress than VA beds?

Sample 10 meadows in both locations

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Technical Approach

Question 2: Will NC eelgrass perform better (greater survival, greater ability to maintain metabolic homeostasis) than VA plants under stressful water temperatures regardless of location?

- 3 selected restoration sites per state
  - 9 restoration plots (3 NC, 3 VA, 3 bare)

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Outputs

- Synthesis of data comparing water quality, temperature, and sediment conditions between NC and VA
- Datasets and analyses providing critical information regarding genomic diversity and resiliency traits
- Technical report outlining specific management recommendations, including identification of specific donor beds in NC and sites in and around CBNERR-VA that could benefit from these restoration approaches
- Journal articles
- Presentations at meetings (NERRA, CERF) and regionally at CBP SAV Workgroup

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