

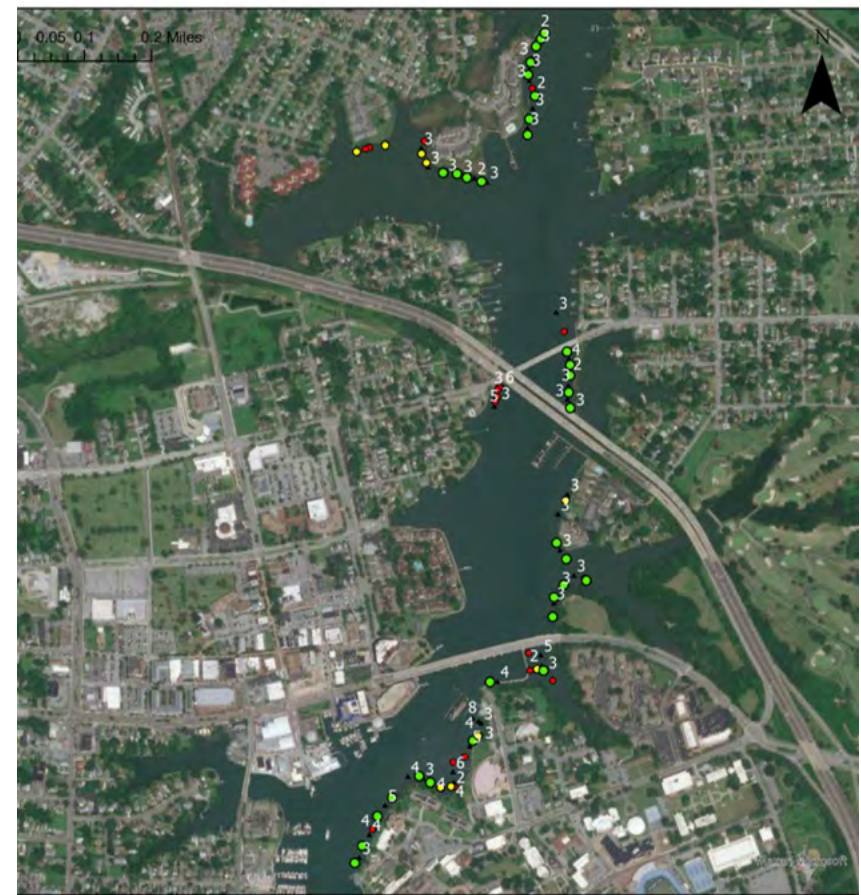


CHESAPEAKE BAY FOUNDATION
Saving a National Treasure

Roots to Reef: A Mosaic Approach to Shoreline Restoration

Oyster Reef Restoration

Jackie Shannon, VA Oyster Restoration Manager



Bathymetry - ft

Bottom Types

- Hard Mud
- Hard Sand
- Soft Mud



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Hampton River: Early Work



Potential Locations for Oyster Restoration Reefs in the Hampton River

Reefs A, B, C, E, F, and G are tentatively scheduled to be constructed in 2025.

Reefs D and H are tentatively scheduled to be constructed in 2027.

Reef Name	Acreage	Reef Name	Acreage
A	.74	E	0.64
B	.71	F	0.69
C	.93	G	0.9
D	1.35	H	4.22



Proposed Oyster Restoration Reefs E, F, & G

J. Luecke
10.3.23

Legend

Reefs E, F, & G

Proposed Reef Coordinates

● No Piling
● Piling
▨ E, F, & G Striations

Reef Name	Acreage
G	0.9
F	0.69
E	0.64

Reef	Label	Latitude	Longitude	Type
E	E1	37.0392091	-76.3372545	
E	E2	37.0392170	-76.3370669	Piling
E	E3	37.0382658	-76.3374378	
E	E4	37.0382605	-76.3377031	
E	E5	37.0385298	-76.3376427	
E	E6	37.0388753	-76.3374944	
F	F1	37.0379040	-76.3374909	
F	F2	37.0379099	-76.3372348	
F	F3	37.0365895	-76.3375281	Piling
F	F4	37.0369667	-76.3376929	
G	G1	37.0361066	-76.3399044	
G	G2	37.0359486	-76.3387730	
G	G3	37.0356482	-76.3387689	
G	G5	37.0358005	-76.3400163	
G	G4	37.0357244	-76.3393926	Piling

Maps by Julie Luecke
Chesapeake Bay Foundation



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Outreach and Permitting



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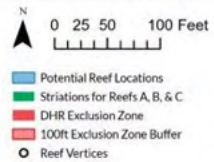
Stake Out and Surveys



Potential Locations for Oyster Restoration Reefs in the Hampton River

Reefs A, B, and C are tentatively scheduled to be constructed in 2025.

Reef Name	Acreage	Striation	Acreage
A	0.09	C1	0.135
B	0.04	C2	0.132
C	0.93	C3	0.144
		C4	0.106



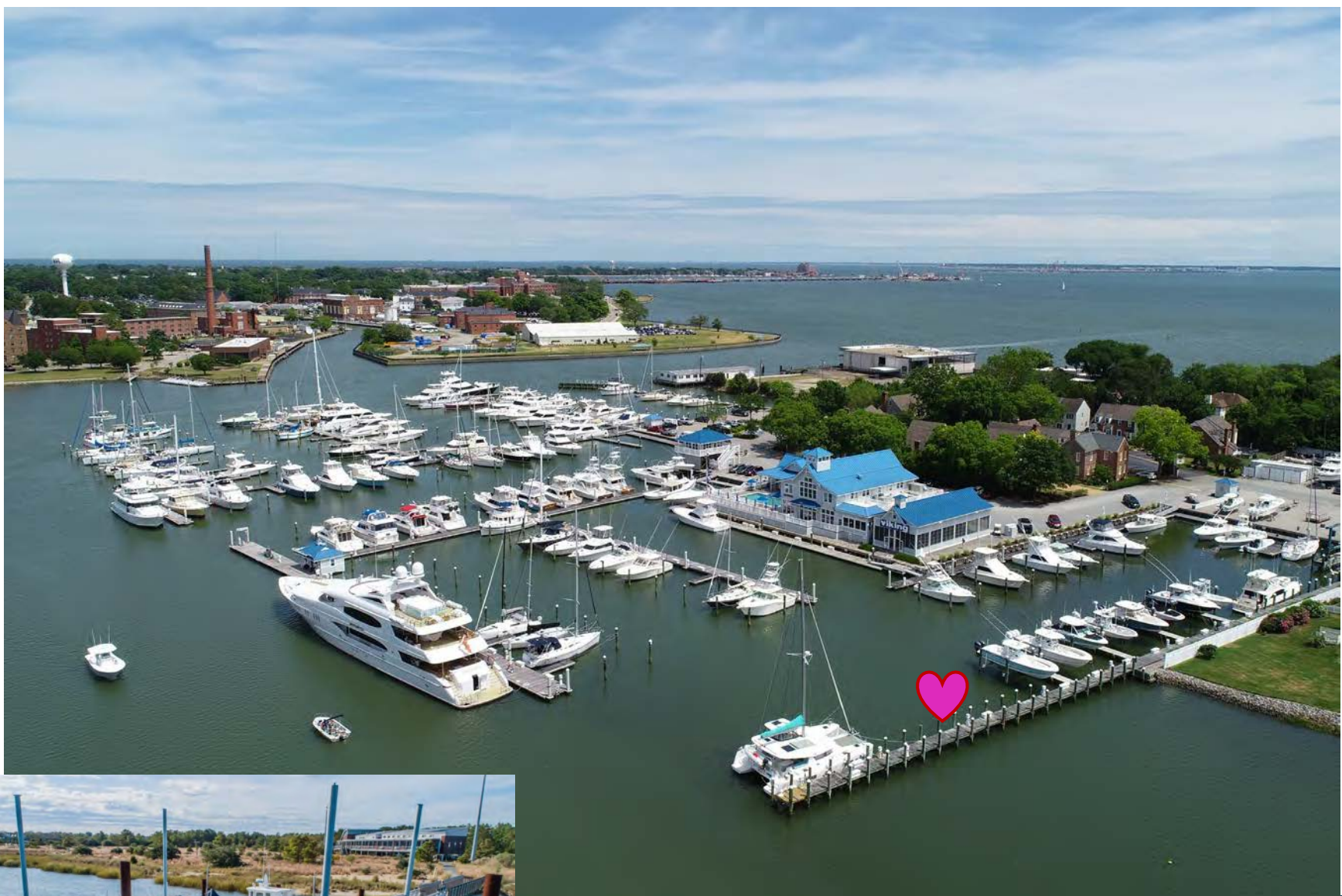
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Adaptive Management



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Oyster Reef Construction



Oyster Barge -> Hampton River!
Safe Harbor Bluewater Marina



CH



We're not done yet!



Mosaic Approach to Restoration Living Shoreline & Buffer

Kati Grigsby
Chesapeake Bay Foundation
Urban Restoration Coordinator



Sue Mangan Photography

Transplanting Live Oysters

An important consideration for the success of oyster growth on a living shoreline sill is the existing wild oyster population in the vicinity of the project area. At Pine Cone Harbour, we have observed a thriving wild oyster population. Introducing additional substrate for oyster growth not only has the potential to enhance habitat conditions but also contributes to the development of a resilient shoreline for the Pine Cone Harbour community.

While it was encouraging to observe numerous oysters along the shoreline, this also presented a challenge during the project's implementation. To prevent any potential damage to live oysters within the project's footprint and create a smooth surface for the interlocking oyster castles, it was necessary to transplant all live oysters channelward, outside the project area. This approach not only ensured the survival of the oysters but also positioned them to spawn future spat (oyster larvae), which can subsequently settle on the oyster sill.





Sue Mangan Photography

Oyster Castles

Oyster Castles are 30-pound concrete blocks that have a diameter of one foot and a height of six inches when interlocked. When designing a living shoreline, it's essential to recognize that no two shorelines are the same. Therefore, it's important to have flexible, modular tools that can adapt to the specific needs of each shoreline. The LEGO-like design of Oyster Castles is one of the main reasons they are a popular choice for the sill material. Additionally, their relatively light weight makes them easy for volunteers to handle, allowing for installation by hand, one block at a time!







Sue Mangan Photography

Natrux Basalt Oyster Shell Bags

Natrux is collaborating with the Chesapeake Bay Foundation to introduce an innovative technology aimed at replacing the commonly used plastic shell bags.

Traditionally, netted plastic bags filled with recycled oyster shells have been used to enhance coastal resilience in low wave energy environments. These bags are typically filled with recycled oyster shells collected through the Chesapeake Bay Foundation's Shell Recycling Program. However, the use of plastic poses several challenges, including the release of harmful chemicals and the disintegration into microplastics over time. Although attempts have been made to use more eco-friendly options, such as jute, coconut, or biodegradable plastics, none have proven to be a sustainable long-term solution.

Extensive research into natural fibers, coatings, and alternatives to plastic has shown that fibers spun from basalt rocks, which are naturally occurring volcanic rocks, offer significant promise due to their durability in harsh environments, such as the Chesapeake Bay. The latest prototype of this bag is currently being tested along the shoreline at Pine Cone Harbour and is planned for use in future shoreline projects along the Hampton River.





CBF Staff

Recycled Loose Oyster Shell

Have you ever sat in a beach chair and noticed one of the legs suddenly collapse as the tide comes in? This happens because the waves and tides erode the sand under the chair. A similar process occurs with oyster castles, where a phenomenon known as "undercutting" can cause the entire structure to tilt toward the channel. To prevent this, CBF installs a wedge of loose oyster shells at the base of the channelward side of the oyster castles. This not only provides additional habitat but also encourages waves and tidal energy to flow up and over the castles.





Planting

Another important factor to consider when constructing a living shoreline is planting native grasses and shrubs to help combat erosion and flooding. *Spartina alterniflora*, a saltmarsh cordgrass, was planted in the low marsh and is naturally found in intertidal marshes. It plays a key role in stabilizing sediment with its dense root system, reducing the energy of incoming waves, filtering pollutants from runoff, and creating critical habitat for fish, crabs, and other estuarine species. The high marsh was planted with *Juncus roemerianus*, *Spartina patens*, and *Borrchia frutescens*. These native species were selected for their ability to stabilize soil, reduce erosion, and tolerate saltwater exposure. These plants enhance shoreline resilience while providing important habitat and ecological diversity.





Sue Mangan Photography

Shoreline Project Overview

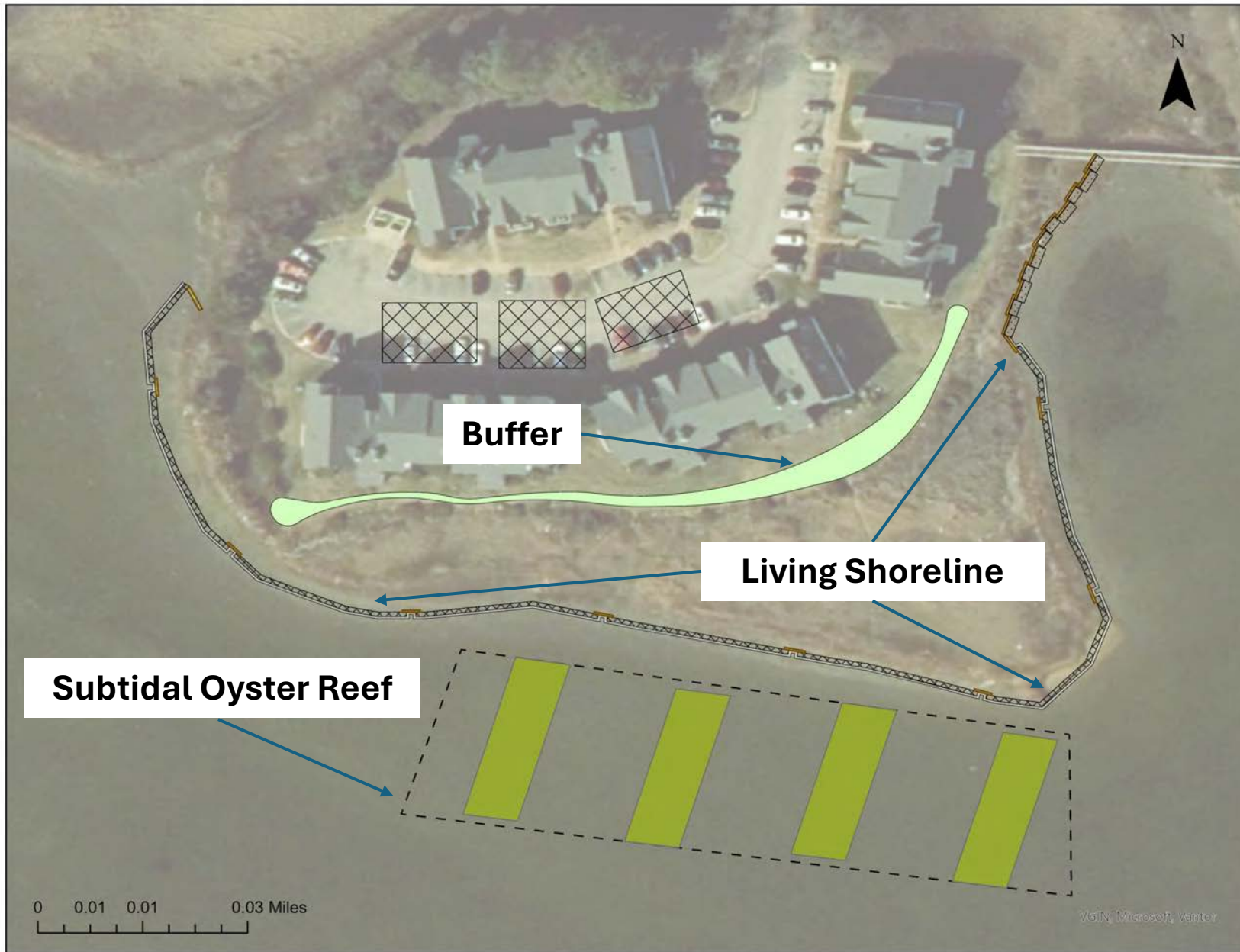
Over the course of 33 dedicated workdays spanning three months, a community of over 200 volunteers came together to rebuild and reimagine the shoreline, one step at a time.

Their efforts led to the installation of:

- 5,584 oyster castles
- 650 bushels of loose oyster shell
- 660 Natrx basalt shell bags
- 21 coconut fiber coir logs
- 9,000 low-marsh wetland plugs
- 3,500 high-marsh wetland plugs
- Support from amazing partners! (Blocker Foundation & Immaculate Conception Catholic Church)
- Lots of watermelon, oranges, popsicles, granola bars, and a few adult beverages.

Their skill and teamwork yielded spectacular results:

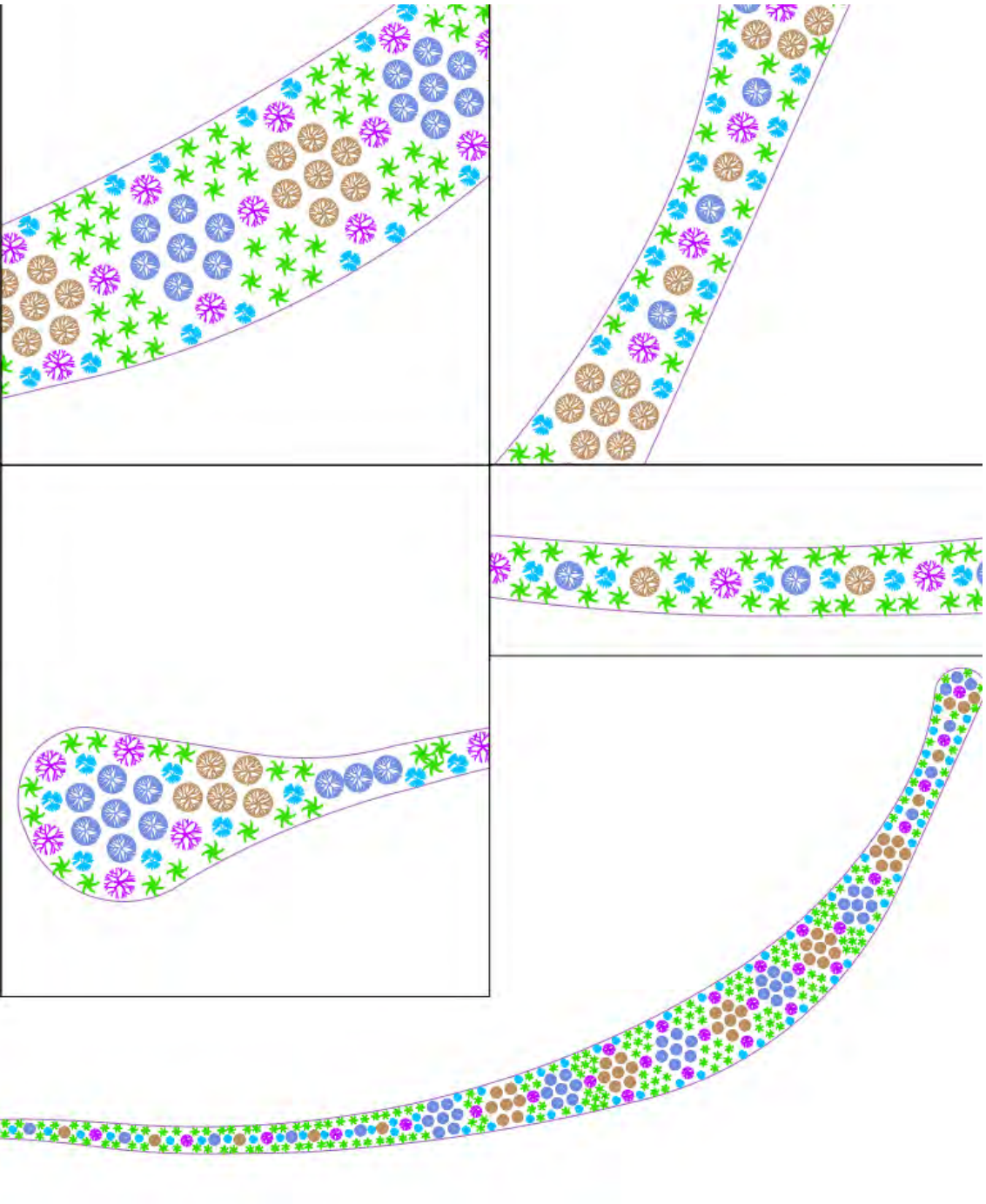
- 1,078-foot living shoreline
- 3,232 square feet of intertidal oyster-reef habitat
- 9,514 square feet of low-marsh wetland habitat



BUFFER INSTALL



PCH Buffer Project Plant Palette			
Plant	Order Size	Quantity	Key
Purple Cone Flower	Quart Pot	64	
Pink Muhly Grss	Quart Pot	39	
Little Bluestem	Plugs	250	
Butterfly Weed	Quart Pot	60	
Rattlesnake Master	Quart Pot	97	



Purple Cone Flower



Butterfly Weed



Rattlesnake Master



Pike Muhly Grass



Little Bluestem

BUFFER INSTALL



Scan to learn more about all
our projects!

Chesapeake Bay NERR-VA Co-managed

through the Virginia
Institute of Marine Science



Four Programmatic Veins

- Research
- Stewardship
- Education
- Training and Engagement

Restoration Monitoring

- BIL/IRA funds for restoration
- NERRs are leaders in long term monitoring
- Lots of groups talking about what monitoring is needed



Monitoring Questions?

- Can we show that the shoreline is trapping sediment?
- Is the sediment type different in the different sections and before install?

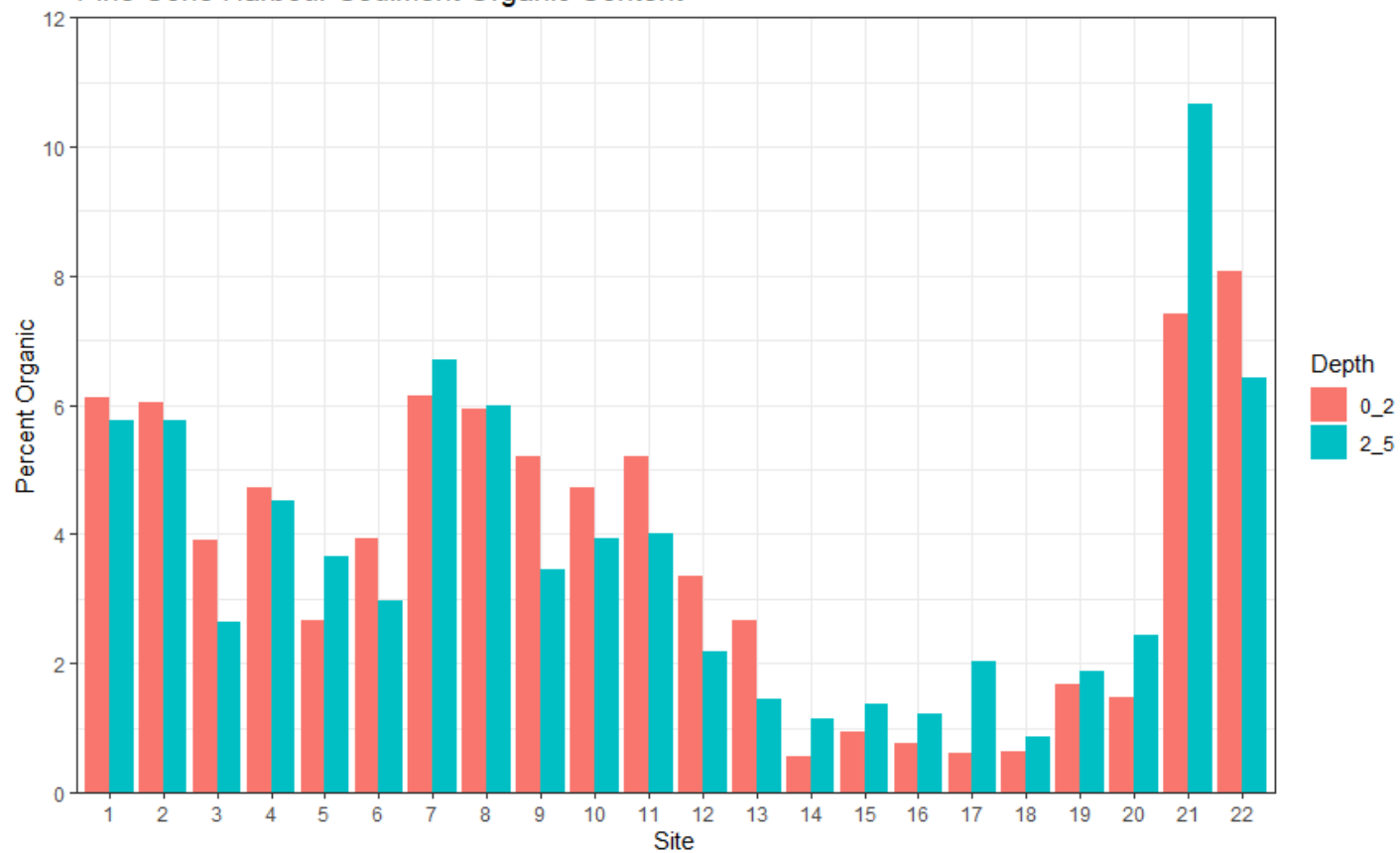








Pine Cone Harbour Sediment Organic Content



Pre-Installation





Potential Locations for Oyster Restoration
Reefs in the Hampton River

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Maps by Julie Luecke, Chesapeake Bay Foundation

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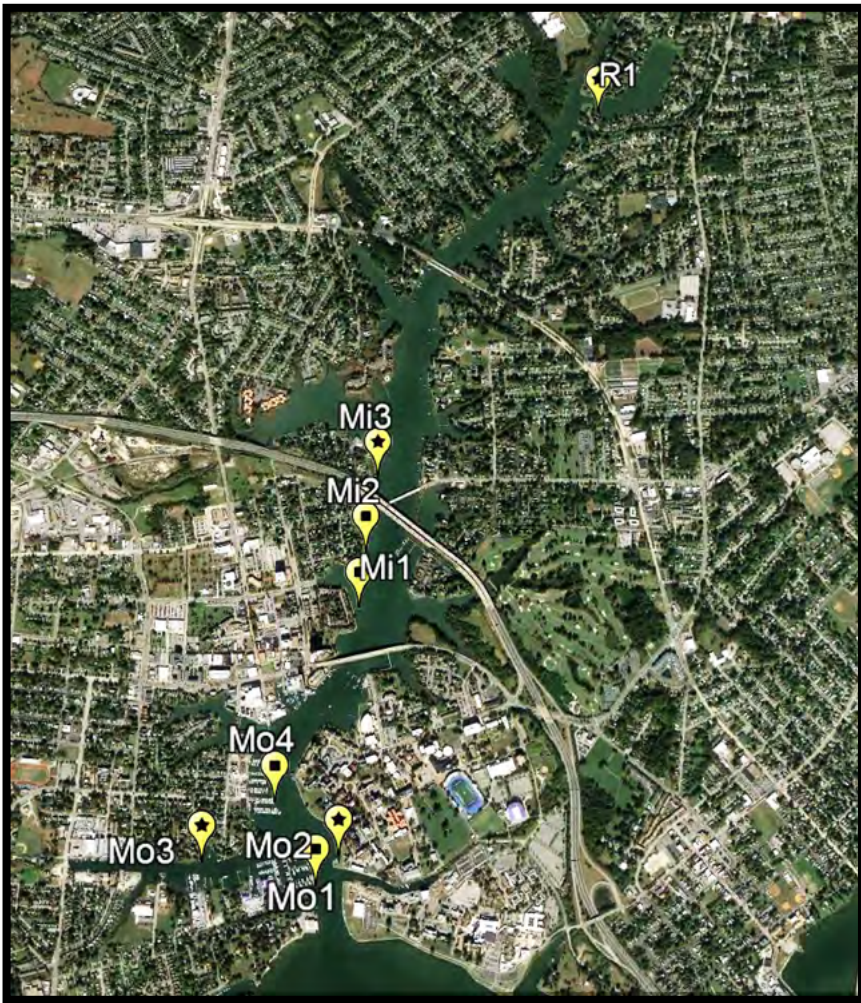
Student Research on Oyster Reefs and Living Shorelines in the Hampton River Estuary

Department of Marine and Environmental
Science
Hampton University

Deidre Gibson, Linda Miranda, Zuri Murph
and Dillon Doomstorm



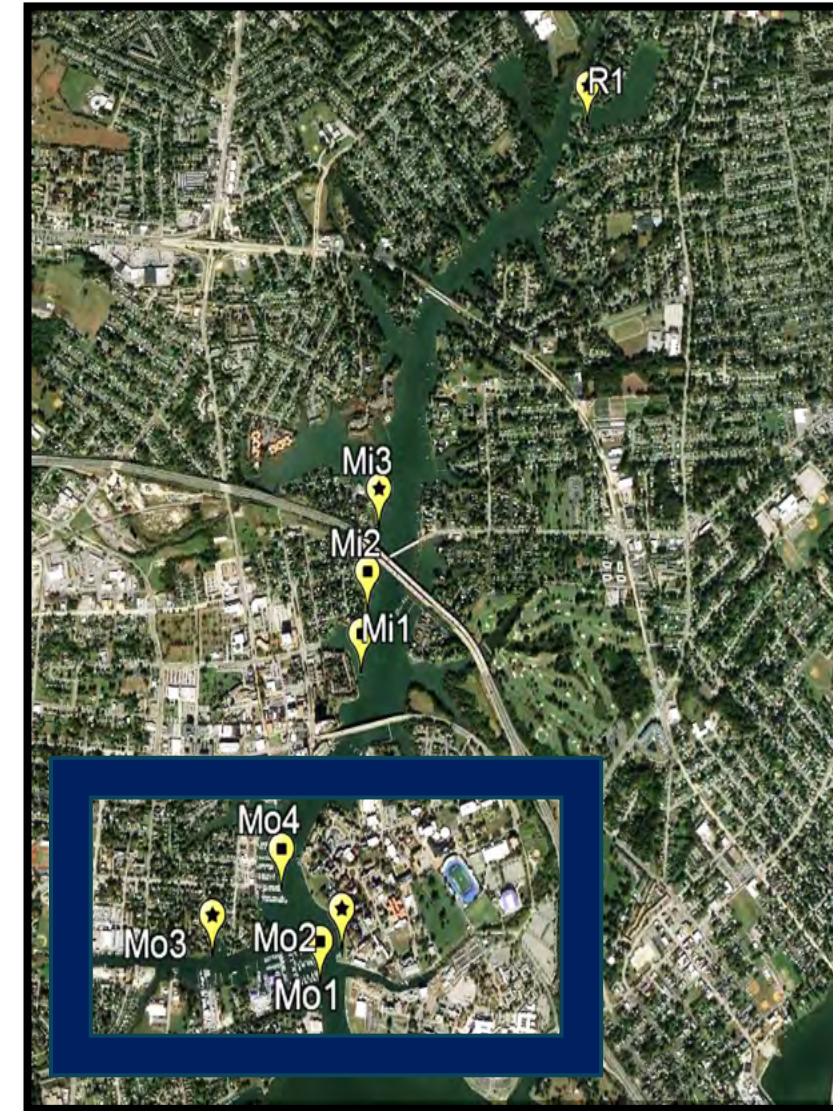
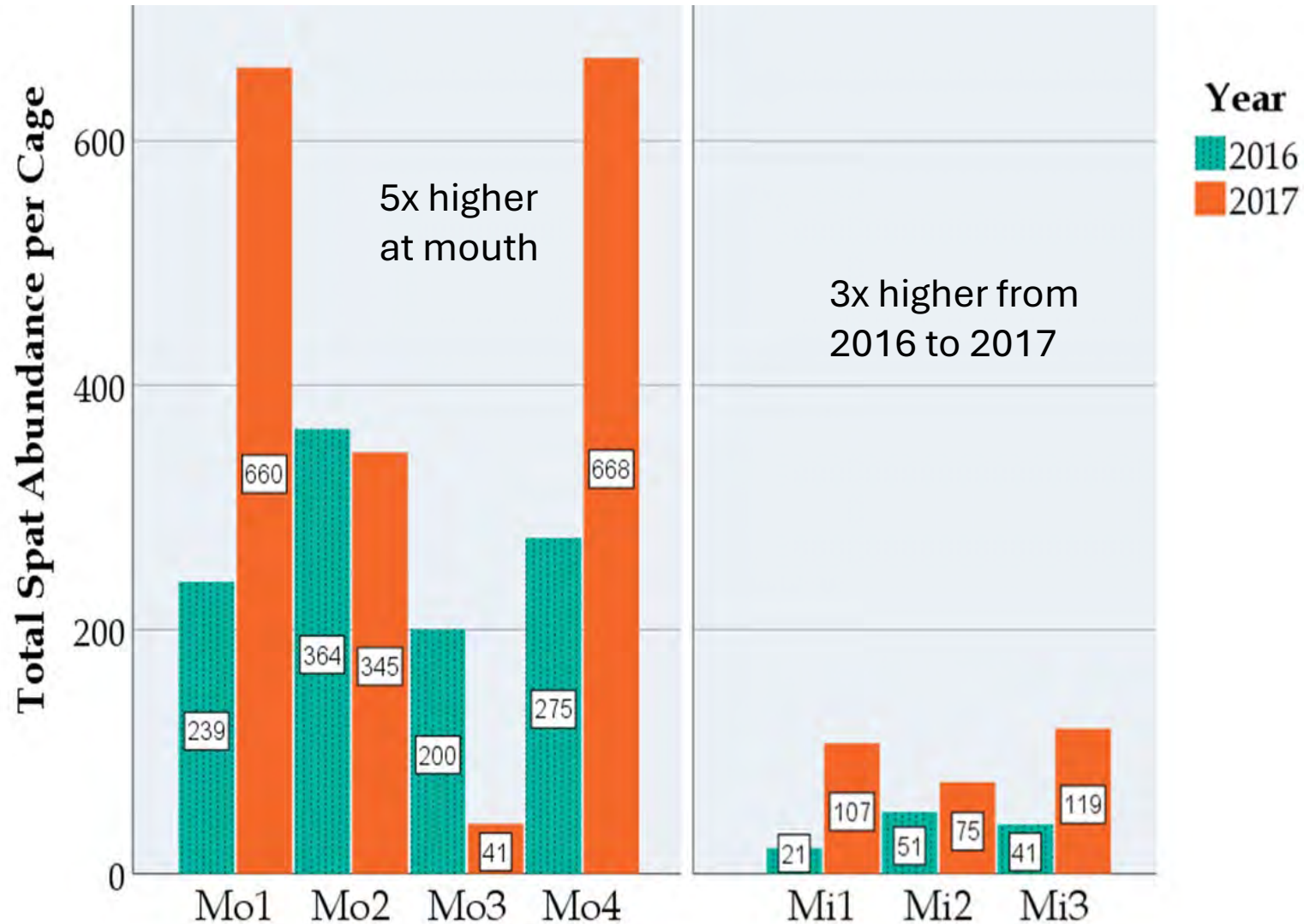
OYSTER RECRUITMENT STUDY



- May to October 2016 & 2017
- 8 study sites
- Identify spat recruitment at each site
- Used oyster cages and strings



OYSTER RECRUITMENT STUDY RESULTS



The Oyster Reef and Living Shoreline Locations based on Research

Hampton University System Restoration Project



Potential Locations for Oyster Restoration Reefs in the Hampton River

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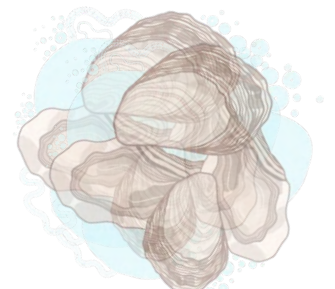
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Maps by Julie Luecke, Chesapeake Bay Foundation

RESEARCH MOVING FORWARD

- **Living Shoreline studies**
- **Microbiology assessment**
- **Oyster Reef Community Structure studies**



Pine Cone Harbor Living Shoreline Project



Project Goal:

Assess the structural integrity of Natrx basalt oyster shell bags

FIELD SITE



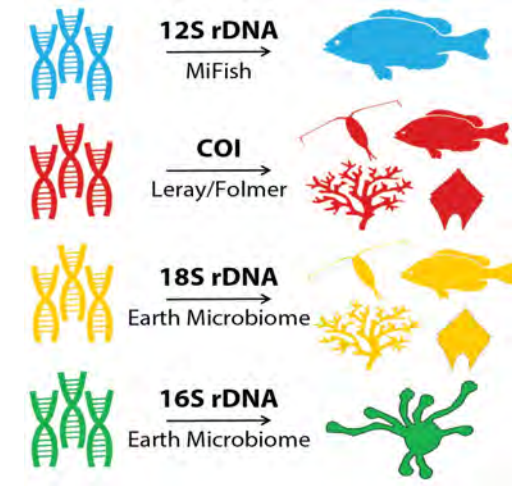
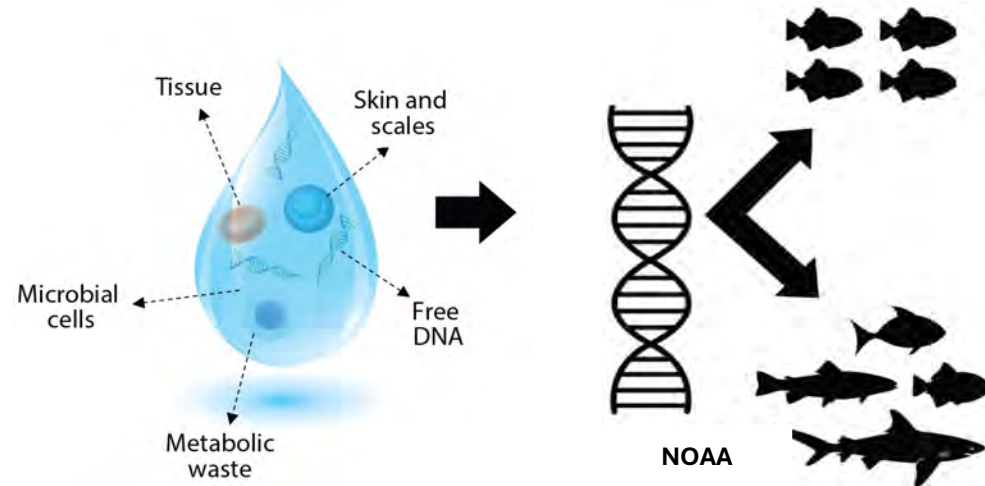
METHODS

PRELIMINARY RESULTS



ENVIRONMENTAL DNA (eDNA)

eDNA to assess biodiversity and potential shifts in aquatic community structure associated with wind development to inform monitoring requirements.



Community Ecology of HRE Oyster Reefs



PC: Megan May



PC: Jessica Lutzow



PC: Bo Lusk





Goals

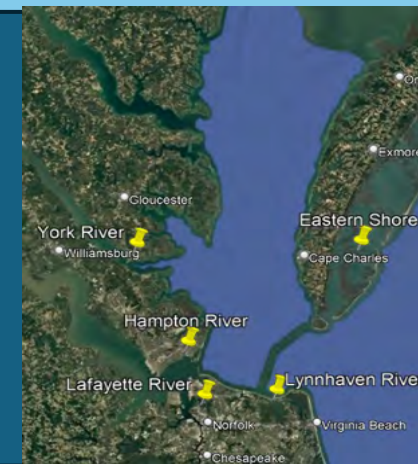
- Evaluate the effects of urbanization on top-down regulation on oyster reefs
- Analyze collected oyster reef flora and fauna for Stable Isotope Analysis for food web complexity within the Chesapeake Bay

Hypotheses

1. Urbanized reefs host lower species richness compared to rural systems
2. Restoration type and urban status within oyster reefs create distinct energetic pathways

Location

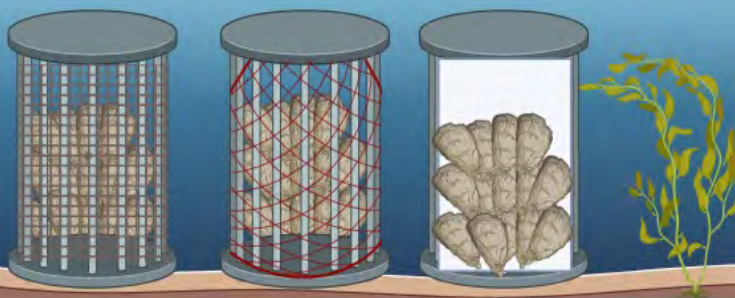
Sampling sites in the lower Chesapeake region.
Sampling done in connection with The Nature Conservancy and CBF



Methodology Part 1

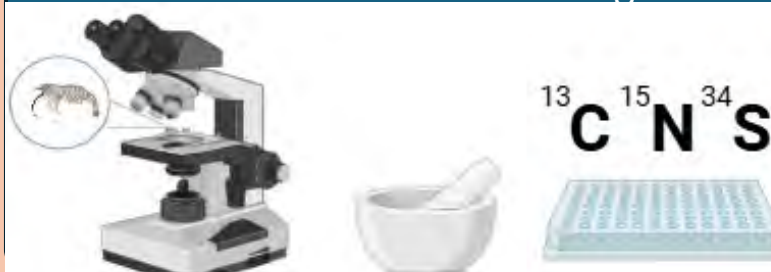
- Cage exclusions within subtidal fringes of intertidal reefs to prevent reef smothering.
- 3 cage types: Control, small mesh, and large mesh

Small Large Control



Methodology Part 2

- Specie identification
 - Species grouping and Grinding for Stable Isotope Analysis ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$, $\delta^{34}\text{S}$)
- Carbon: Carbon food sources
Nitrogen: Trophic positioning
Sulfur: Further defines carbon signatures



Anticipated Results

- Urban reef systems show less biodiversity than rural oyster reefs
- Bi-plots reveal food web distinctions between Urban and Rural reef systems

Project made possible through NSF funding: NSF BRC-BIO: REEF CRABS, in coordination with Hampton University's Reef lab under Dr. Joseph Reustle. NOAA LMRSC

Acknowledgements

