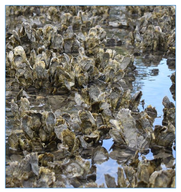
Not so Basic – A Look at Mangrove Encroachment Impacts on pH Landscapes Across Intertidal Oyster Reefs

Meghan Bradburn, Katherine Harris and Linda Walters
Department of Biology, University of Central Florida, Orlando, FL 32816

Background

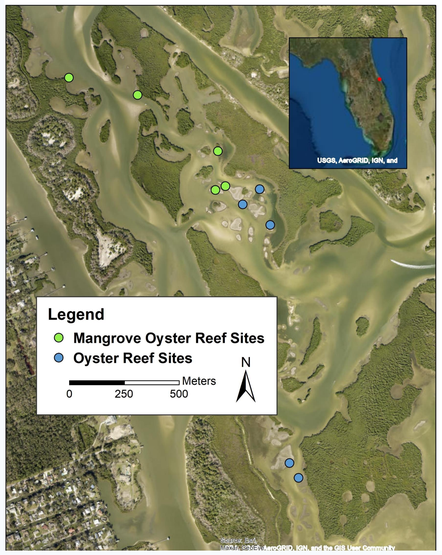
- Due to a lack of sub-freezing temperatures in Central Florida[1], encroachment of red mangroves (*Rhizophora mangle*) on intertidal oyster reefs (*Crassostrea virginica*) has begun to occur
- Mangrove root exudates are acidic[2,3]
- Due to this acidity, the pore-water in the sediment directly beneath mangrove trees should be lower than surrounding sediment
- The extent to which these exudates are affecting the surrounding soil pH across oyster reef landscapes is currently unknown



Questions

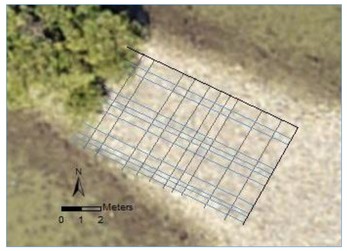
1) What is the sediment pH across the oyster reef landscape?
2) Does mangrove presence affect the pH landscape?

Study Site: Mosquito Lagoon



Methods

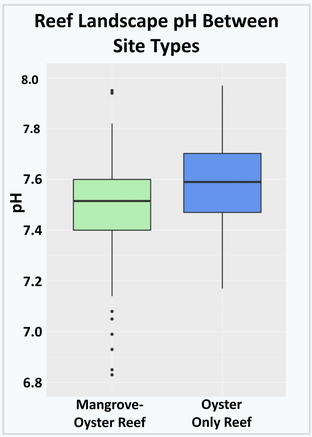
- Five oyster reefs with mangroves and five oyster reefs without mangroves were compared
- Data was collected between December 2021 and February 2022
- Grids were set up across each reef, 40 random points were sampled within each grid
- Pore-water (water beneath sediment) was collected by hammering a PVC pipe 10 cm deep into reef sediment. A syringe was then used to collect pore-water and transfer it to a vial
- A portable pH meter was used to record the pH of each pore-water sample
- Additional data was recorded for the mangrove closest to each sampling point, including the mangrove's height and its distance from the sampling point



Top: Overhead view of grid layout.

Bottom: Volunteers collecting samples on oyster reef.

Results: pH Landscape



- Mangrove-oyster reef pH ranged from 6.83 – 7.95, oyster-only reef pH ranged from 7.17 – 7.97
- T-Test: No significant difference in the overall pH landscape between mangrove-oyster and oyster-only reef site types (p-value = 0.32)

Results: Mangrove Impact

- Directly underneath mangroves, sediment pH averaged 7.25
- The interaction between distance and height has a significant effect on sediment pH
- As shown below, sediment pH decreases when mangroves are at a minimum of 100 cm in height. There was no pH reduction for mangroves less than 100 cm

Results of GLM

Comparison	P - Value
Mangrove Distance	0.155
Mangrove Height	< 0.001
Interaction (Distance:Height)	< 0.01

Effect of Mangrove Distance and Height on pH

Orange points = small mangroves (< 100 cm)

Green points = large mangroves (≥ 100 cm)

Orange line = best fit for small mangroves (< 100 cm)

Green line = best fit for large mangroves (≥ 100 cm)

Discussion

- Based on the data, mangrove driven acidification was observed directly beneath trees that are at or over 100 cm tall
- There was a 103% increase in mangrove numbers on oyster reefs in central Florida since 1984[4]. If this trend continues, then reefs will be overwhelmed, and the overall sediment pH landscape should decrease
- Oyster shells dissolve at a pH of 7.17 or less[5]. If the overall sediment pH on reefs is lower than 7.17, mangroves will likely outcompete and take over oyster reefs

Acknowledgements

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References

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