Examining the Life Growing on (and Inside) Apalachicola's Oysters

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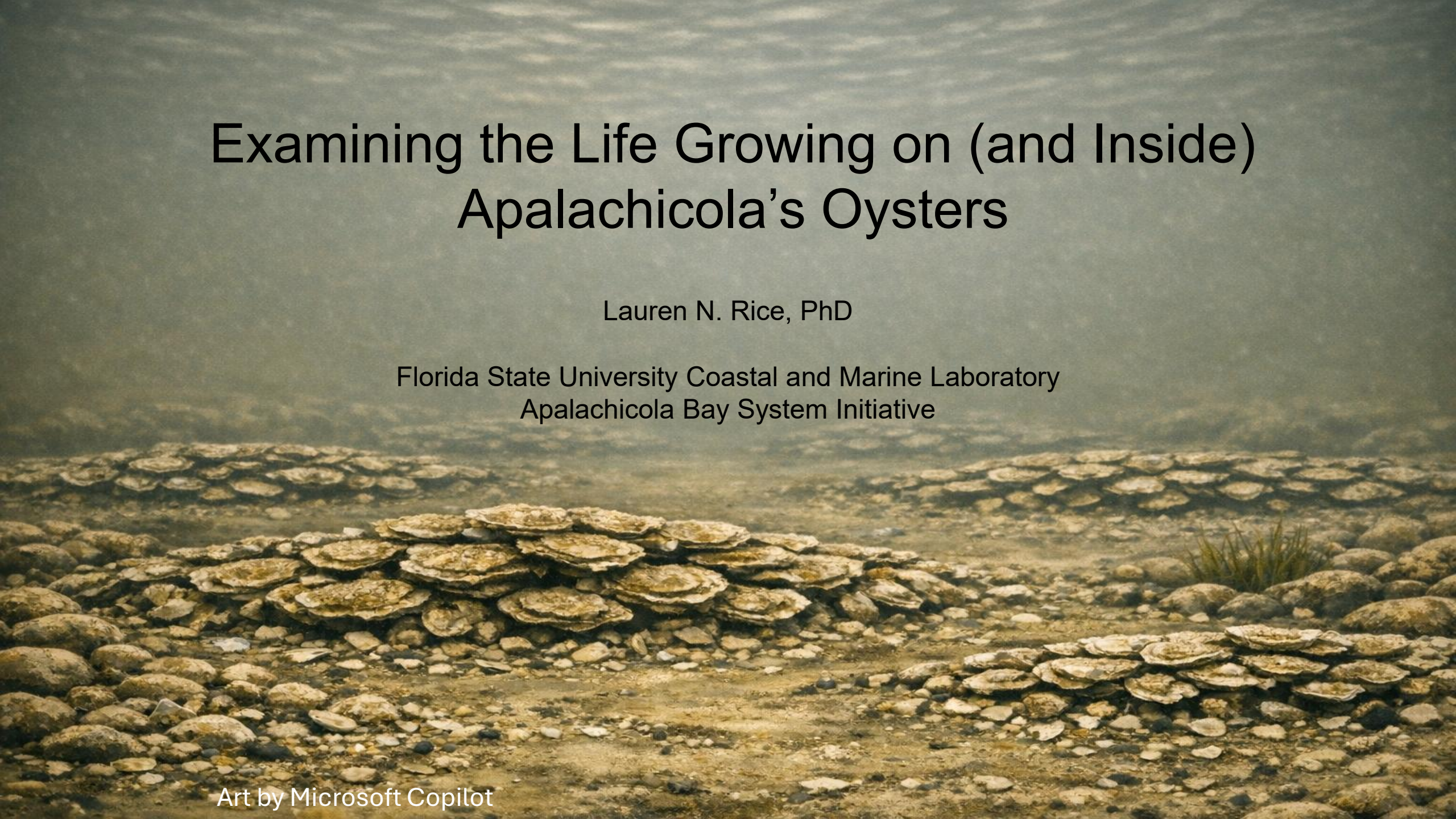
Florida State University Coastal and Marine Laboratory
Apalachicola Bay System Initiative



Art by Microsoft Copilot

ABSI – Apalachicola Bay System Initiative

GOAL: to gain insight into the root causes of decline of the bay's ecosystem and the deterioration of oyster reefs.

Ultimately, the ABSI will develop a management and restoration plan for the oyster reefs and the health of the bay.

Use a variety of field and laboratory-based approaches:

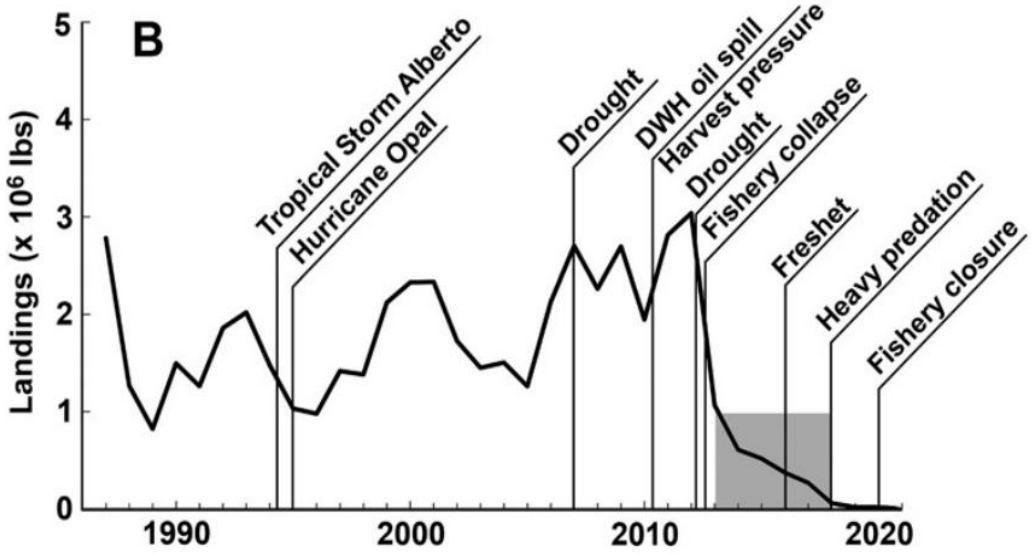
- Research hatchery
- Field monitoring
- *In situ* and lab experiments
- Biophysical modeling
- Drone mapping

Dr. Sandra Brooke

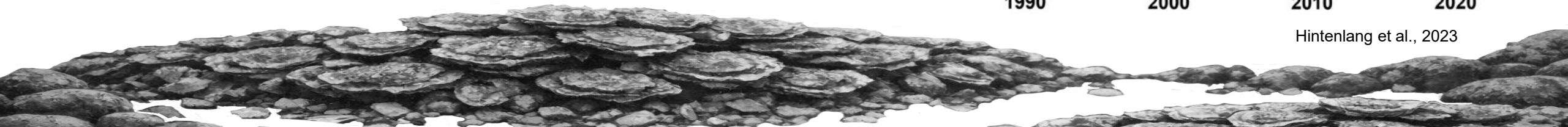
Collapse of the Apalachicola Bay Oysters

- Apalachicola Bay historically supported a robust oyster fishery

- In 2012 the fishery collapsed; federal government declared a fishery disaster in Apalachicola

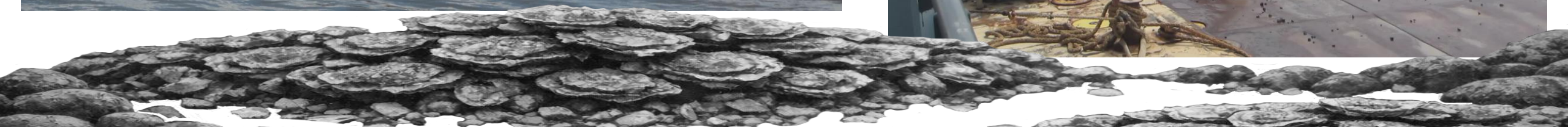


Hintenlang et al., 2023

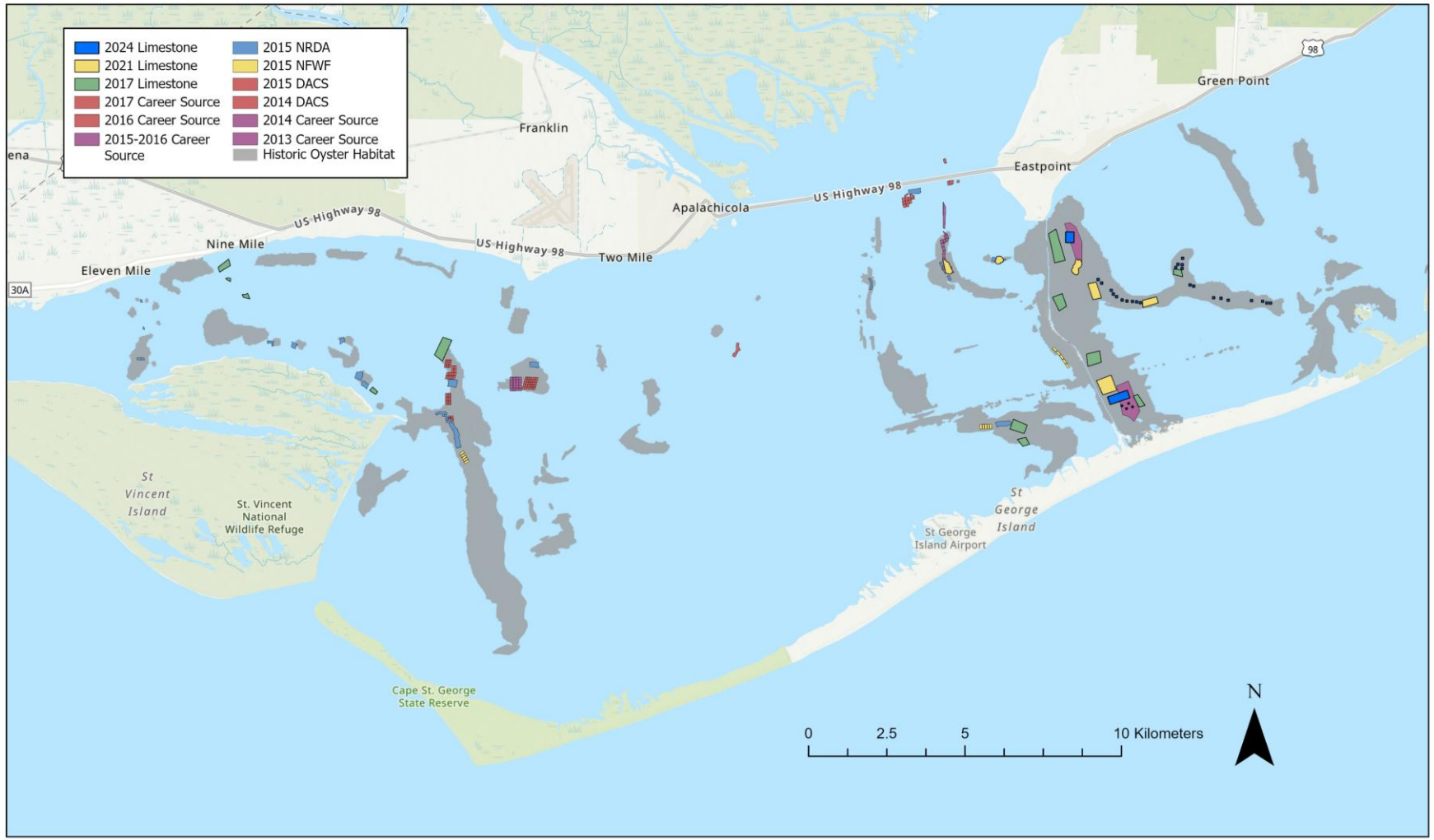


Restoration efforts for Apalachicola

- Intensive restoration efforts began following the collapse
- Supported by large funding efforts
- Over 100,000 m^3 of shell and limestone deployed throughout the bay (Johnson et al, 2023)



My postdoc work

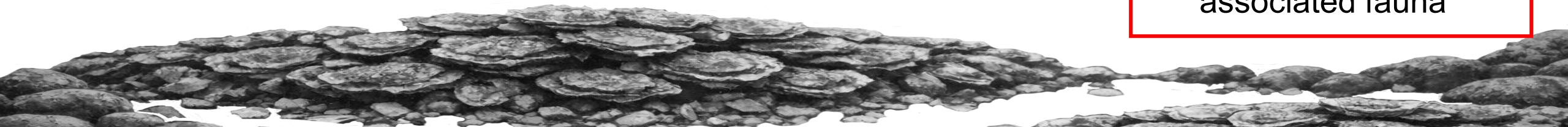


- Evidence of recovery across the bay has been minimal

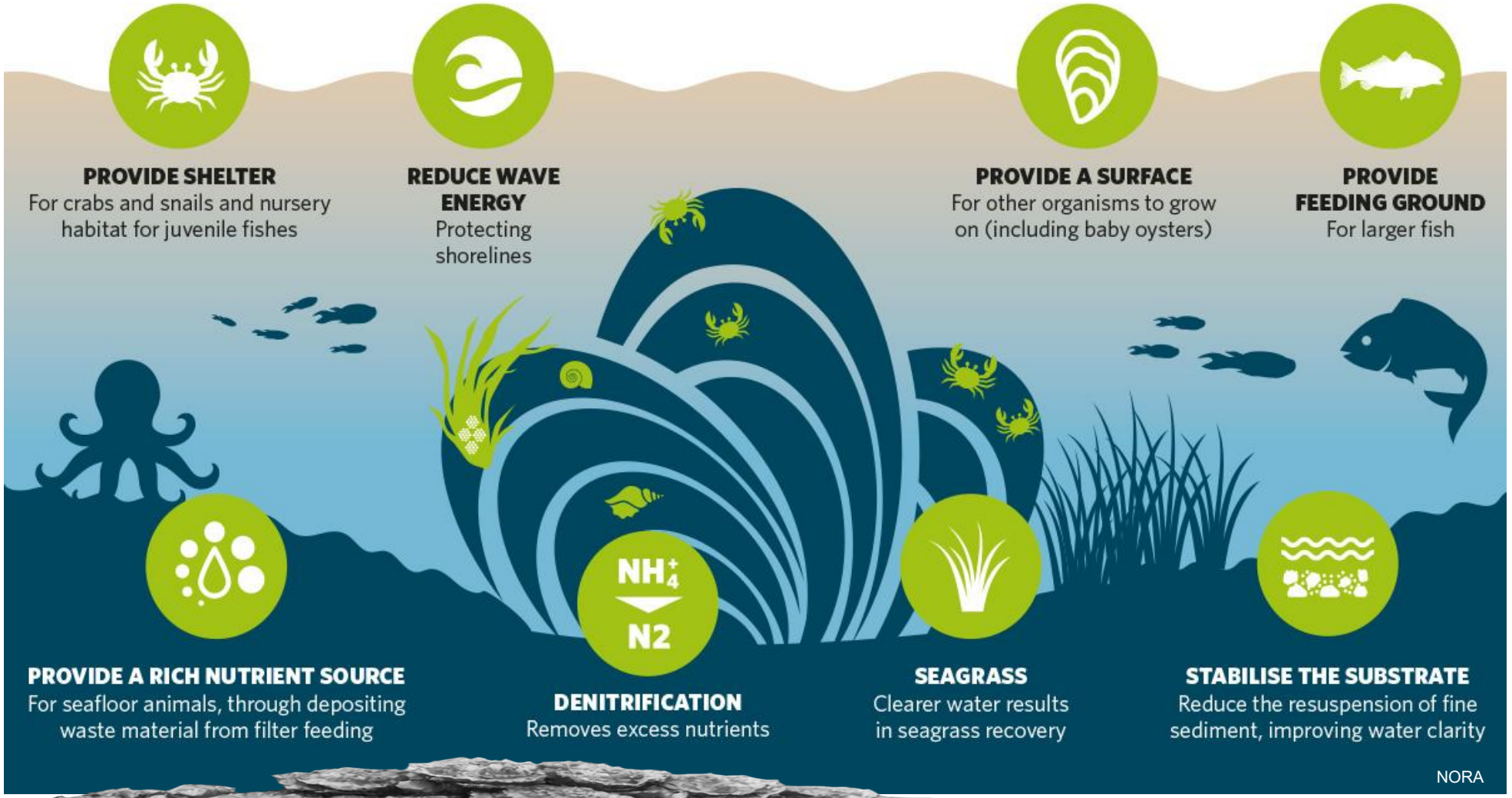
- Disproportionate levels of recovery across the bay

- Could be caused by various factors:
  - Investment
  - Sedimentation
  - Predator abundance
  - Environment

My work focuses on:
- Reproductive patterns
- Growth and mortality
- Oyster condition and associated fauna

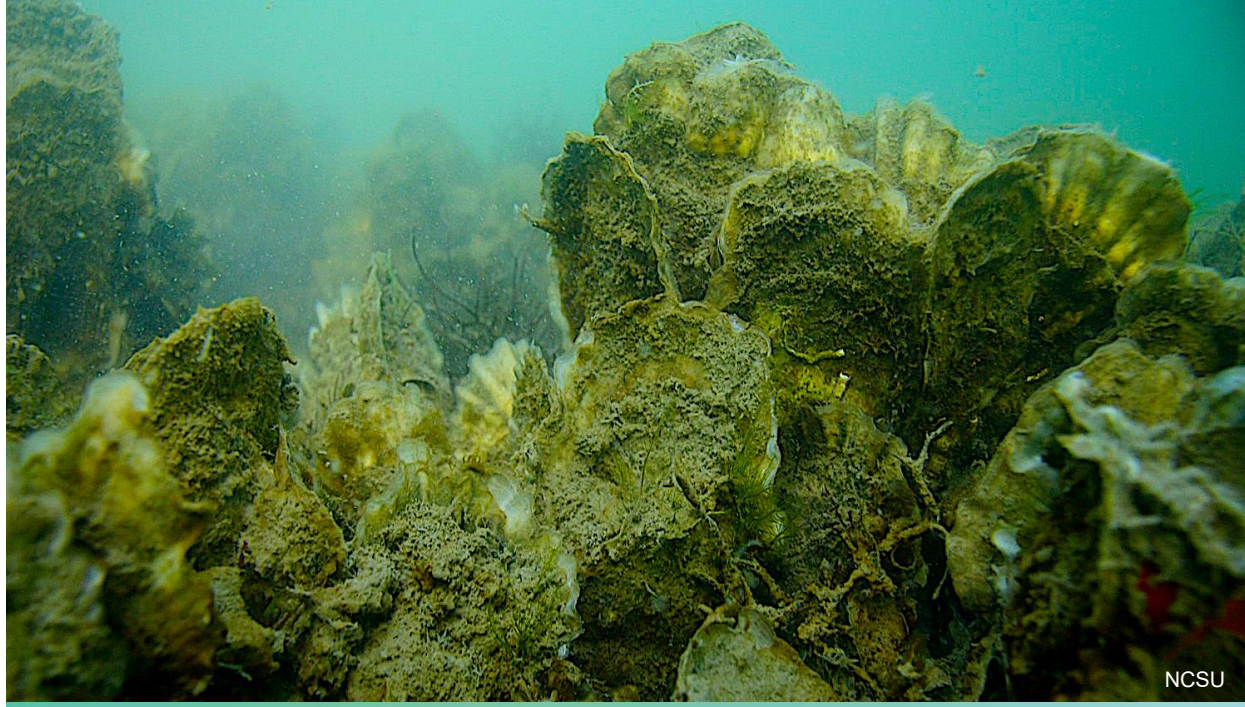


“Multidimensional Foundation Species” – Dr. Mansfield



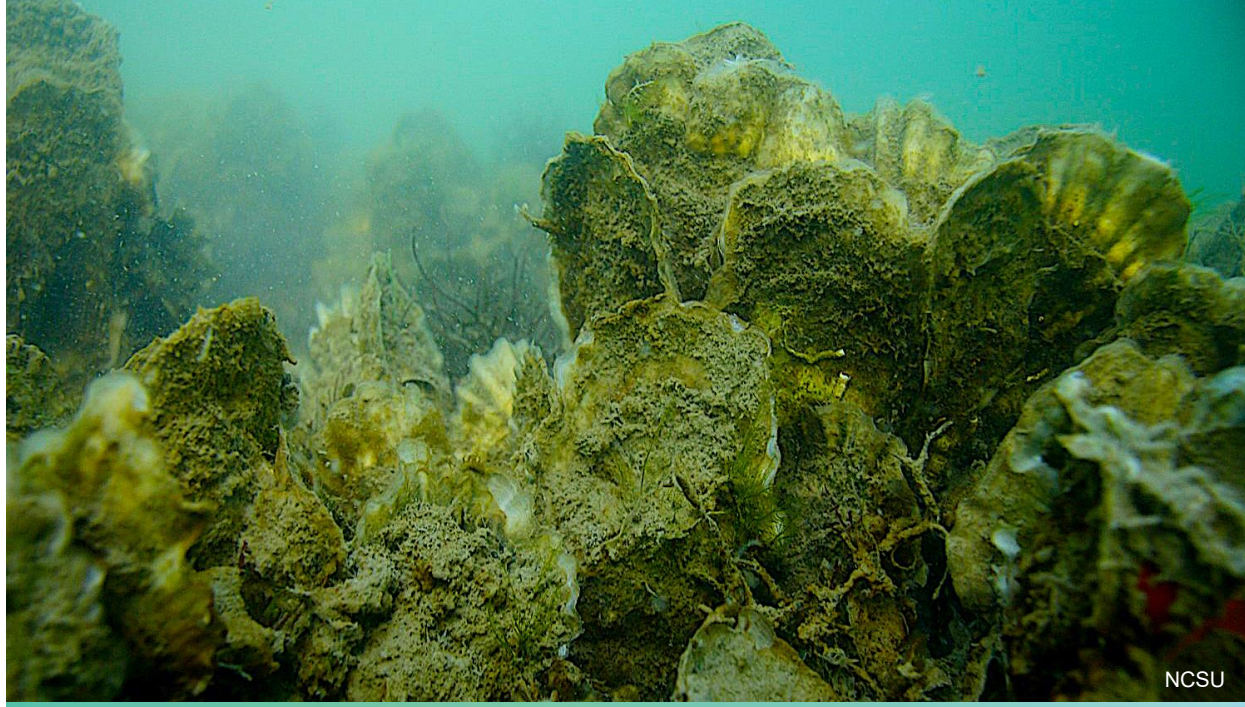
Oyster Reef Ecology

- Oysters create habitat for other species
- Can include fish



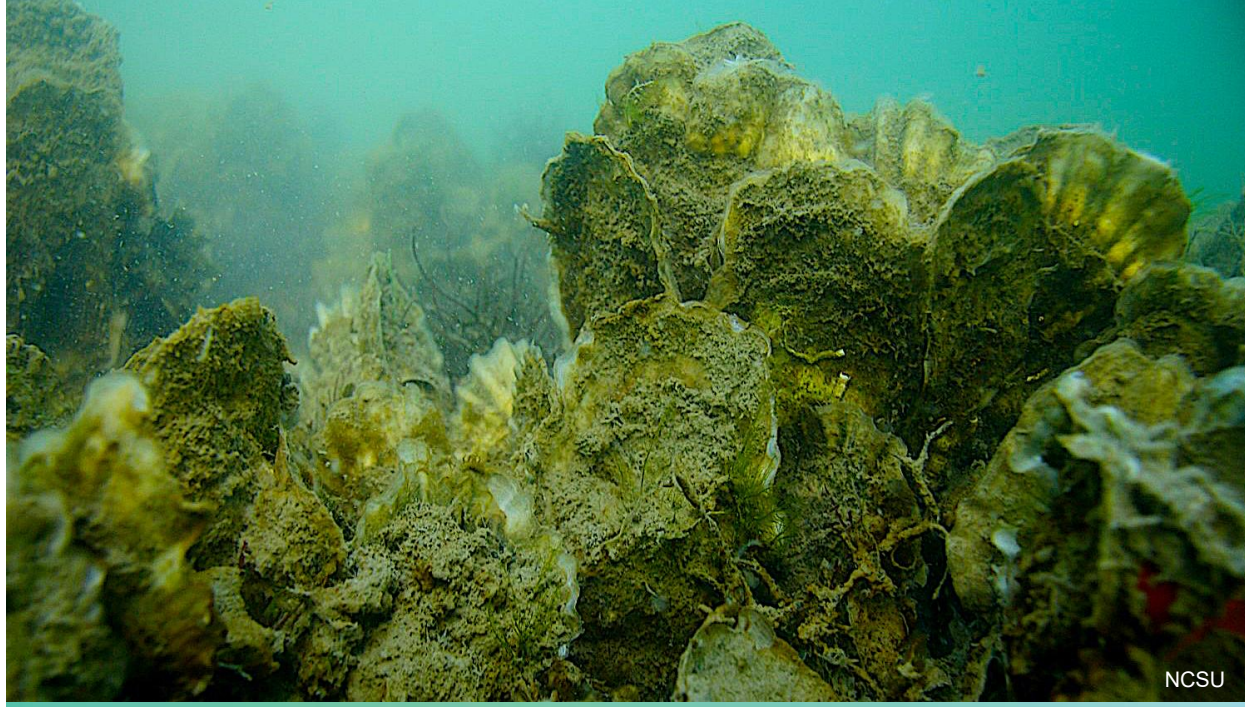
Oyster Reef Ecology

- Oysters create habitat for other species
- Can include fish
- Can also include many invertebrate species



Oyster Reef Ecology

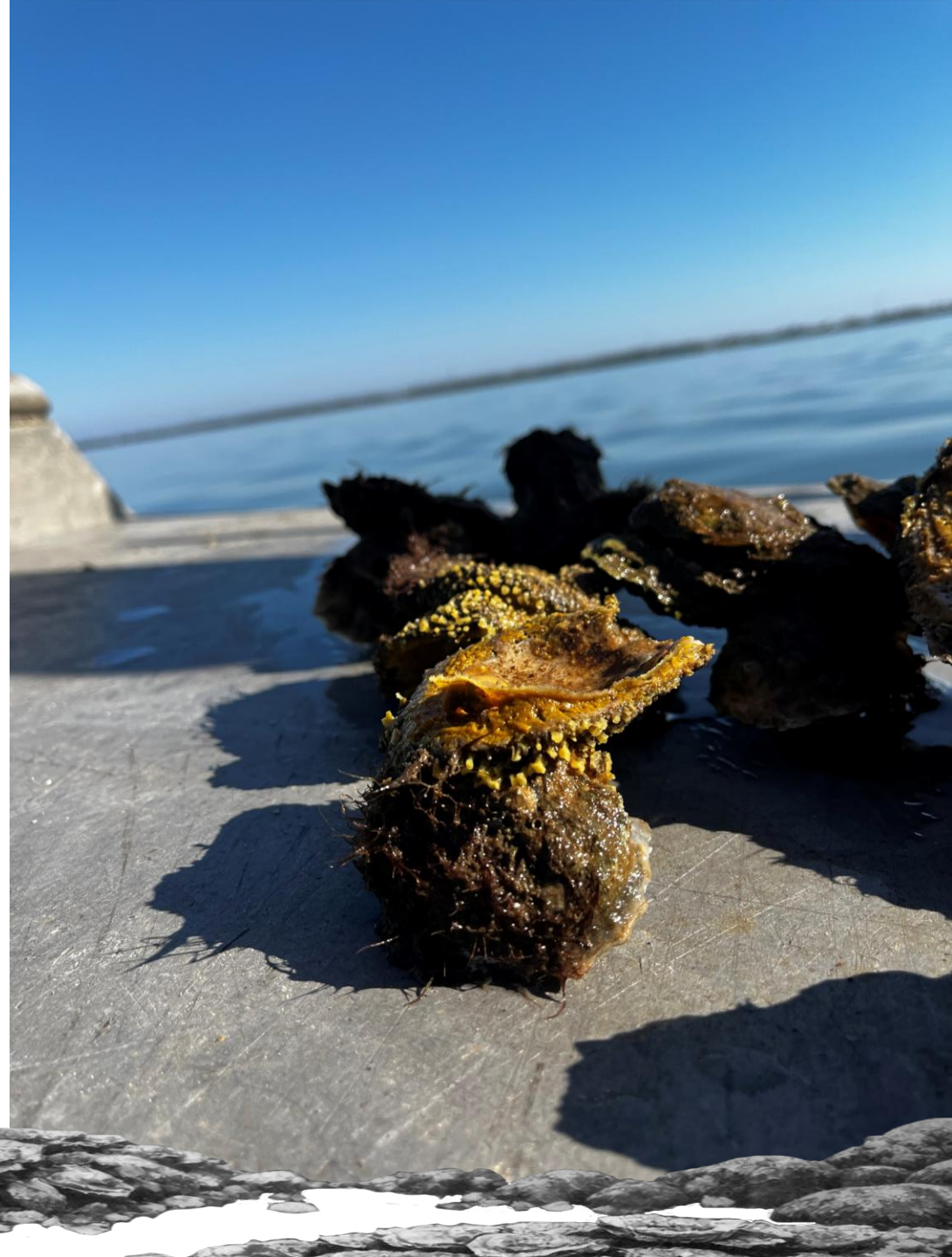
- Oysters create habitat for other species
- Can include fish
- Can also include many invertebrate species
- Epifauna live attached directly to the oysters



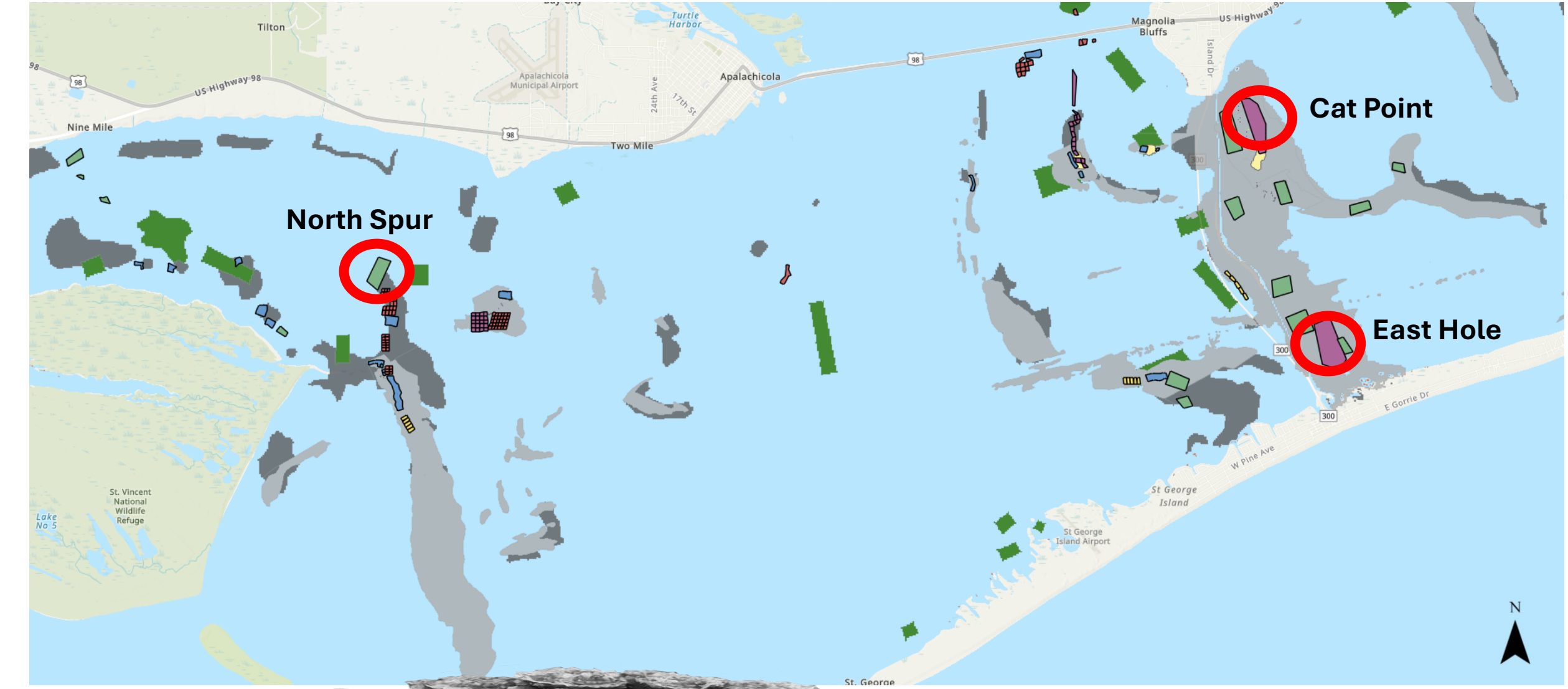
Guiding Questions

1). What epifaunal organisms are commonly found attached to the oysters, are any known to be detrimental to oyster health?

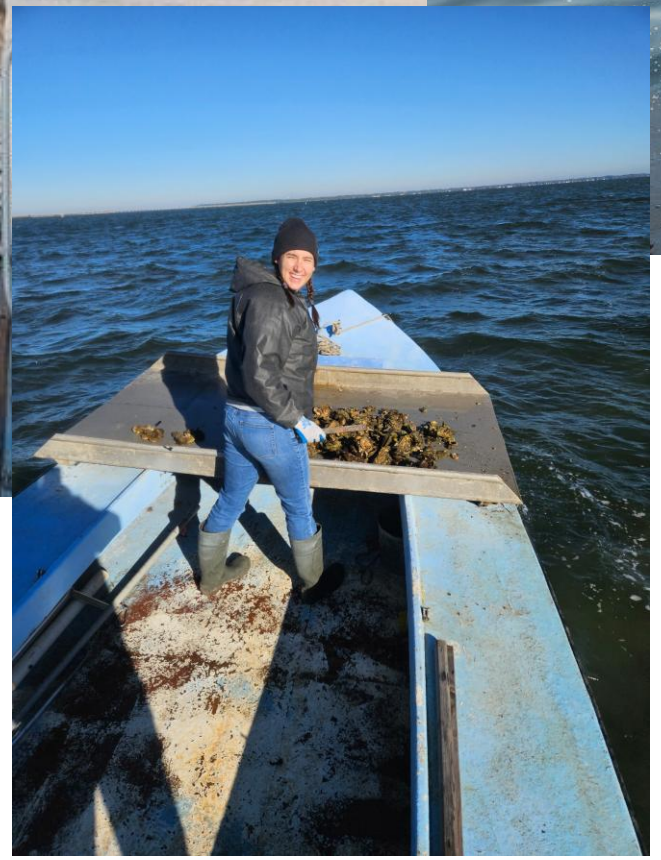
2). How do these communities change across the bay?



Methods


North Spur
Cat Point
East Hole
Tilton
US Highway 98
Nine Mile
Two Mile
Apalachicola
Apalachicola Municipal Airport
Turtle Harbor
Magnolia Bluffs
US Highway 98
Island Dr
24th Ave
17th St
St. Vincent National Wildlife Refuge
Lake No 5
St George Island
St George Island Airport
W Pine Ave
E Gorrie Dr
St. George
N

Methods



20-30 oysters from each site sampled monthly in 2025

Oysters measured, epifauna identified

Tissues from half of the collected oysters dried and condition indices calculated

Methods

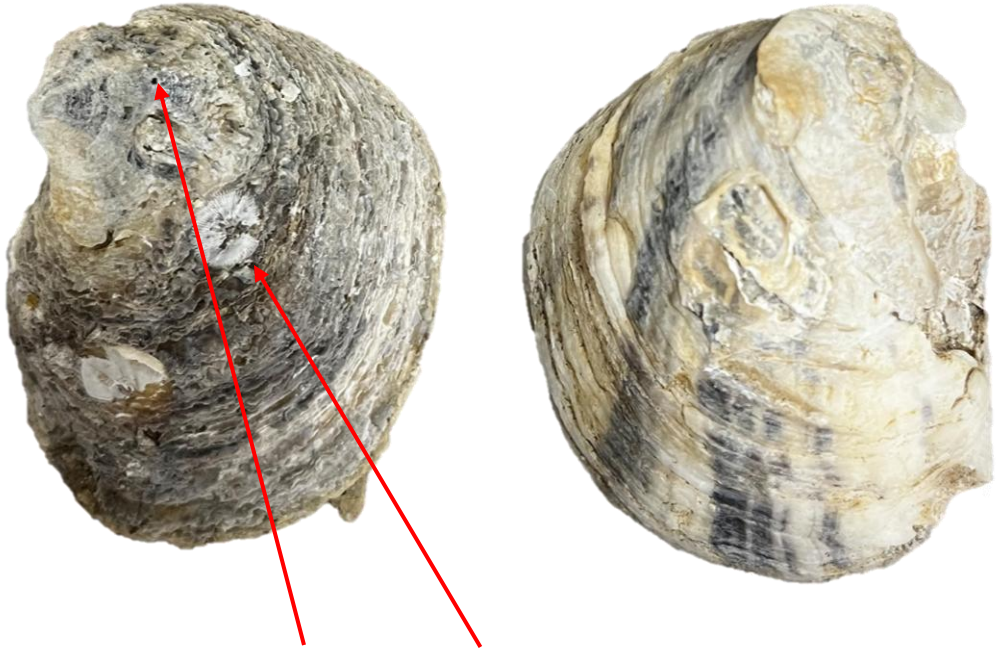
Rank	Title	Description
1	Light, no boring	Few epifaunal taxa present. Only encrusting species observed.

Some evidence of encrusting epifauna

Inner surface clear, no staining

Methods

Rank	Title	Description
1	Light, no boring	Few epifaunal taxa present. Only encrusting species observed.
2	Light, with boring	Few epifaunal and boring taxa present. Indications of shell boring on outer surface.

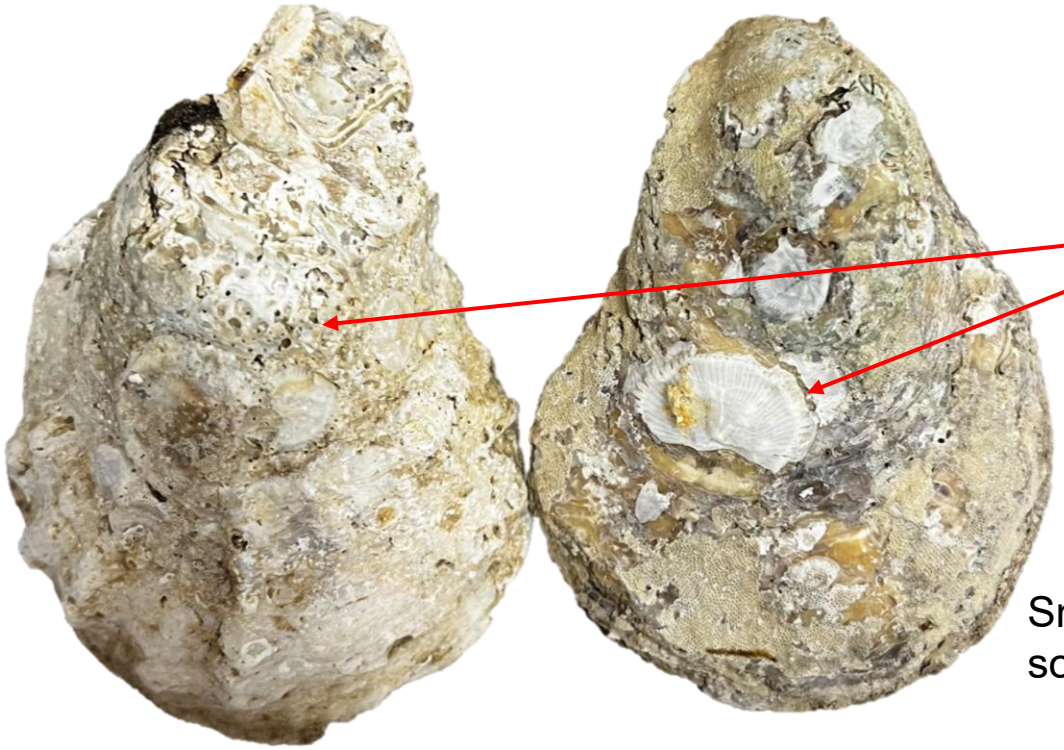


Evidence of boring and epifaunal taxa

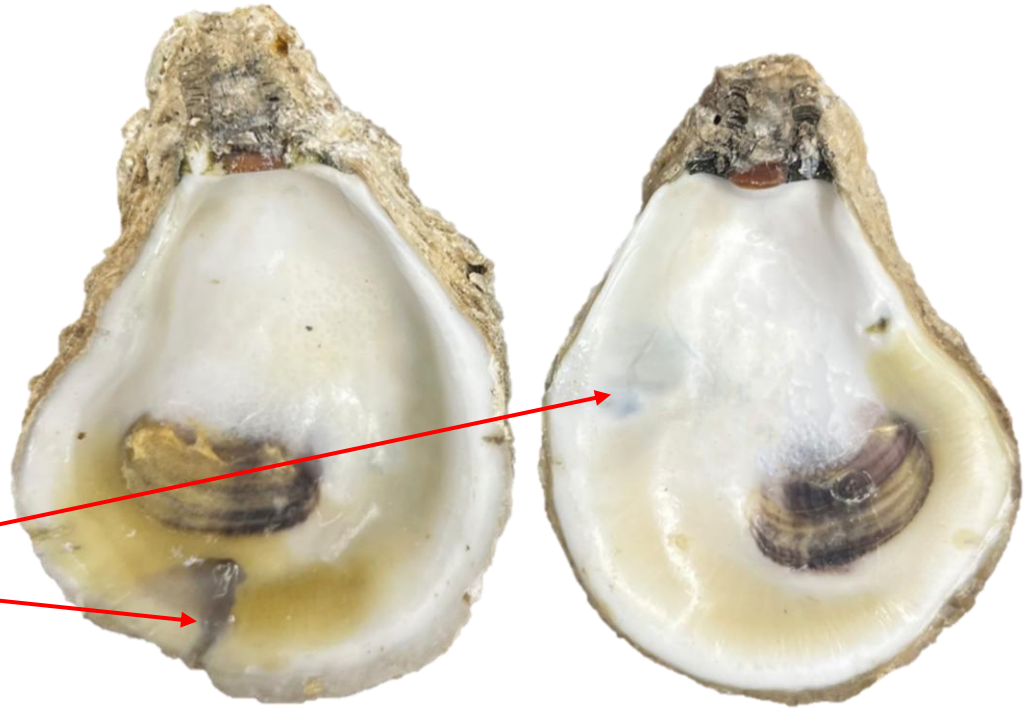
Inner nacre clear, some staining

Methods

Rank	Title	Description
1	Light, no boring	Few epifaunal taxa present. Only encrusting species observed.
2	Light, with boring	Few epifaunal and boring taxa present. Indications of shell boring on outer surface.
3	Moderate	Notable presence of epifauna and boring taxa. Clear evidence of boring and some blisters on inner surface.



Epifauna, pits lefts by boring taxa

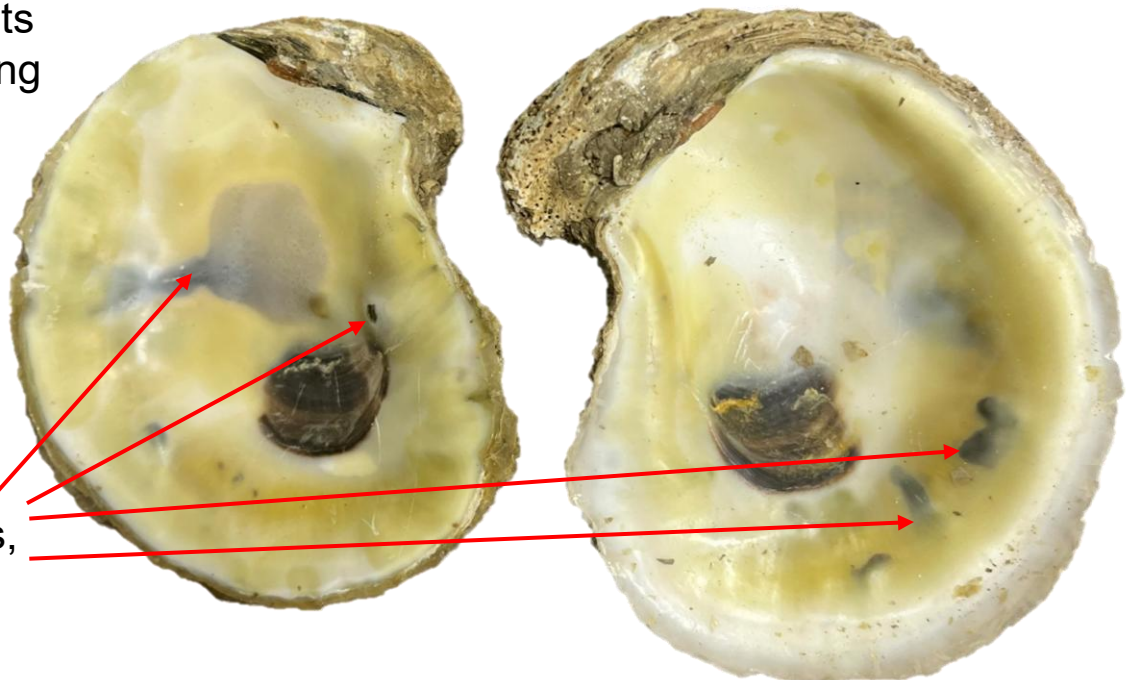


Small blisters, some staining

Methods

Rank	Title	Description
1	Light, no boring	Few epifaunal taxa present. Only encrusting species observed.
2	Light, with boring	Few epifaunal and boring taxa present. Indications of shell boring on outer surface.
3	Moderate	Notable presence of epifauna and boring taxa. Clear evidence of boring and some blisters on inner surface.
4	Heavy	High prevalence of epifauna and boring taxa. Several sizable blisters on inner surface.

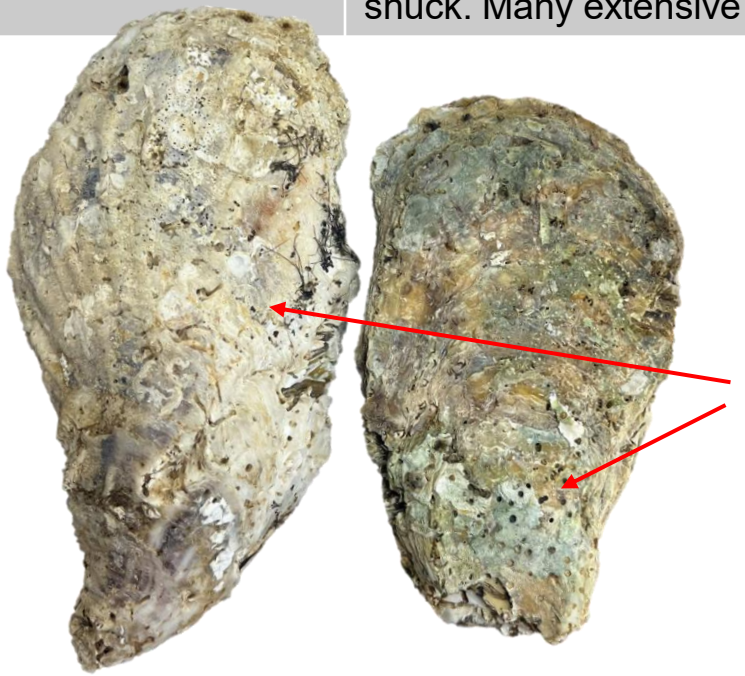
Epifauna, pits lefts by boring taxa



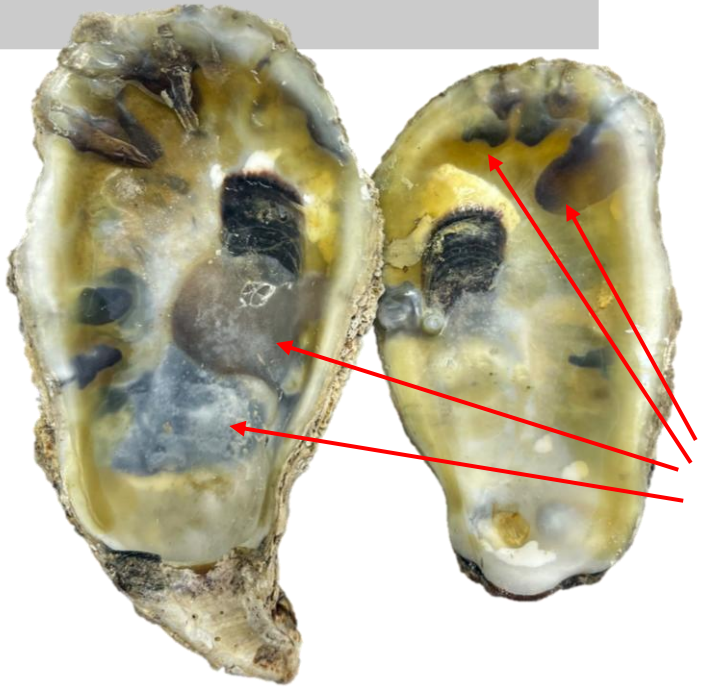
Multiple blisters, some sizable

Methods

Rank	Title	Description
1	Light, no boring	Few epifaunal taxa present. Only encrusting species observed.
2	Light, with boring	Few epifaunal and boring taxa present. Indications of shell boring on outer surface.
3	Moderate	Notable presence of epifauna and boring taxa. Clear evidence of boring and some blisters on inner surface.
4	Heavy	High prevalence of epifauna and boring taxa. Several sizable blisters on inner surface.
5	Severe	Shells almost covered by epifauna and boring taxa. Shells brittle and difficult to shuck. Many extensive blisters on inner surface.



Numerous scars from boring taxa

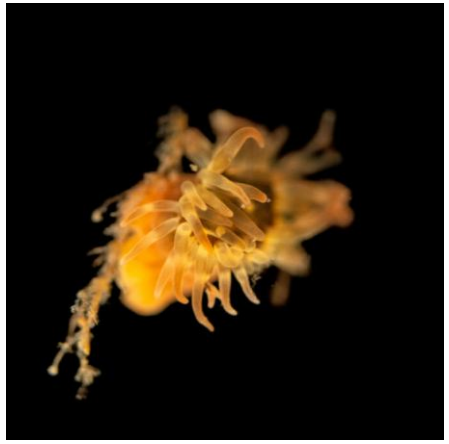


Many sizable blisters

Results – What epifaunal organisms are commonly found attached to the oysters?

- 15 types of common epifaunal/boring taxa
- Most were encrusting

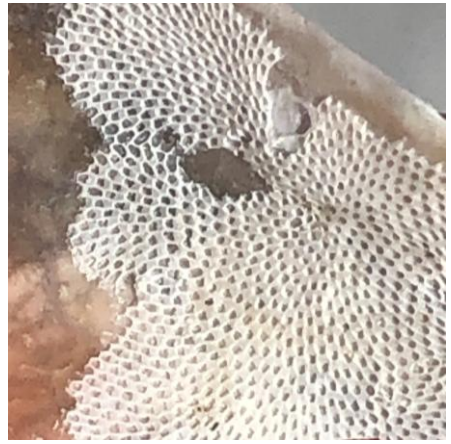
Fouling Anemones



Algae

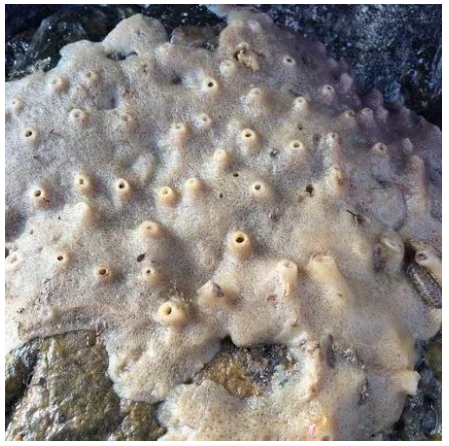
Balanoid Barnacles

Bryozoans



Hydroids

Porifera



Serpulids

Crepidula sp.

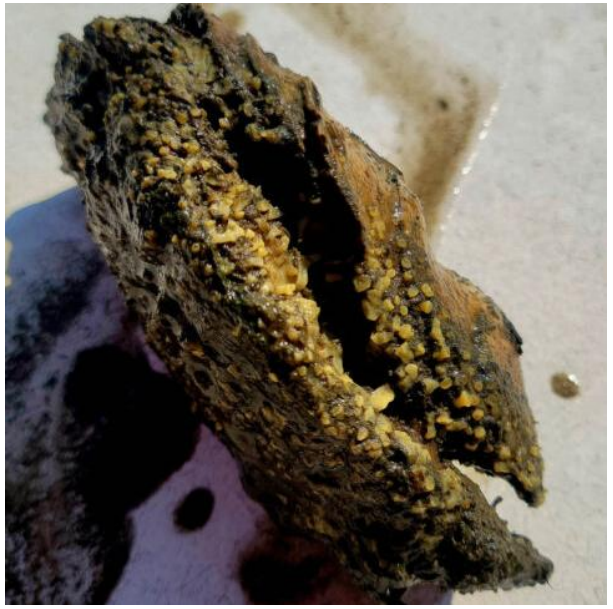
Styela sp.

Results – What epifaunal organisms are commonly found attached to the oysters?

- 16 types of epifaunal/boring taxa
- Most were encrusting
- Some burrowed into the oyster shells or were ectoparasites

Diplothyra sp.
Boring Clams

Cliona spp.
Boring Sponge



Polydora sp.
Mud Blister Worm

Boonea impressa
Impressed Odostome

Results – What epifaunal organisms are commonly found attached to the oysters?

- 16 types of epifaunal/boring taxa
- Most were encrusting
- Some burrowed into the oyster shells or were ectoparasites
- Some were other filter-feeding bivalves that could compete for food resources

Modulis sp.
Mussels

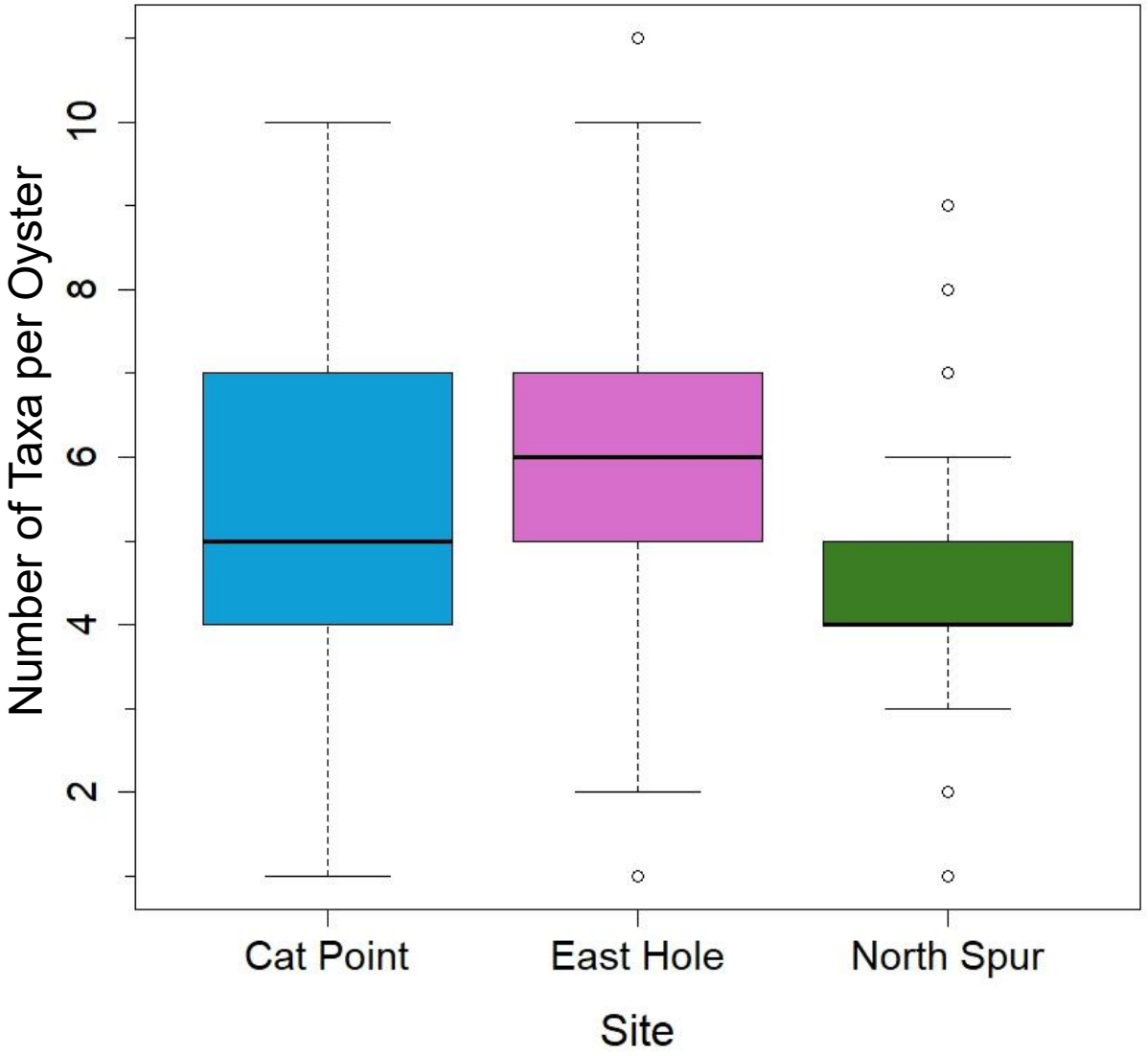
Crassostrea virginica
Eastern Oyster

Results – How do these communities change across the bay?

- East Hole had the most epifaunal taxa per oyster

- North Spur had the lowest epifaunal diversity overall

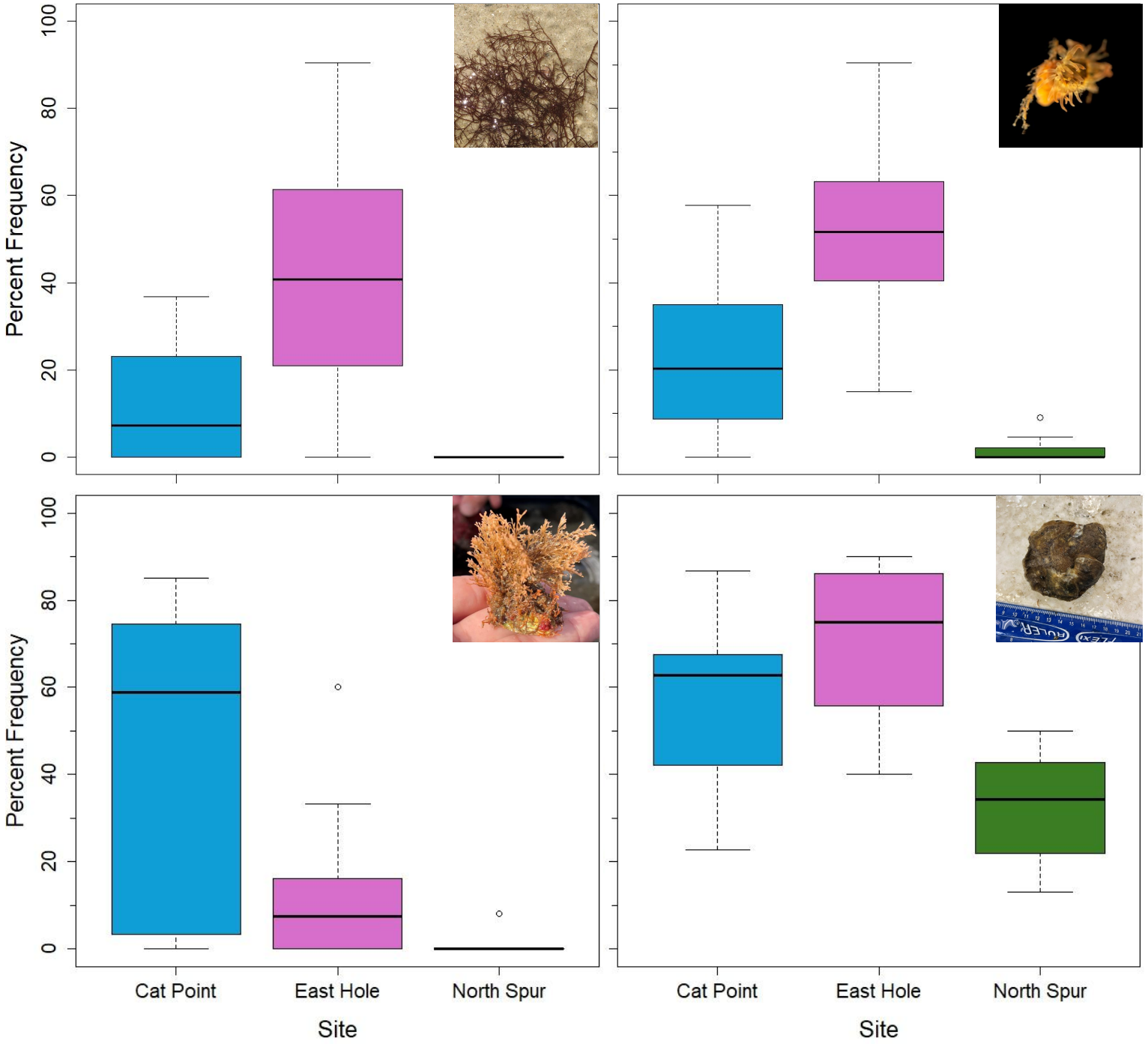
- Species evenness was higher at Cat Point (0.85) and East Hole (0.88) than at North Spur (0.75)



Results – How do the communities change across the bay?

- Cat Point and East Hole more likely to have:

- Algae
- Fouling Anemones
- Hydroids
- Oyster Spat

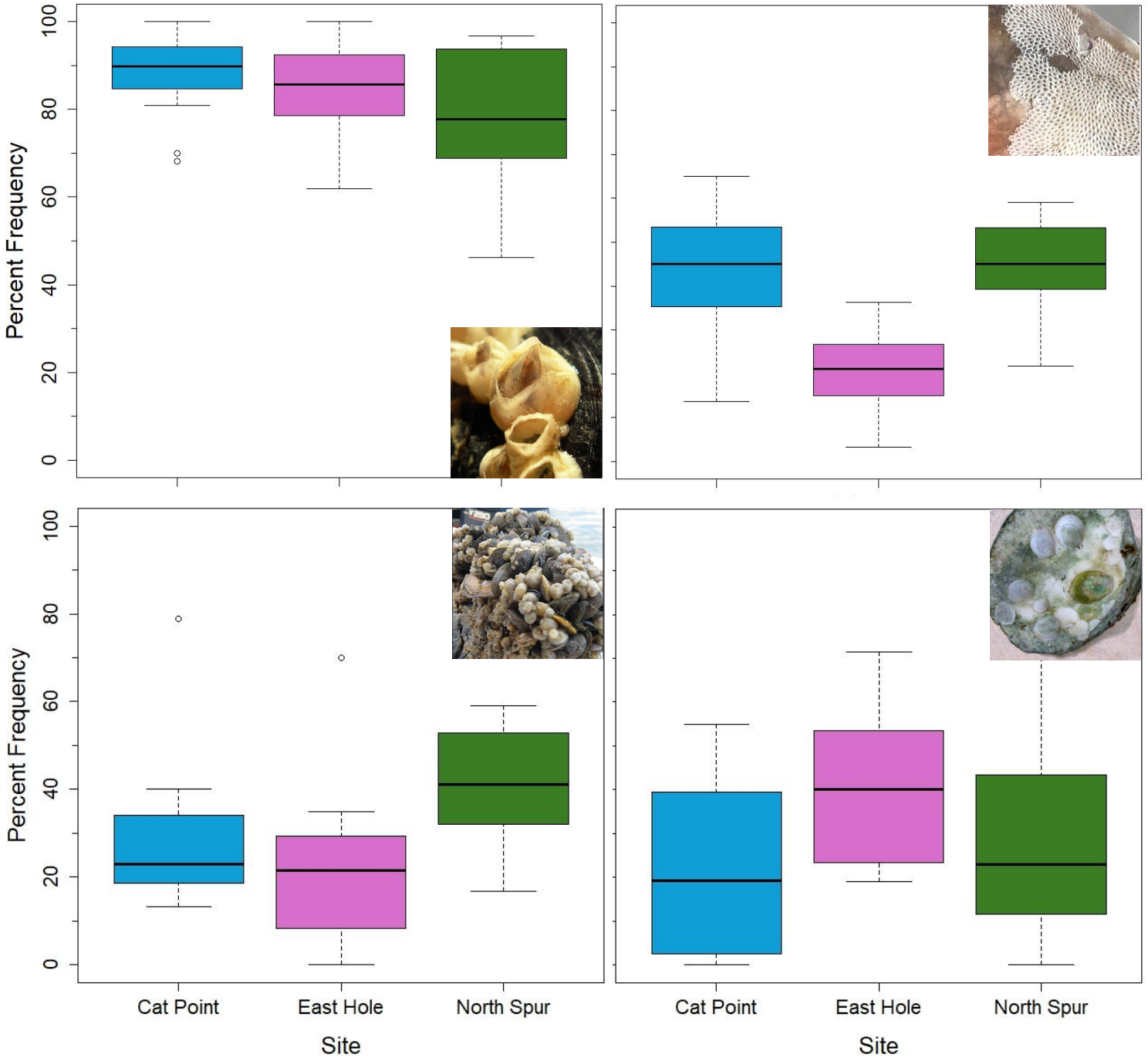


Results – How do the communities change across the bay?

- Oysters at North Spur commonly had epifaunal:

- Balanoid Barnacles
- Bryozoans
- *Modulis* mussels
- *Crepidula sp.* slipper shells

- Mussels were most seen on North Spur oysters

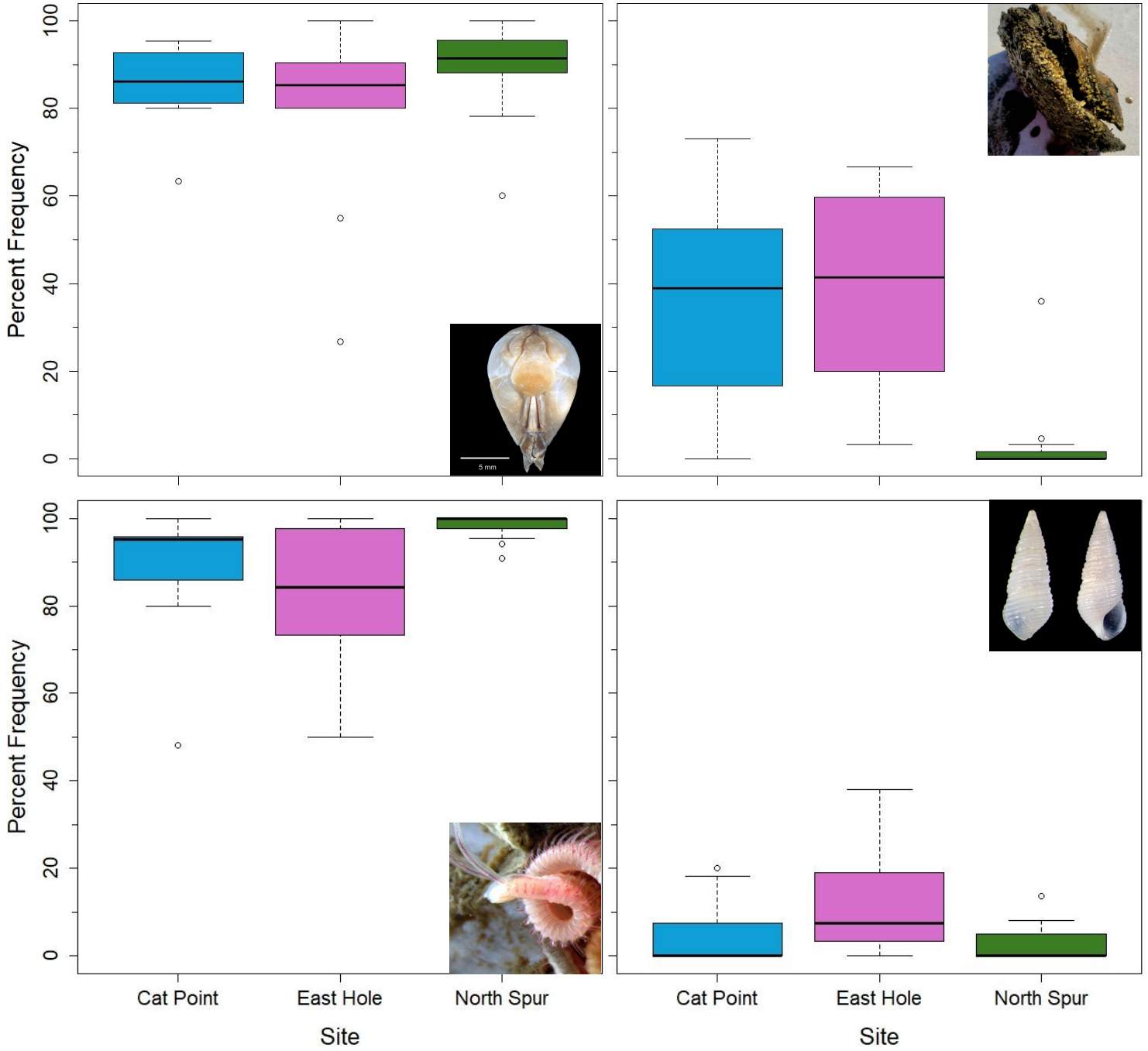


Results – How do the communities change across the bay?

- *Diplothyra* (boring clams) and *Polydora* (mud blister worms) were slightly more abundant at North Spur

- *Cliona* (boring sponge) was much more abundant at Cat Point and East Hole

- The ectoparasitic *Boonea impressa* was most abundant at East Hole



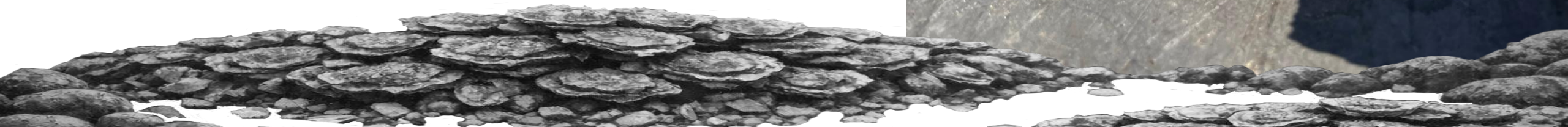
Guiding Questions

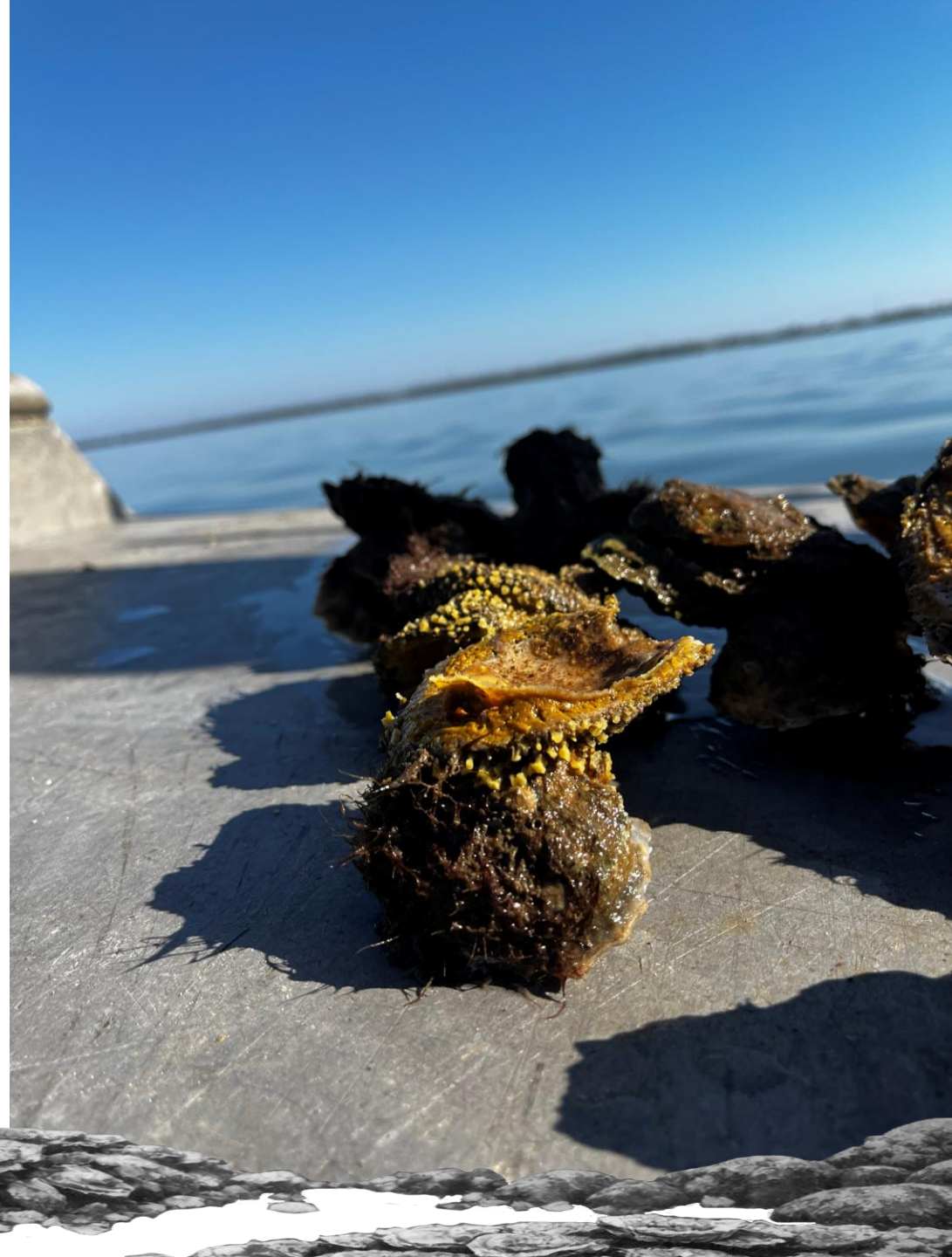
1). What epifaunal organisms are commonly found attached to the oysters, are any known to be detrimental to oyster health?

2). How do these communities change across the bay?

3). Does oyster health/condition change across the bay corresponding to these communities or any of the taxa?

- What about parasites?



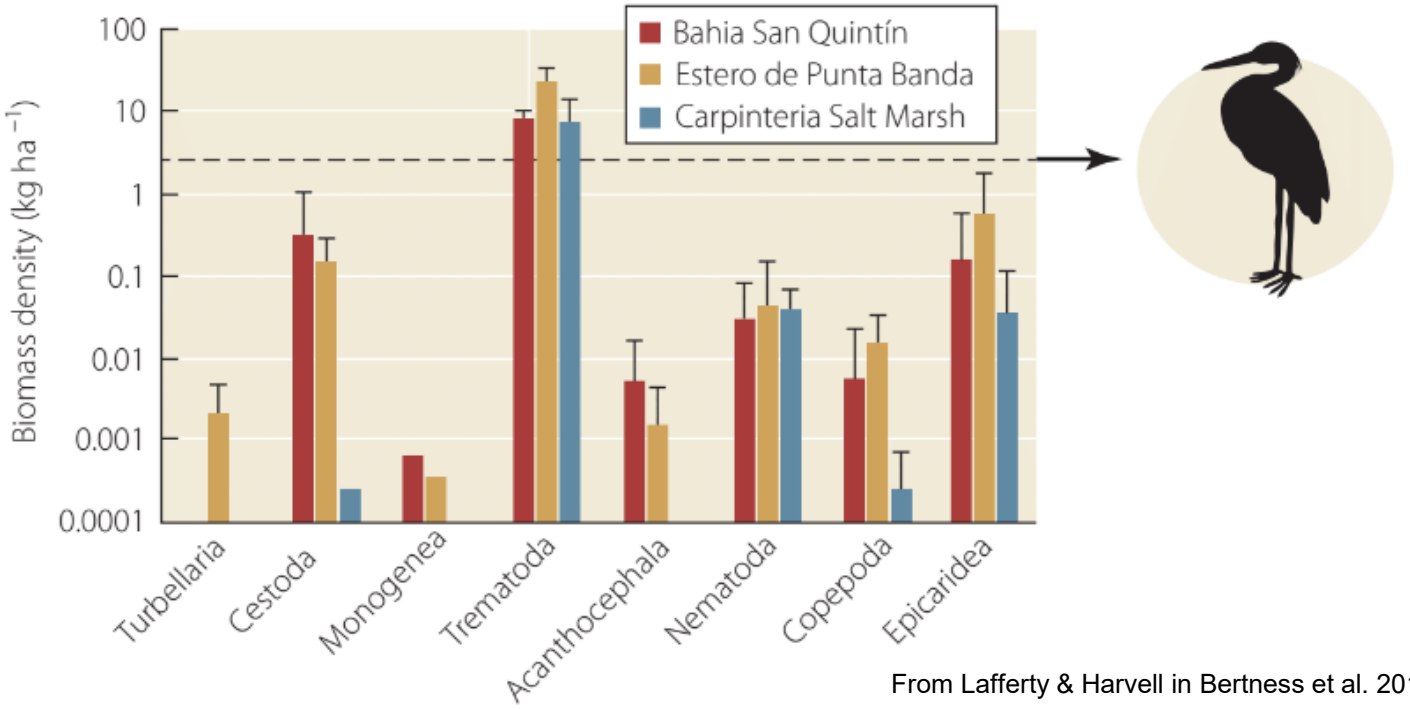


The Importance of Parasites

- Although small, parasites collectively can have greater biomasses than other ecosystem members

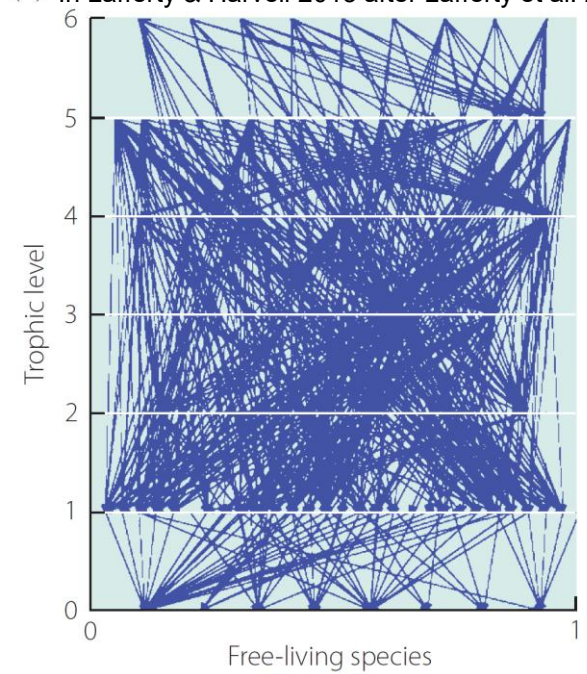
- Parasites influence energy flow through food webs

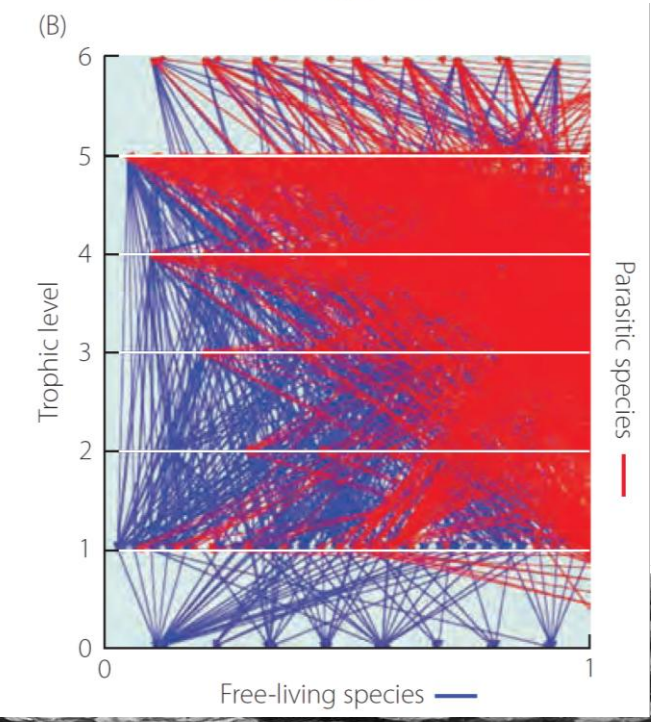
- Can influence the health of host individuals



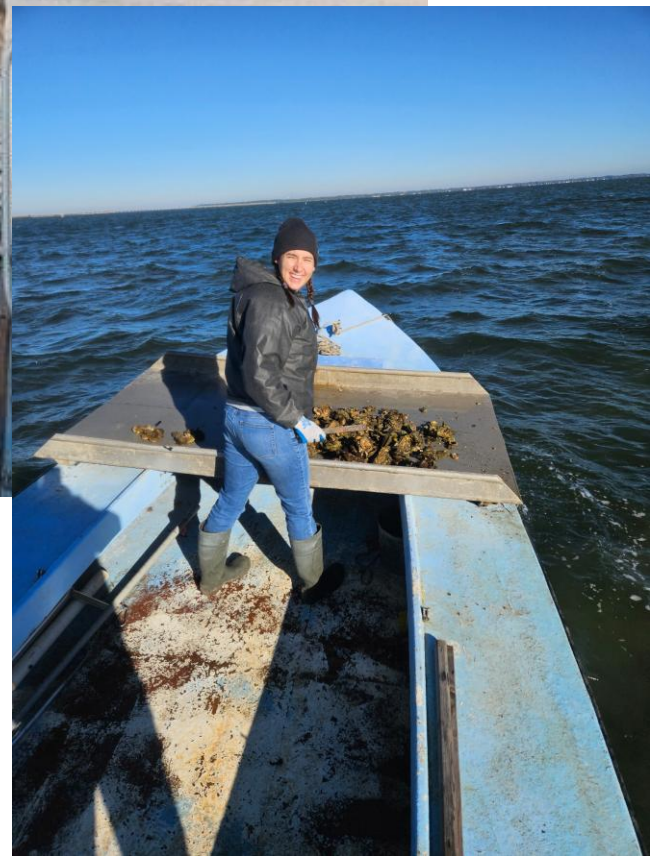
From Lafferty & Harvell in Bertness et al. 2013

(A) In Lafferty & Harvell 2013 after Lafferty et al. 2006

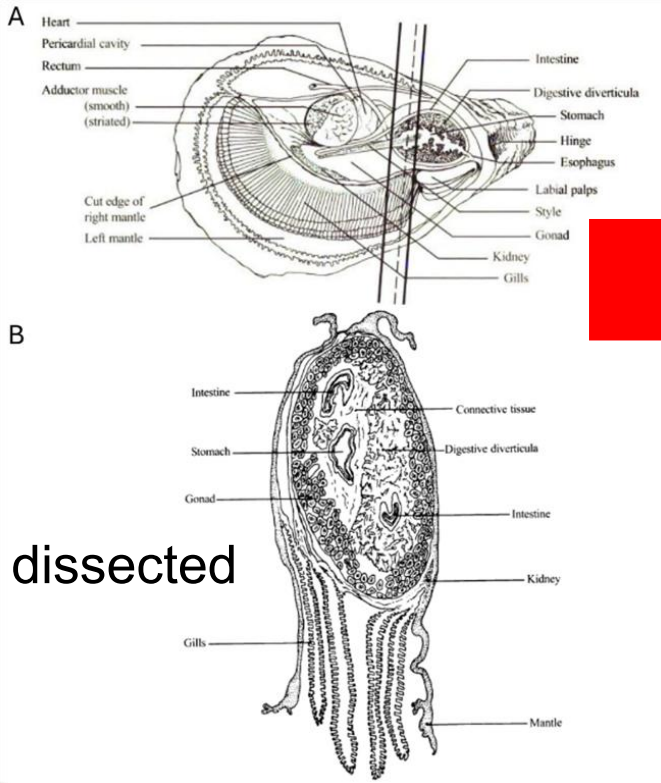




Methods



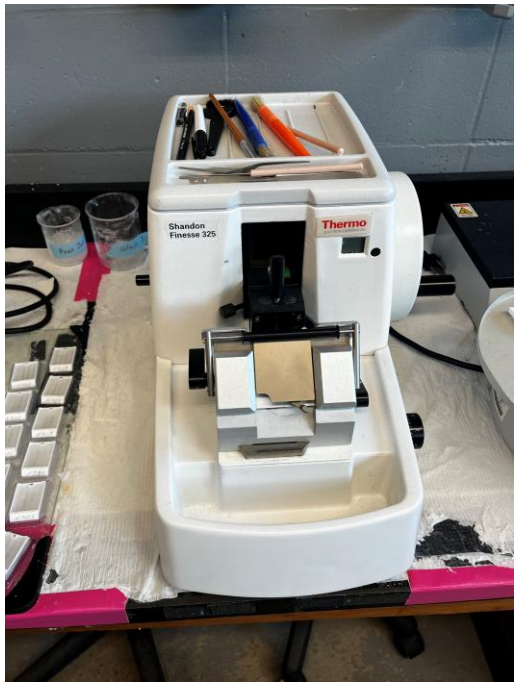
20-30 oysters from each site sampled monthly in 2025



Oysters dissected

Tissues embedded in wax blocks

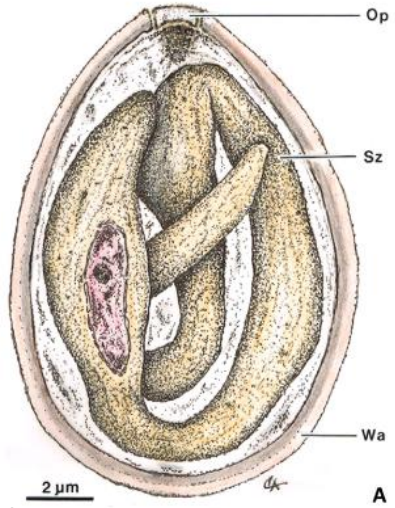
Blocks sliced and made into microscope slides



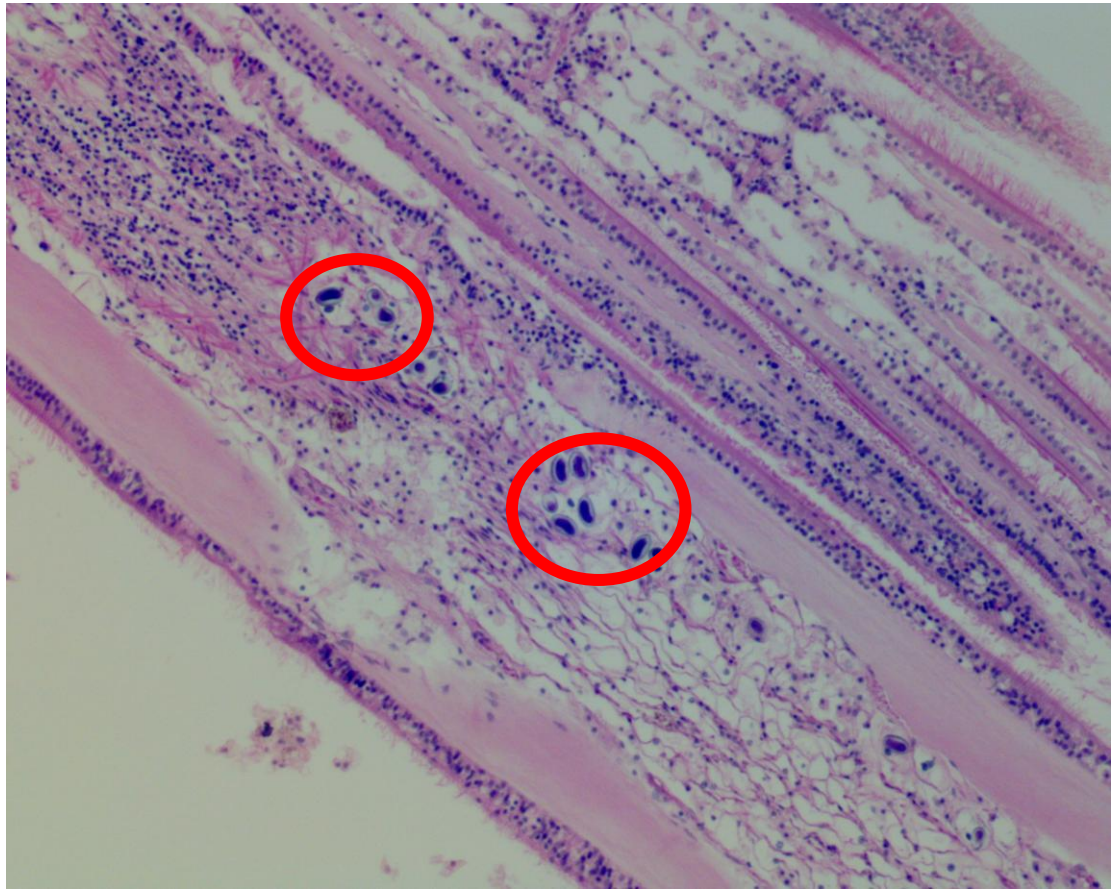
Methods

- *Nematopsis spp.* – a parasitic Gregarine protozoa

- Can cause inflammation and lesions in oyster gills



Azeveda et al., 2023



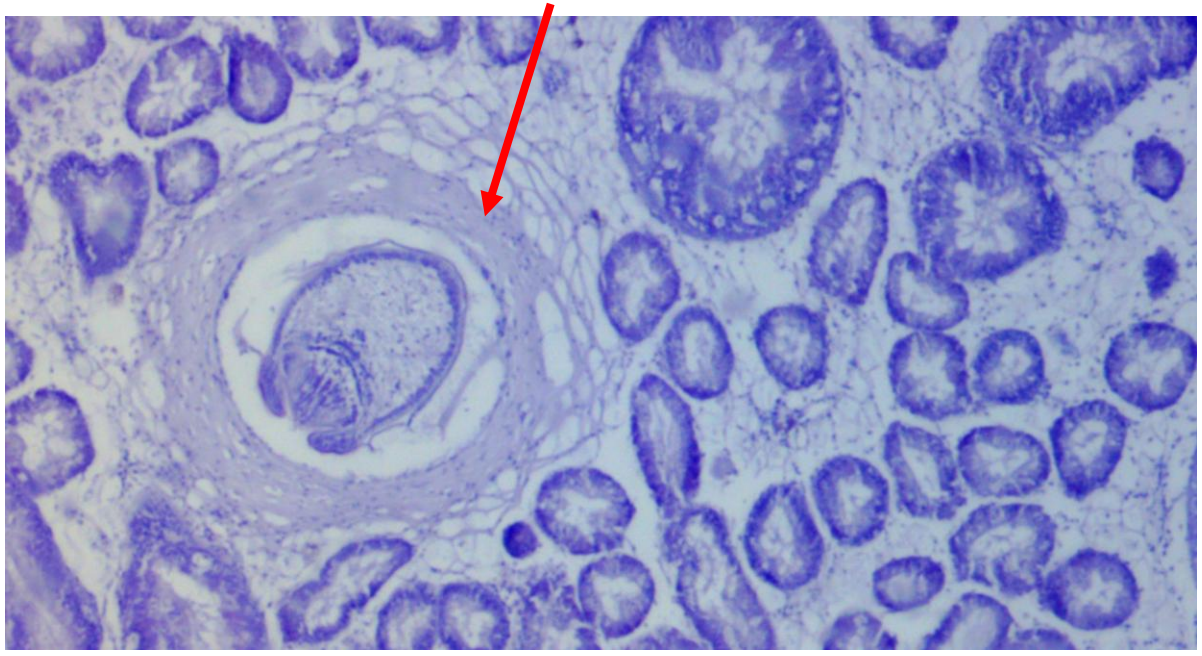
Methods

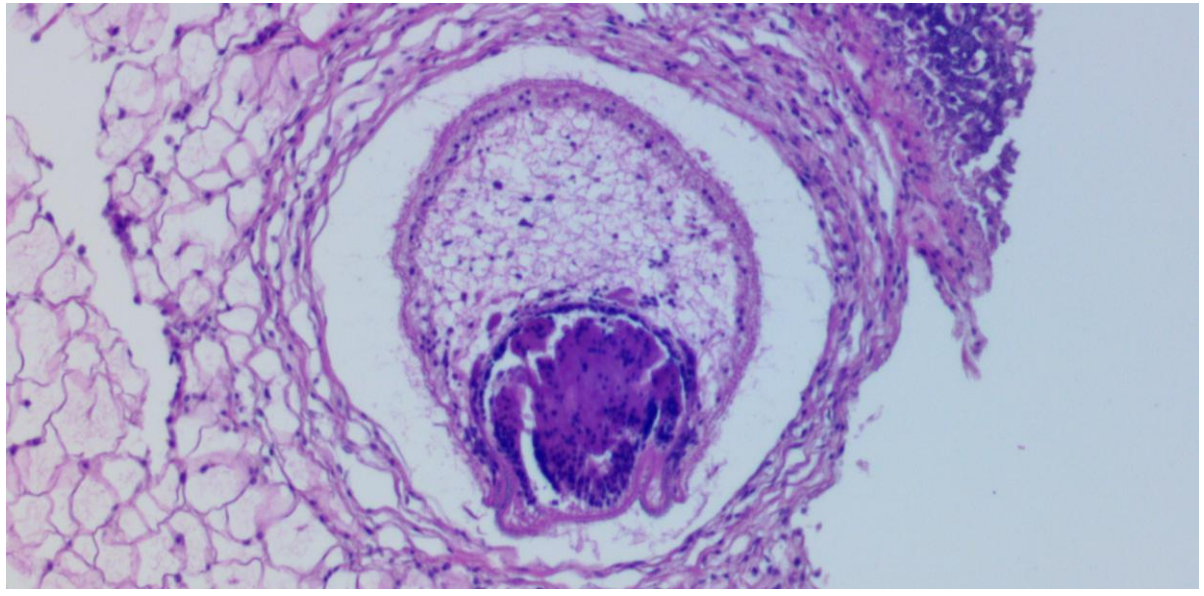
- *Tylocephalum sp.* – a trematode flatworm

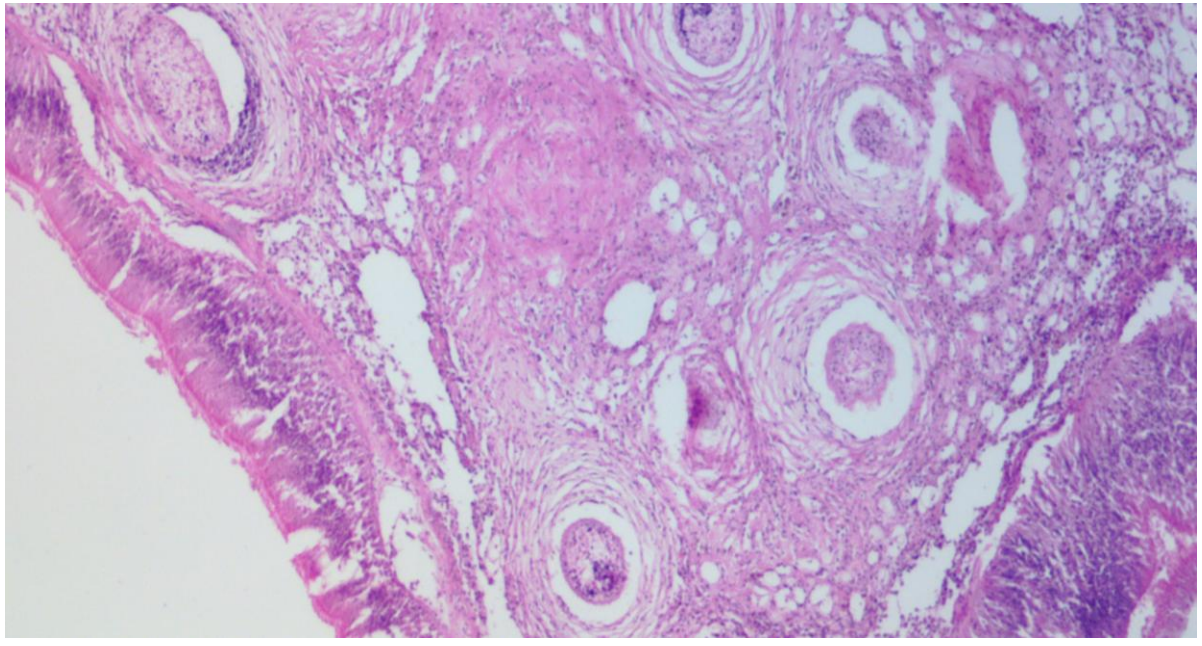
- Oyster immune systems respond by encapsulating the parasite

- Can lower reproductive investment and overall condition of the oyster

Tissue capsule around parasite





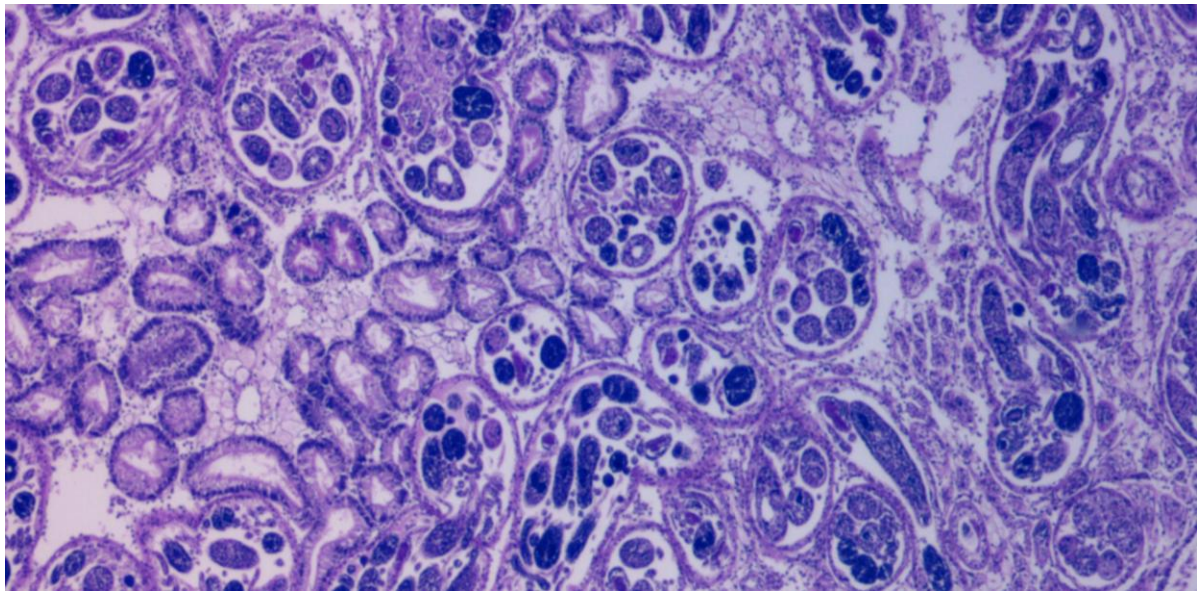


Methods

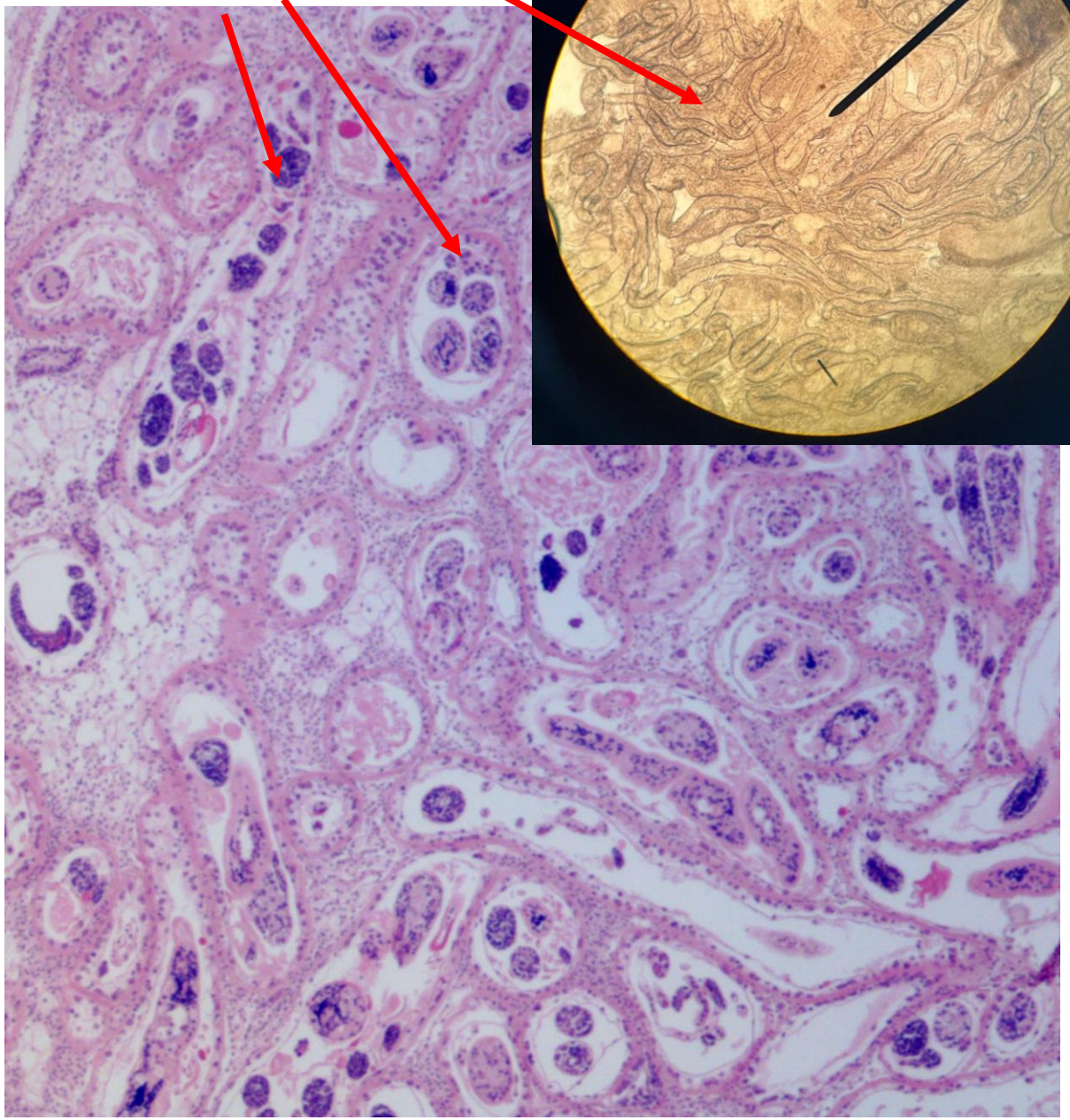
- *Bucephalus sp.* – a parasitic trematode

- Consumes the reproductive tissue of oysters (castrating parasite)

- Heavy infestations also disrupt feeding and respiration of the host oyster



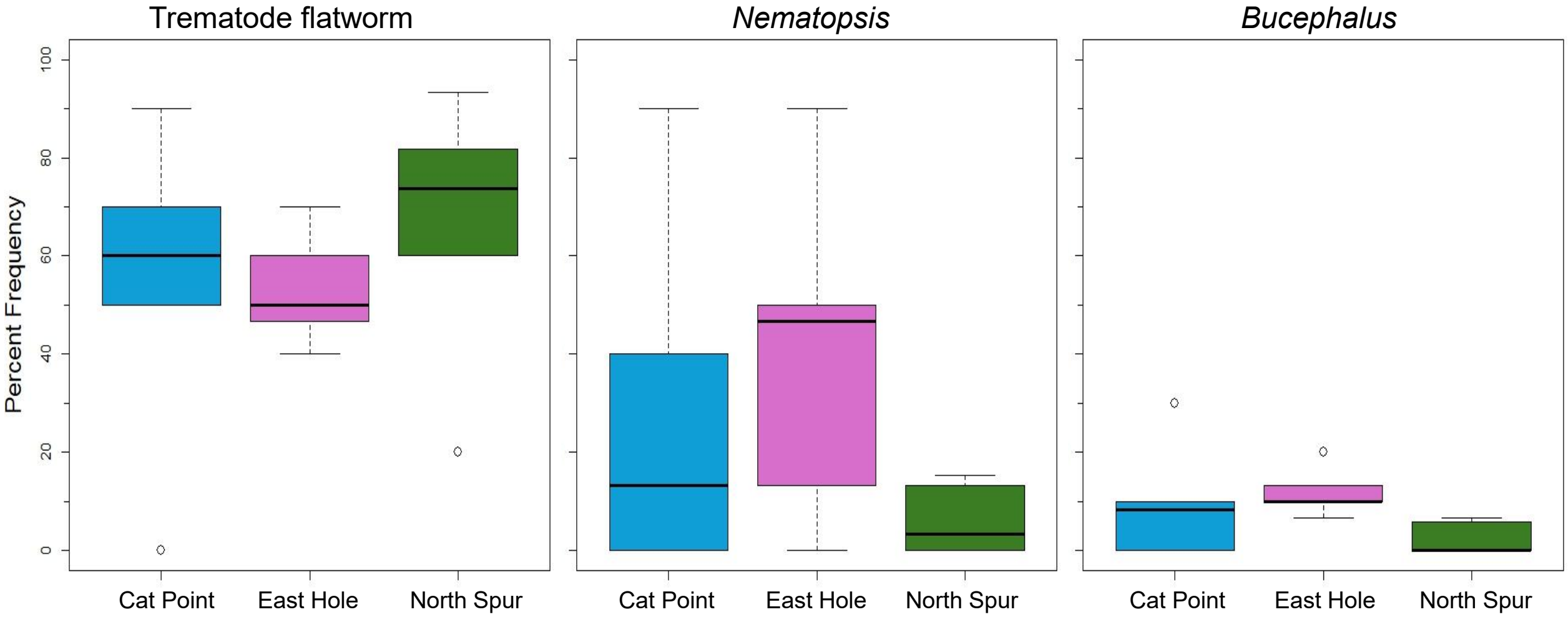
Worms found in oyster tissue



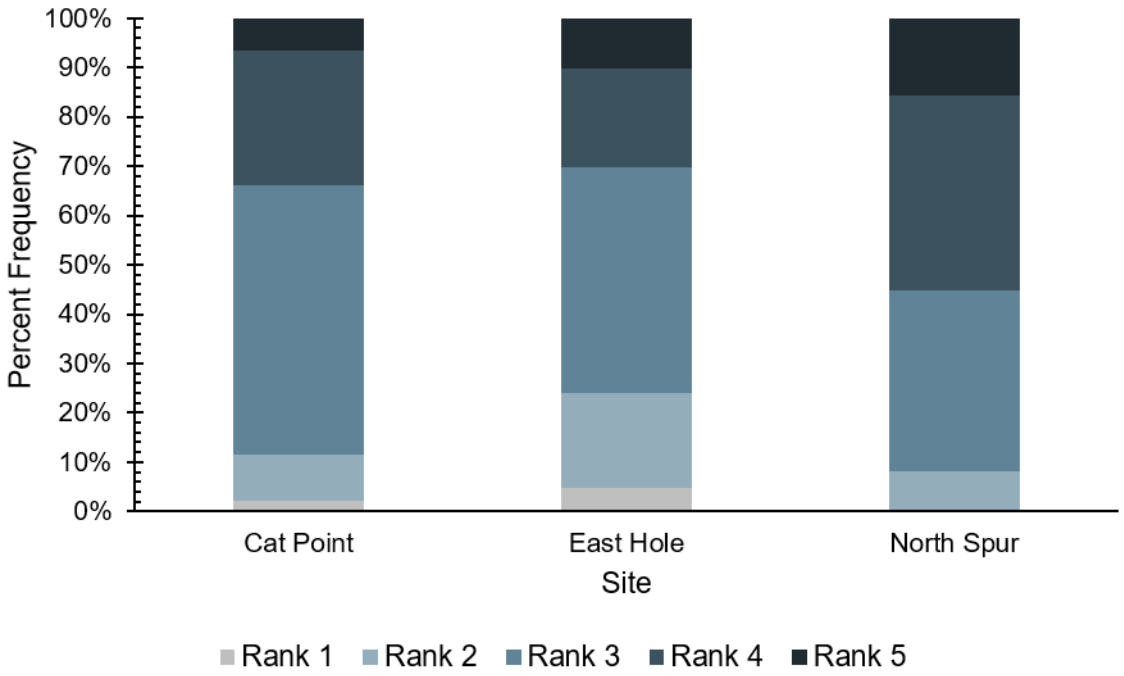
Results – How does parasite presence change across the bay?

- North Spur oysters are more likely to have trematode flatworms

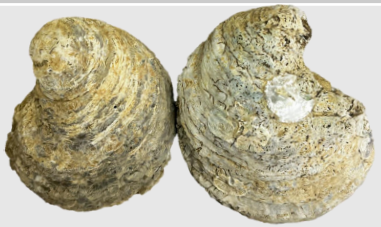
- Oysters from Cat Point and East Hole have higher occurrences of *Nematopsis* and *Bucephalus*



Results – Does oyster condition appear to correlate with any parasites or epifauna?

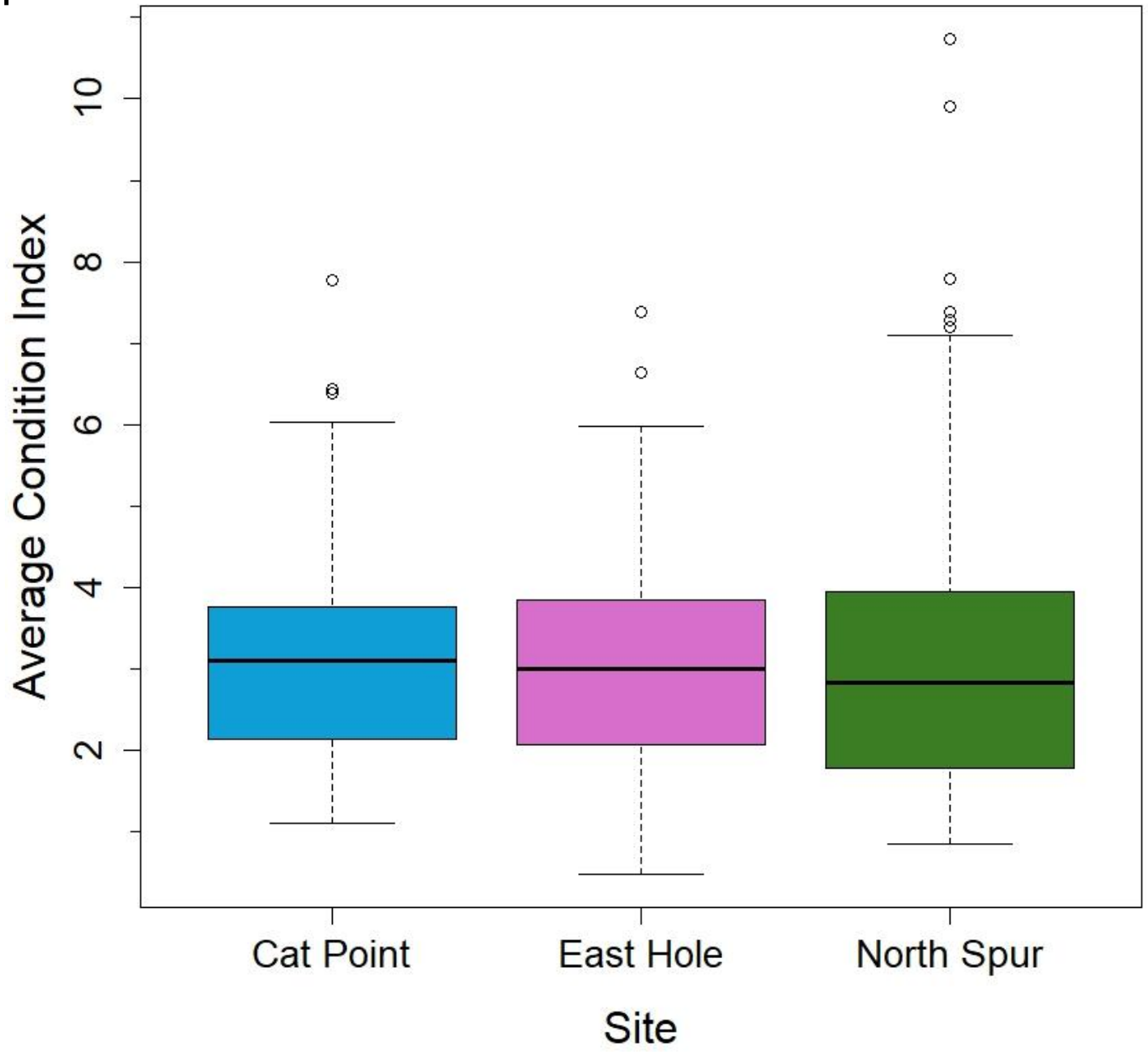


- North Spur had more oysters with shells ranked 4 and 5 and did not have any Rank 1

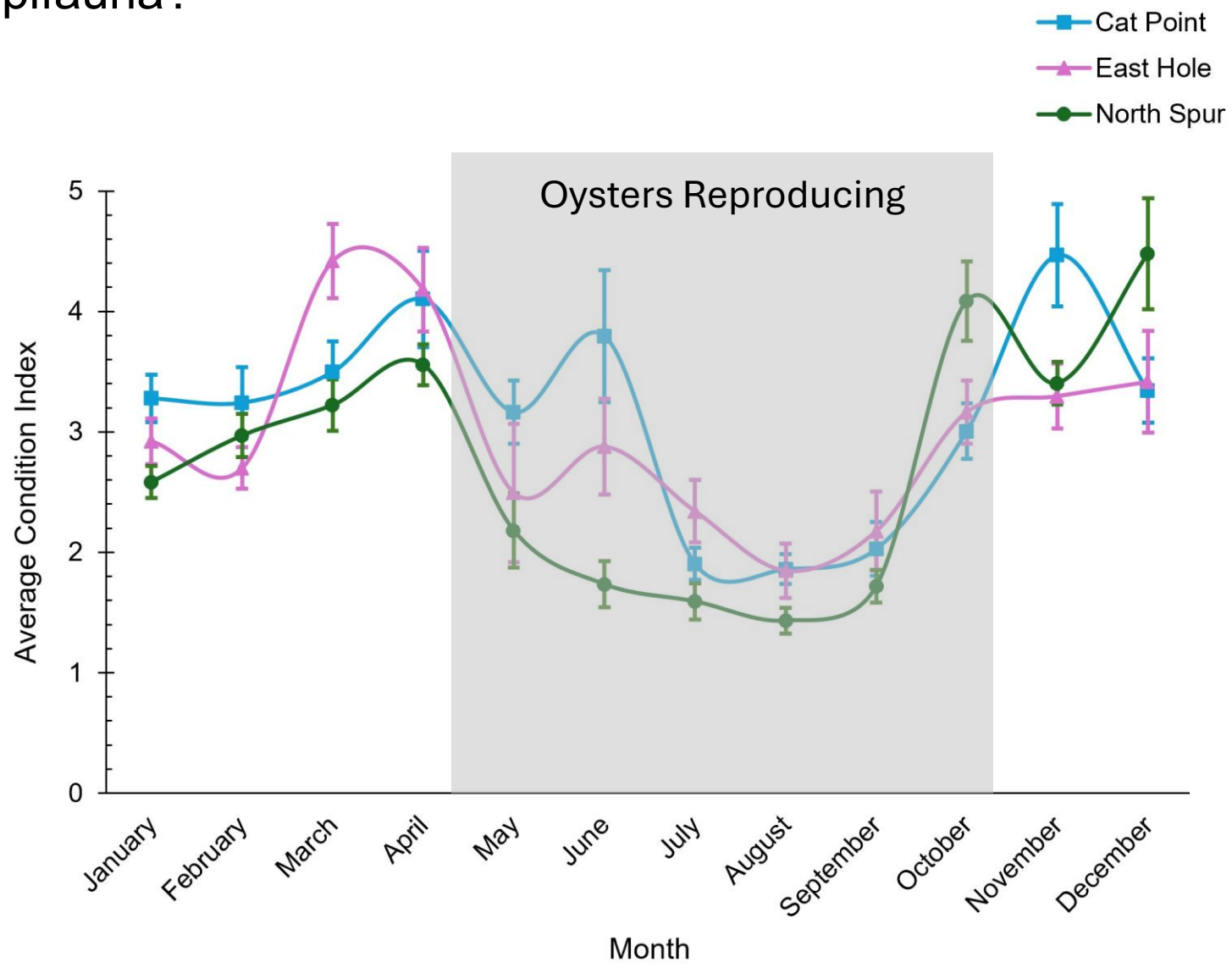
Rank	Title	Outer Surface	Inner Surface
1	Light, no boring		
2	Light, with boring		
3	Moderate		
4	Heavy		
5	Severe		

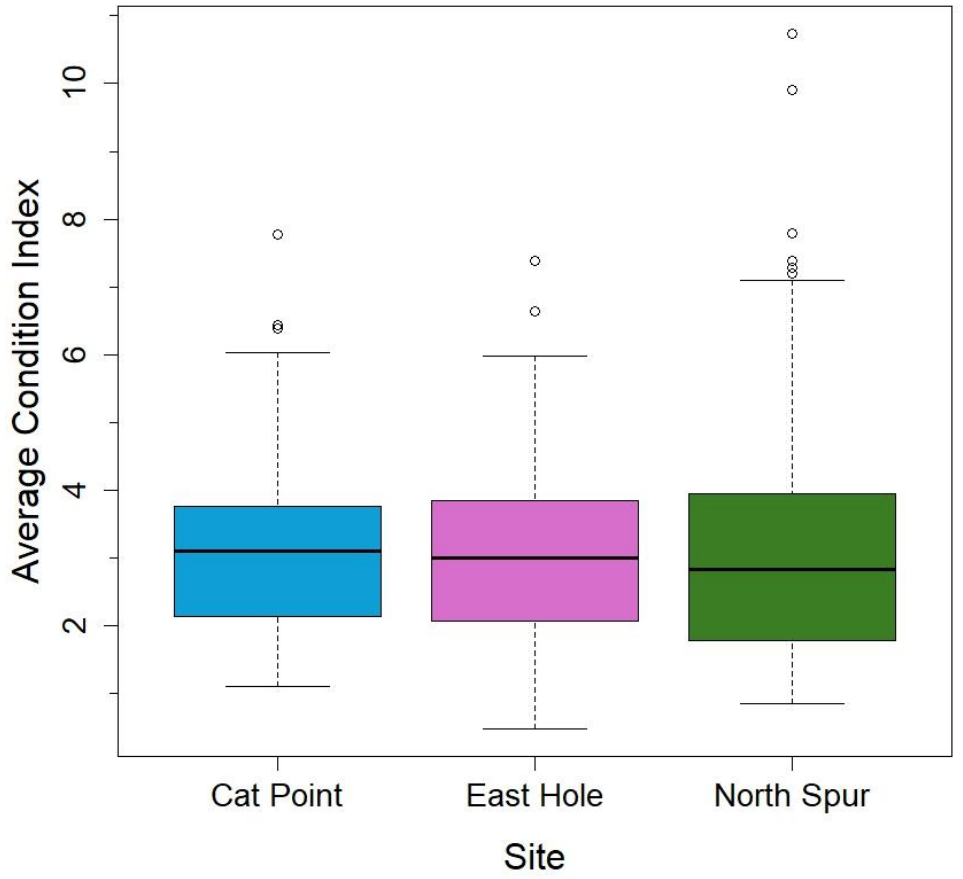
Results – Does oyster condition appear to correlate with any parasites or epifauna?

- No significant differences in overall average condition indices between the sites
    - Cat Point = 3.12
    - East Hole = 3.02
    - North Spur = 2.82



Results – Does oyster condition appear to correlate with any parasites or epifauna?





- Oysters at North Spur had lower condition indices during the summer

- Could be influenced by poor shell quality and higher load of parasitic trematodes

Summary of Findings

1). What epifaunal organisms are commonly found attached to the oysters, are any known to be detrimental to oyster health?

- 15 different types of epifaunal organisms commonly occurred on Apalachicola Bay oysters
- While most likely don't impact the oyster, three species routinely burrow into the oyster shells
- One species observed is an ectoparasite

2). How do these communities change across the bay?

- Oysters at East Hole and Cat Point had more types of epifauna per individual oyster
- Some epifaunal organisms appeared to prefer specific regions of the bay, likely relating to aspects of the environment (salinity, temperature, etc.)
- Some types of parasites are abundant within Apalachicola oysters, but these also exhibit spatial patterns

3). Does oyster health/condition change across the bay corresponding to these communities or any of the taxa?

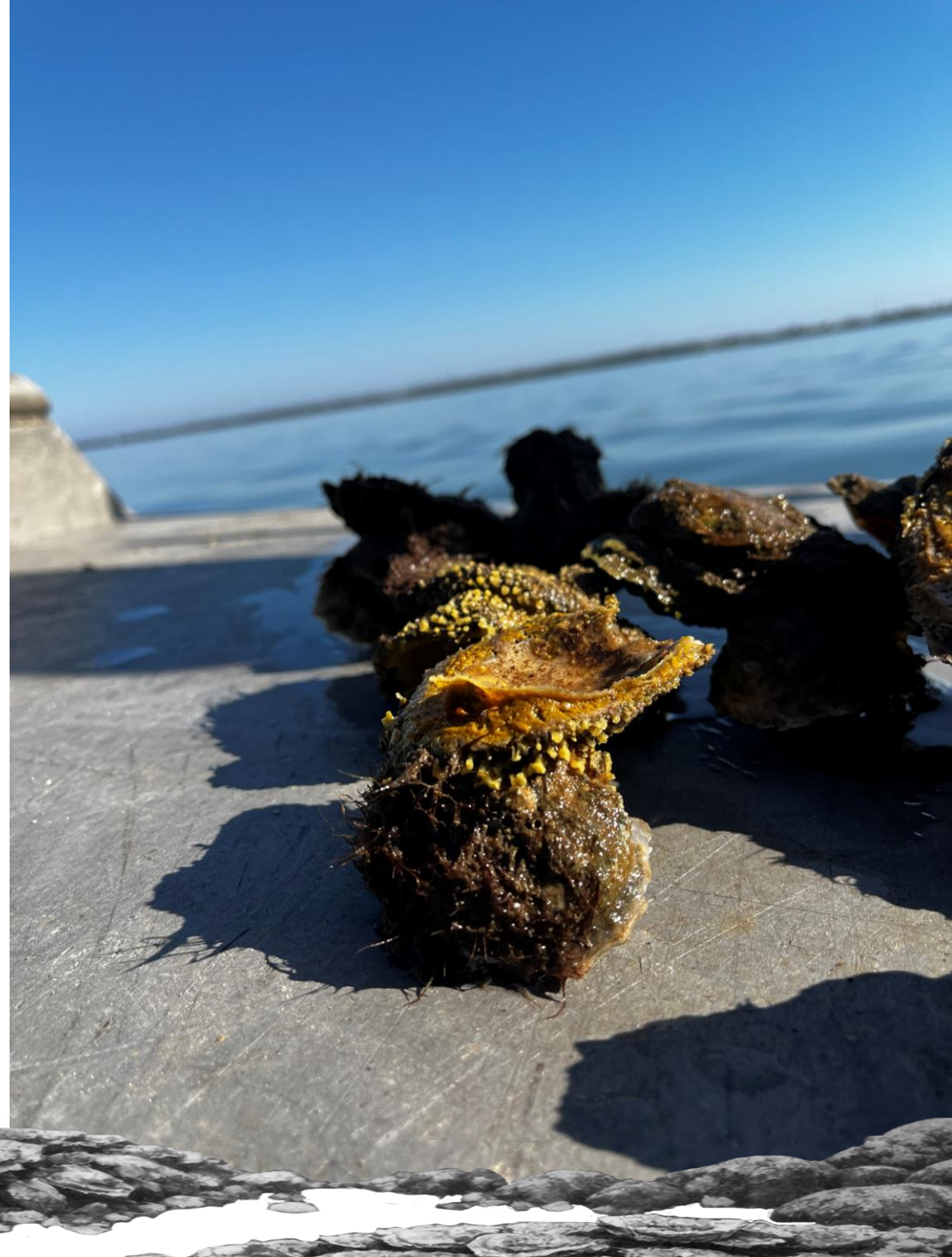
- To some degree, oyster condition (especially at North Spur) might be influenced by parasite abundance and the prevalence of shell-boring animals during the summer months

Implications

Patterns of epifauna at the restored region of North Spur could indicate that oyster reefs are not as robust or well developed compared to the restored reefs at Cat Point and East Hole.

The impacts of shell-boring species and parasites could be a potential factor for the reduced level of recovery at North Spur.

Many of the results presented here are preliminary, and more analysis is required to understand how environmental factors (salinity, temperature, etc.) might drive the patterns observed in parasite and shell-boring taxa.



Acknowledgements

Shannon Hartsfield

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Apalachicola National Estuarine Research Reserve


Questions?