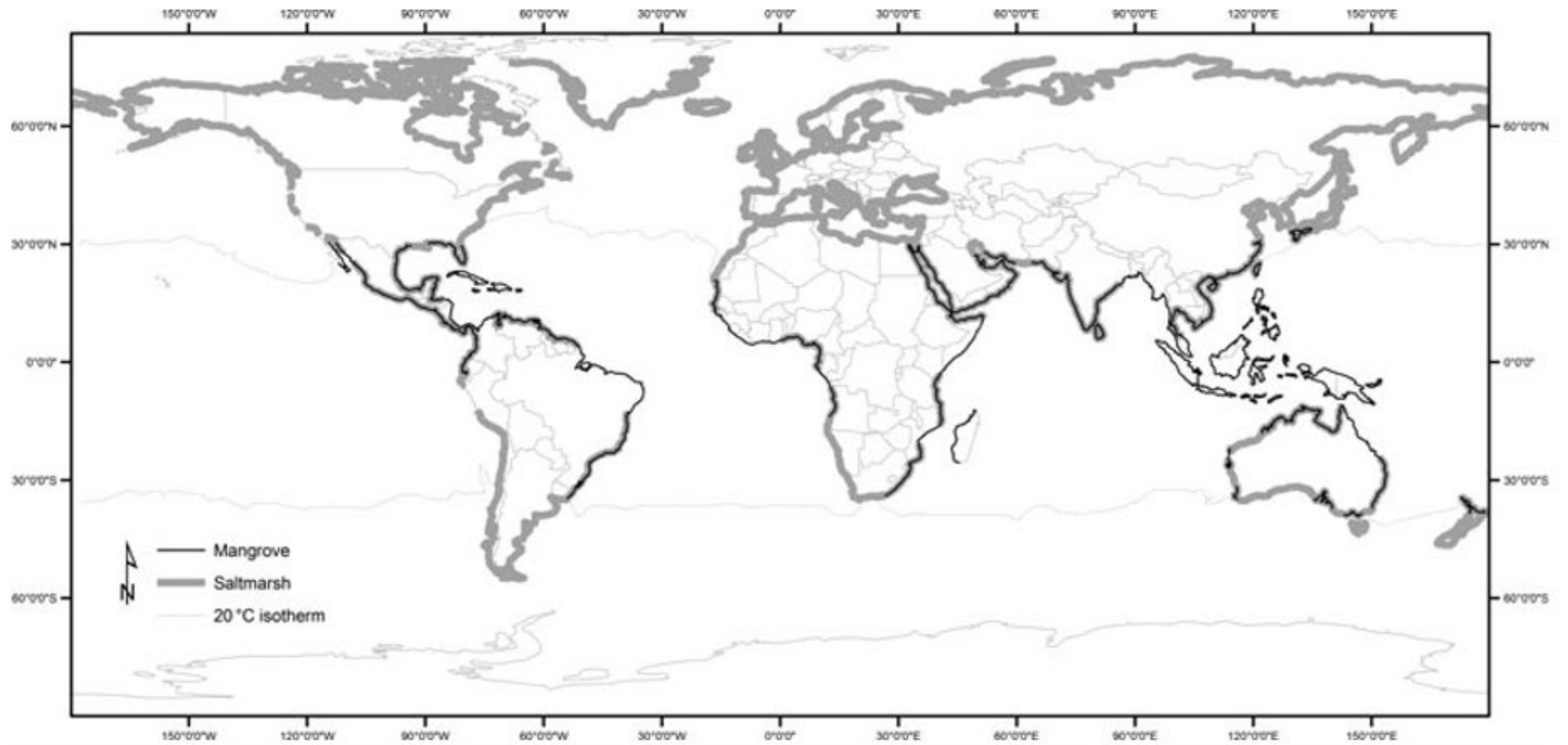


Effects of Changing Vegetation Composition on Community Structure, Ecosystem Functioning, and Predator–Prey Interactions at the Saltmarsh–Mangrove Ecotone

Julie Walker*, Christine Angelini, Ilgar Safak, Andrew Altieri, Todd Osborne



SALTMARSH

Arctic-Temperate
Herbaceous grasses



MANGROVE

Tropical
Woody Trees



**Intertidal
Habitat Forming
Ecosystem Services**

SALTMARSH

Arctic-Temperate
Herbaceous grasses



MANGROVE

Tropical
Woody Trees



Habitat Structure?
Stability?
Predation Regimes?
**Invertebrate
Community?**

Habitat Structure

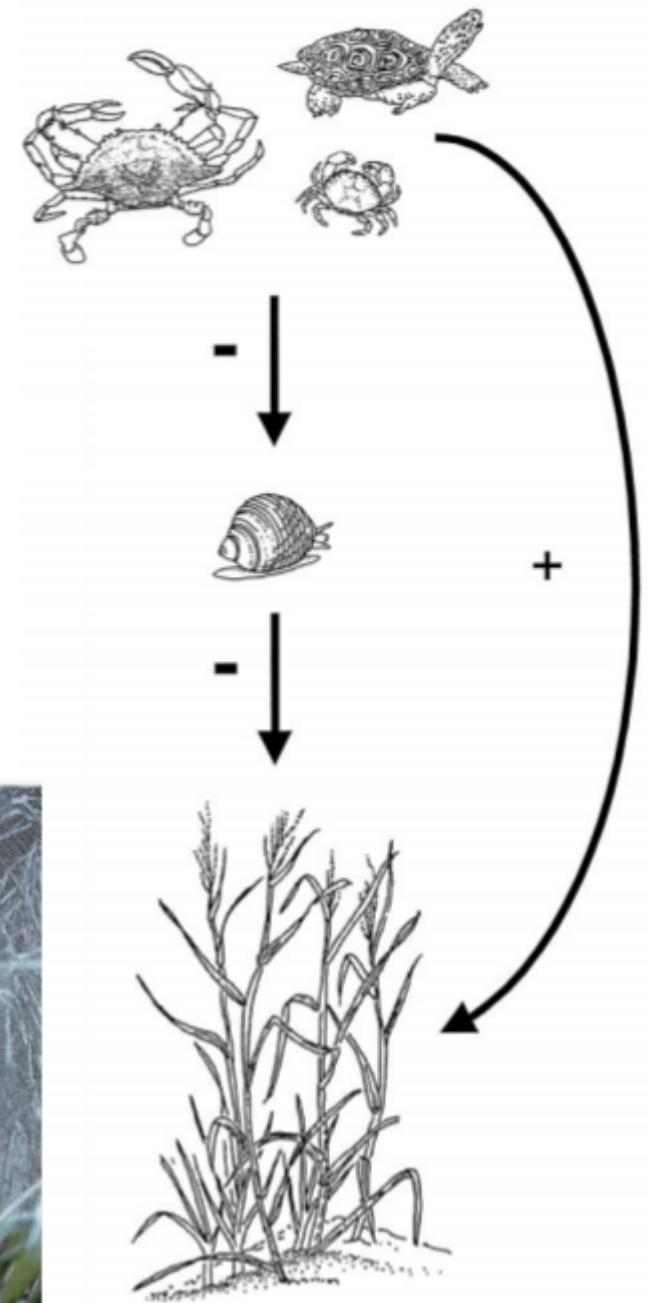
- Δ to Habitat complexity $\rightarrow$ Δ Nekton use
 - Hinder movement
 - Size selective
 - Δ Sightlines



Brian Skerry

Predation Regimes

- Alter number of interactions between predator and prey
- Predator–prey dynamics may drive variation in community and habitat structure with many coastal systems influenced by top-down predation control.



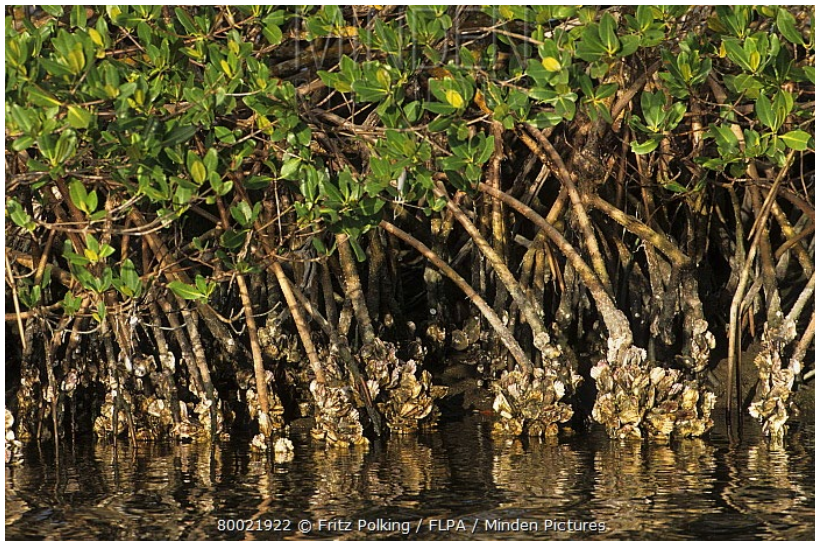
Stability

- Temporal variation in vegetation structure
 - May influence community and species populations temporally
 - Indicators of susceptibility to species extinctions, reliability of ecosystem processes, and ability to predict change in a system



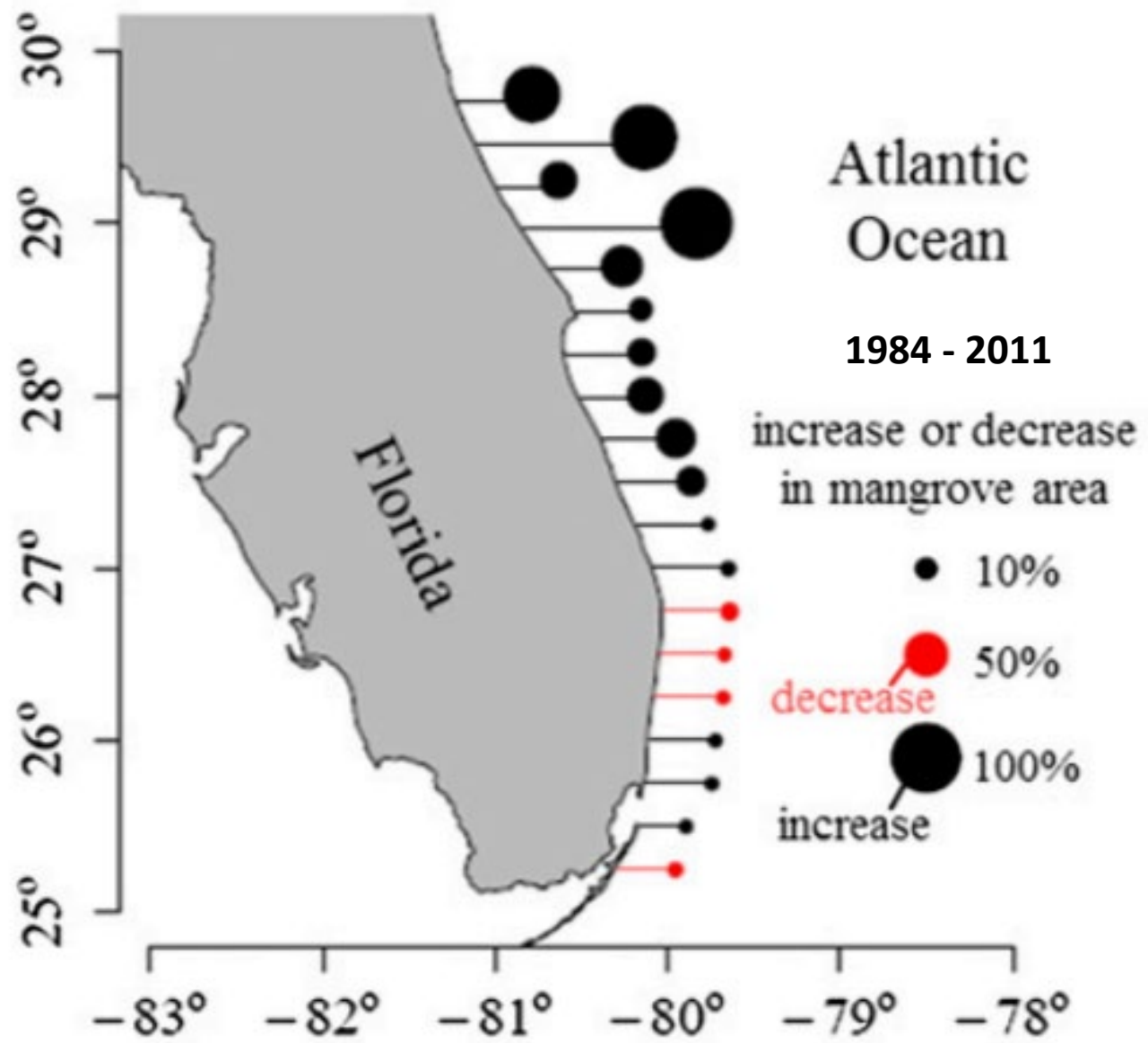
Invertebrate Communities

- Saltmarsh derived litter may support ecosystems at higher trophic levels than mangrove derived matter
- Changes in decomposition rates of mangrove vegetation compared to saltmarsh may influence nutrient availability in the system
- Both mangrove and saltmarsh invertebrates rely on a mixed diet of vegetation and algae

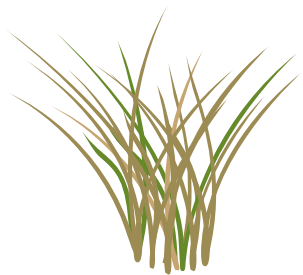
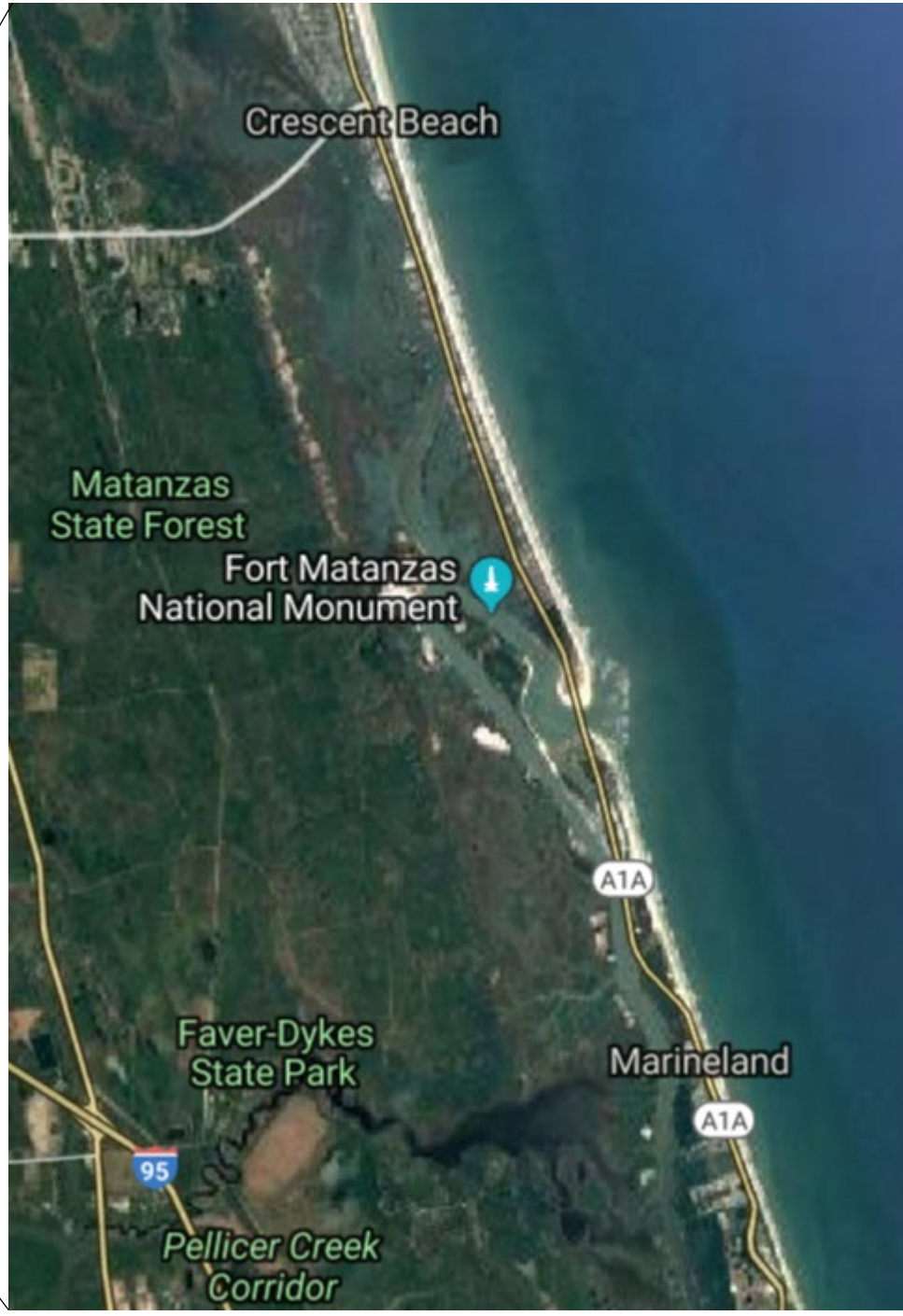
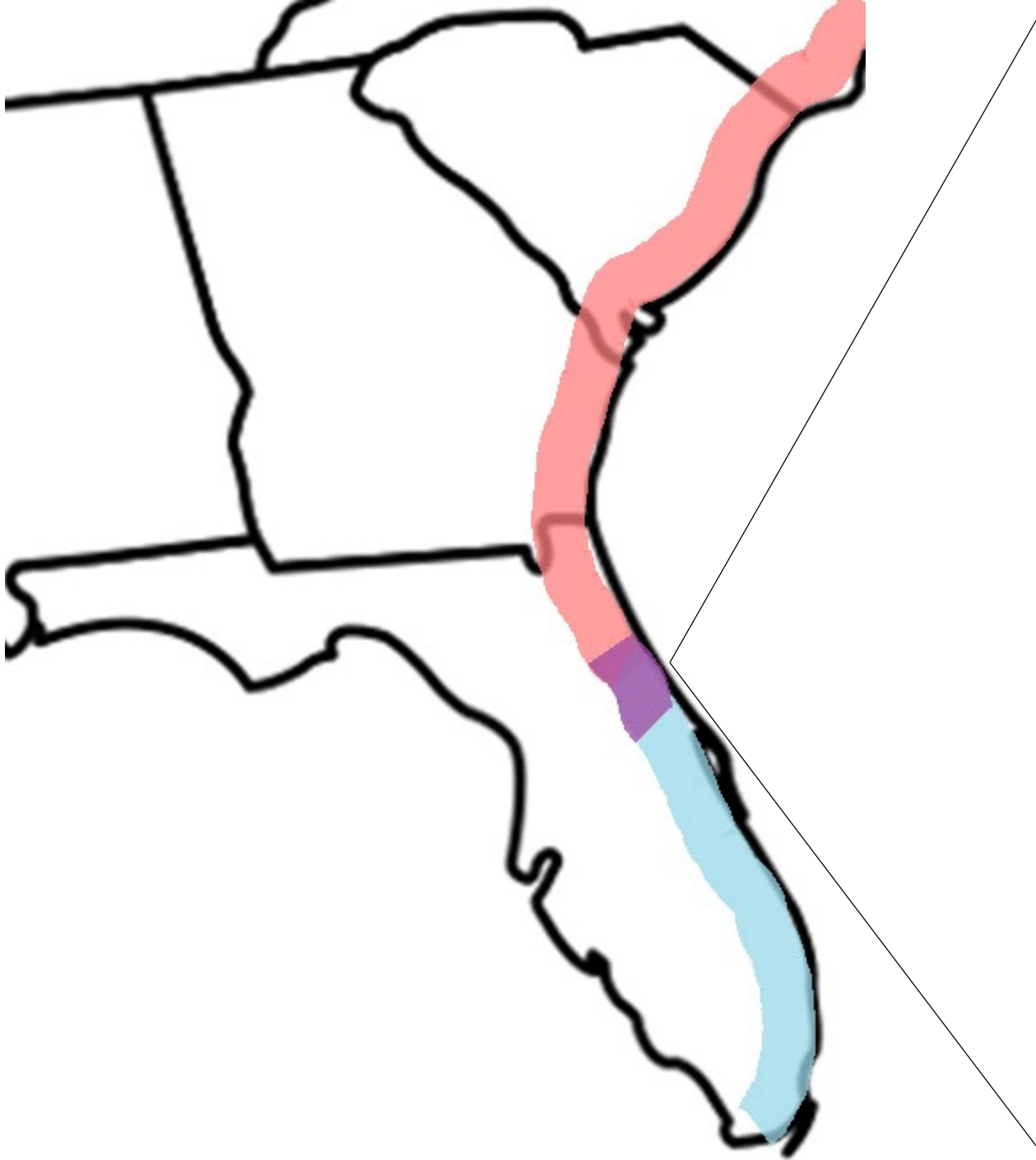




Saltmarsh
Ecotone
Mangrove



*Cavanaugh et al 2014



How are large predators affecting plants, benthic algae, and invertebrates at the ecotone?

How are large predators affecting plants, benthic algae, and invertebrates at the ecotone?

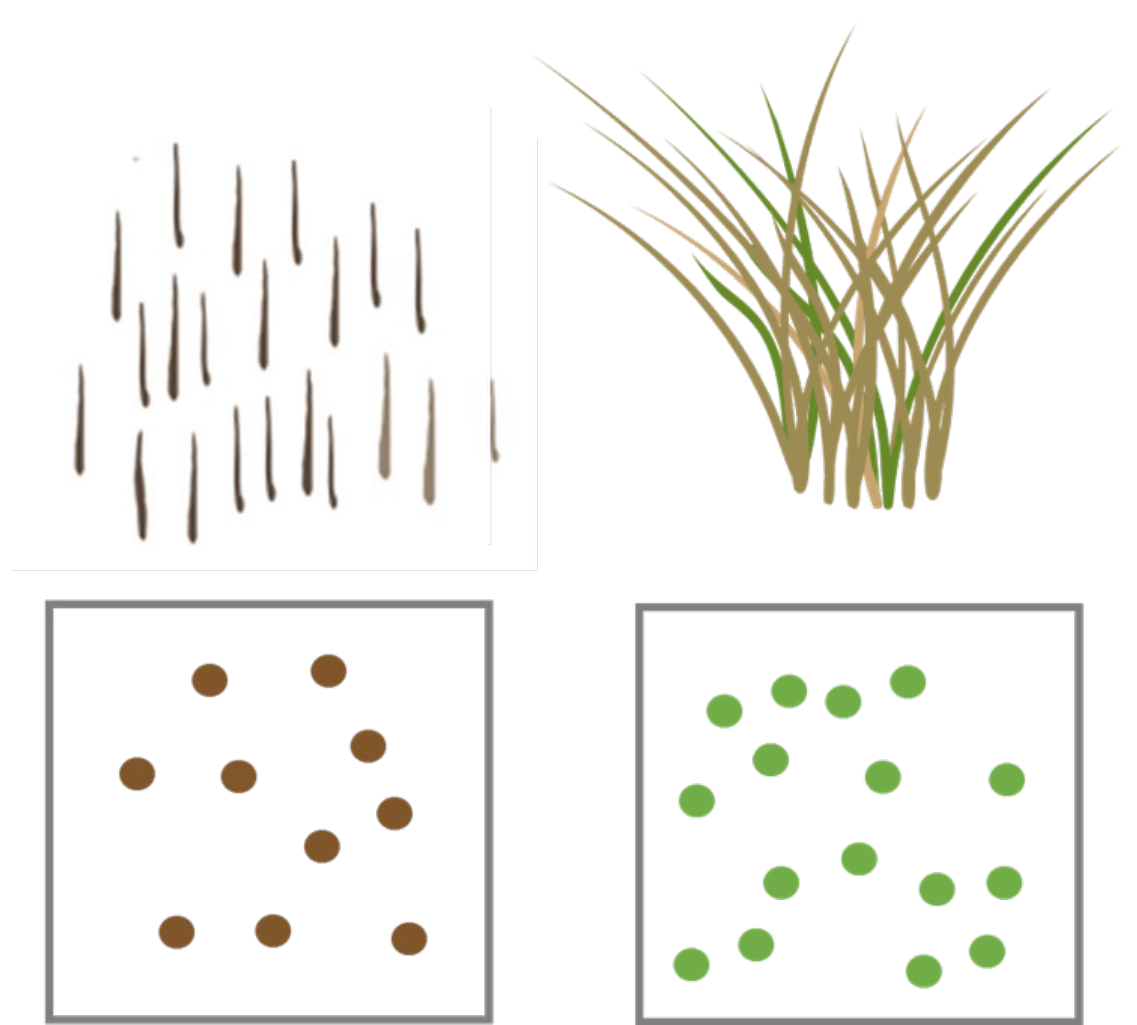
- Predator exclusion cages
 - 1 m² cage
 - 2 cm diameter mesh
 - 2 year study
 - One representative Mangrove and one Saltmarsh site
 - 5 cages per site
 - 5 control plots per site



Are large predators affecting plants?

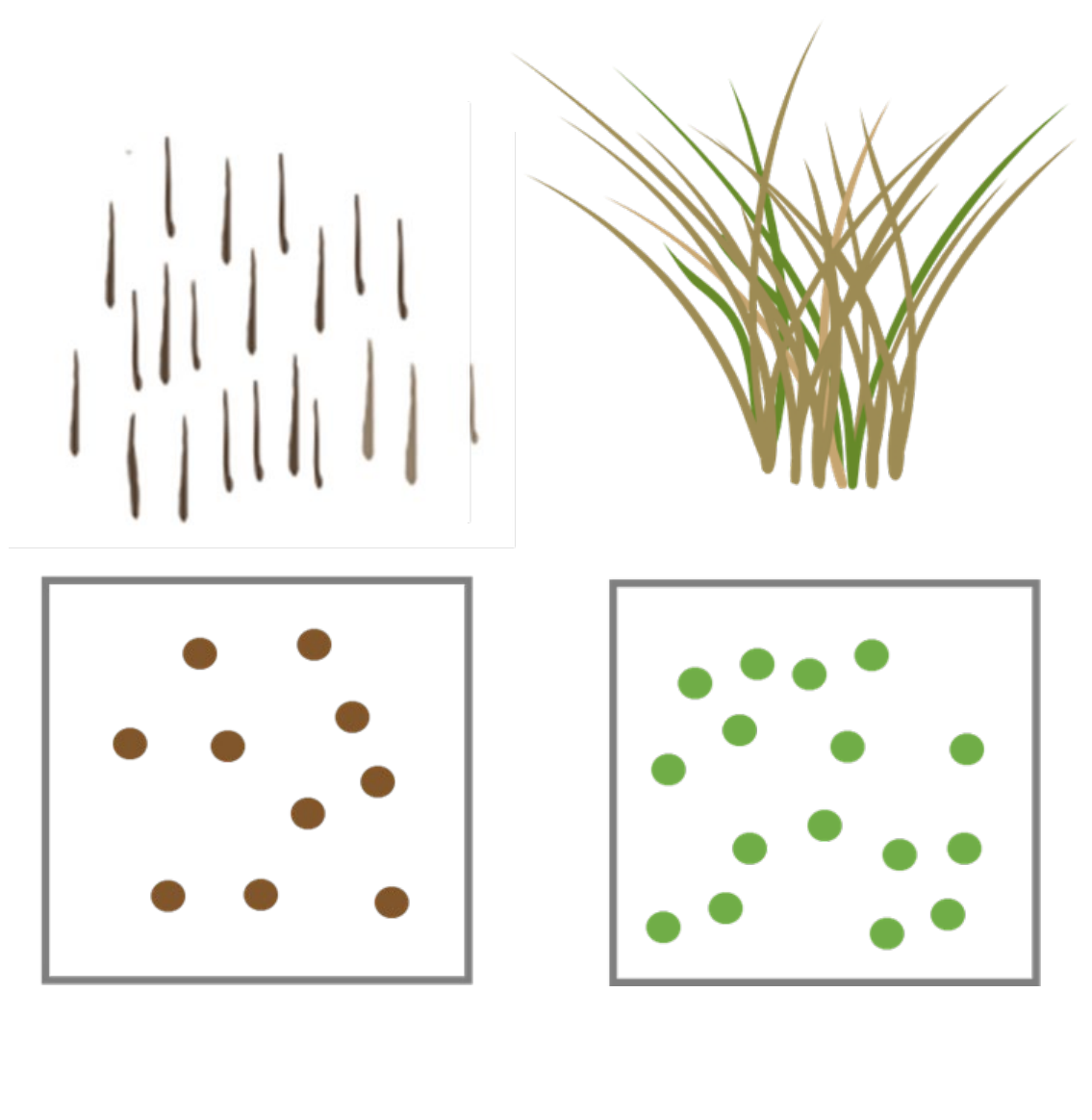
Seasonally monitored

- Vegetation Height
(n= 50 per treatment per date)
- Vegetation Density
(n=10 per treatment per date)



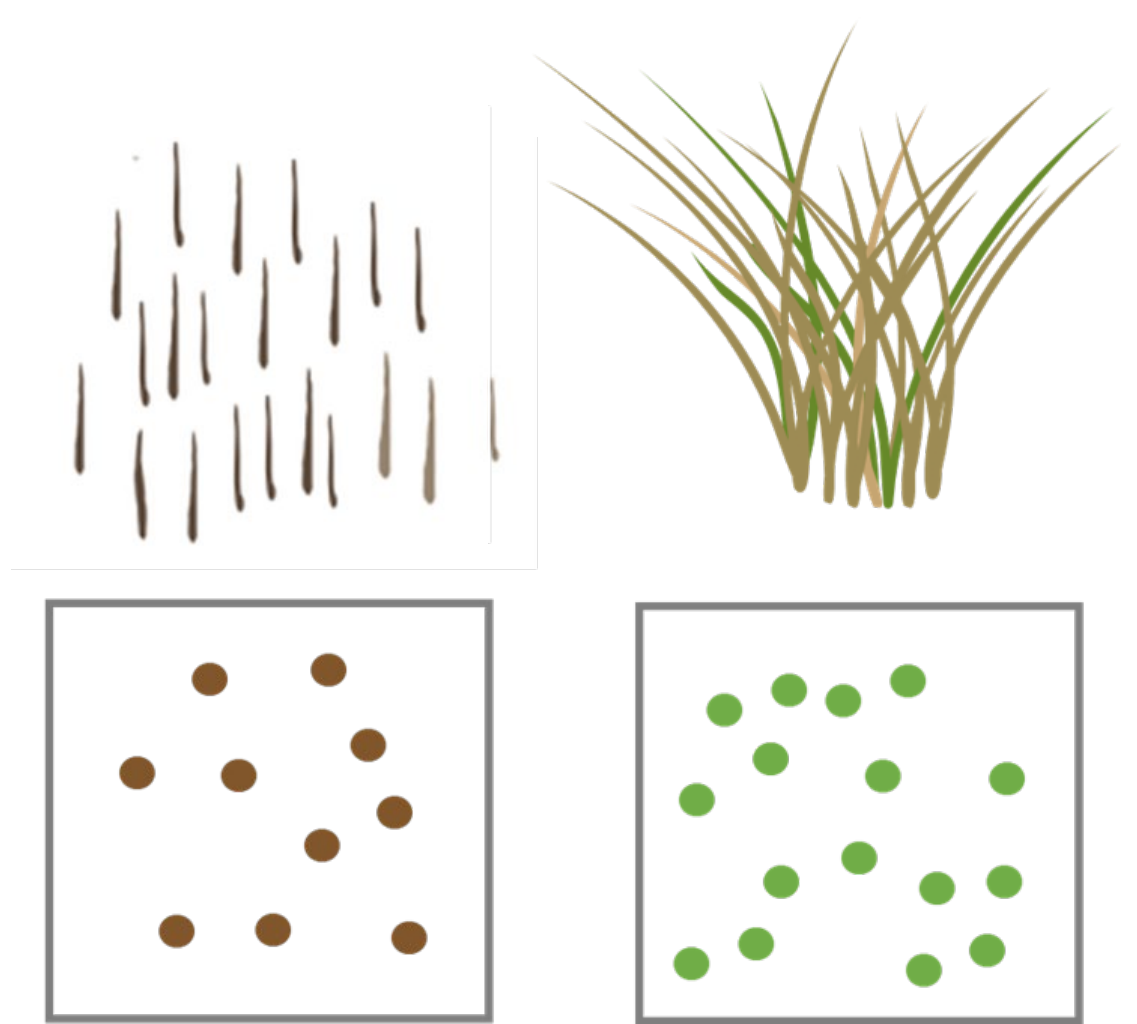
Are large predators affecting plants?

- No.



Are large predators affecting plants?

- No.
- No effect of treatment on stem height or density in either the mangrove or saltmarsh



Are large predators affecting benthic algae?

- Seasonally monitored
 - Field Fluorometer
 - Cyano Bacteria, Green Algae, Diatoms (n= 25 per treatment, per date)



Are large predators affecting benthic algae?

- Still, no.



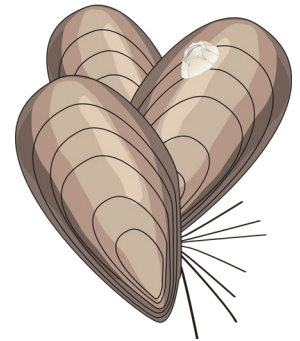
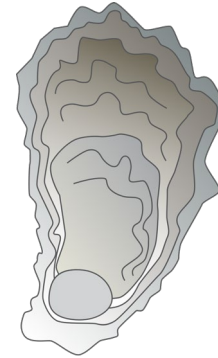
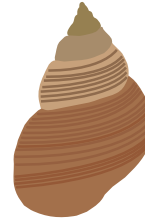
Are large predators affecting benthic algae?

- Still no.
- No effect of treatment on any algae group (cyano bacteria, green algae, or diatoms) in either the mangrove or saltmarsh



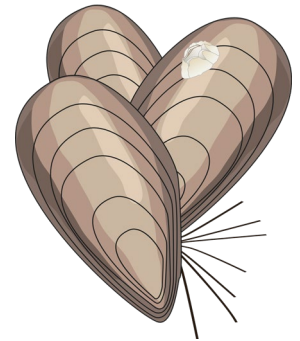
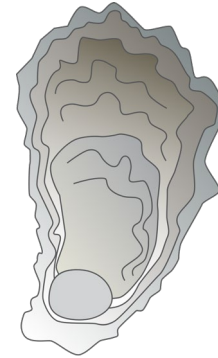
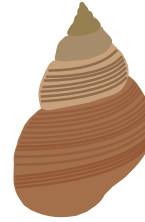
Are large predators affecting invertebrates?

- Seasonally monitored
 - Densities of periwinkle snails, oysters, mussels, and crab burrows (n=5 per treatment per date)



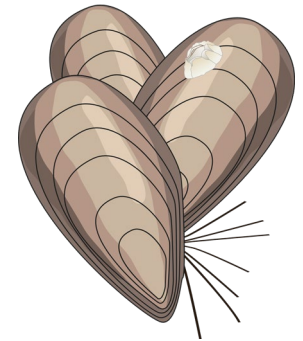
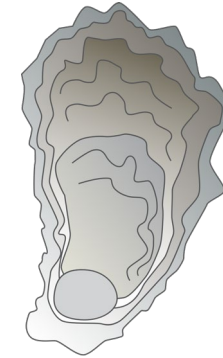
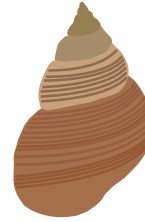
How are large predators affecting invertebrates?

- Again, no.

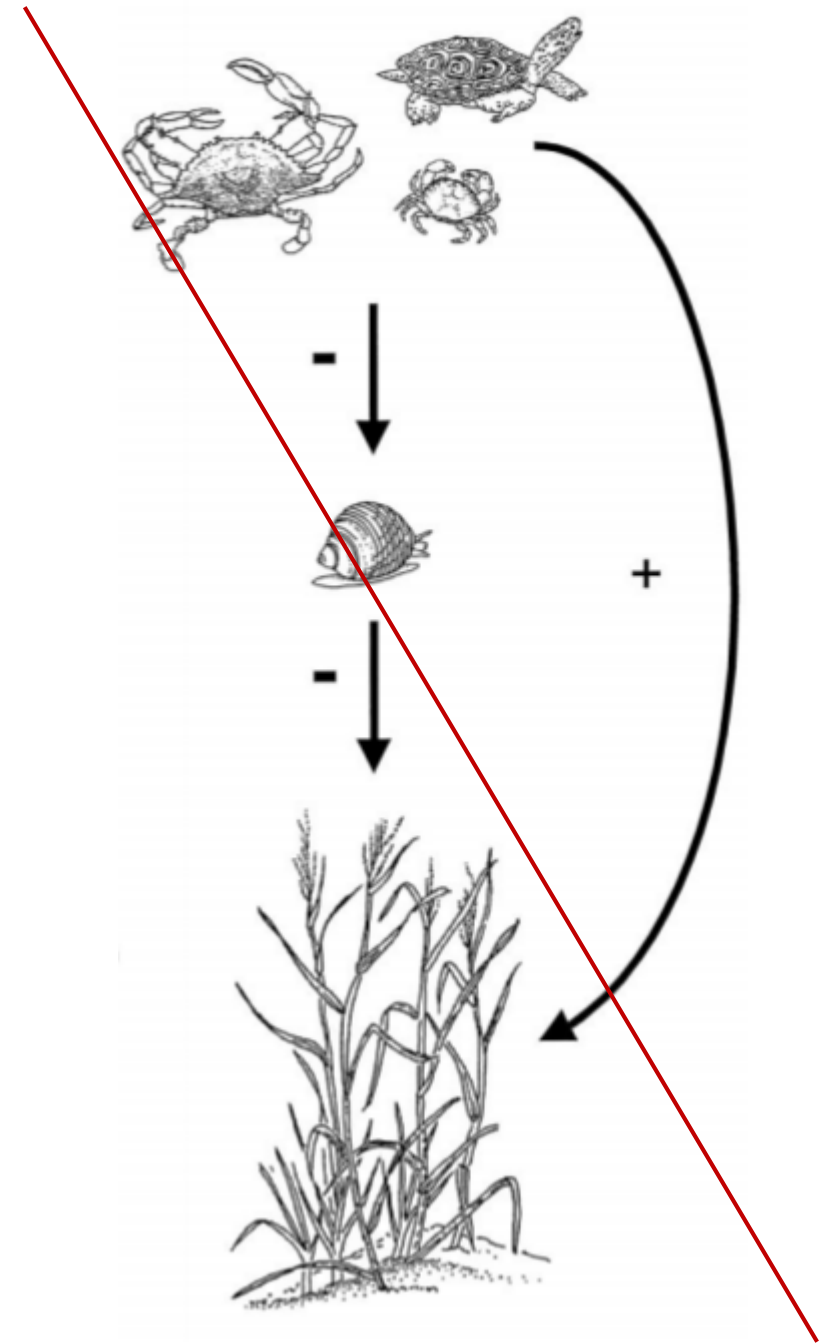


How are large predators affecting invertebrates?

- Again, no.
- No effect of treatment on any invertebrate groups in either the mangrove or saltmarsh



Large predators have
no affect on plants,
benthic algae, and
invertebrates at the
ecotone.



How is mangrove migration affecting vegetation and invertebrate community temporal stability?

Stability

- 2 years exclusion cage data
- 10 plots per vegetation type
- 6 sampling dates
 - Vegetation Structure
 - Height (n=100, per date)
 - Density (n= 20, per date)
 - Algal Biomass (n=40, per date)
 - Invertebrates (n=10 per date)

Stability



S_t

Mean



μ_t

μ_t

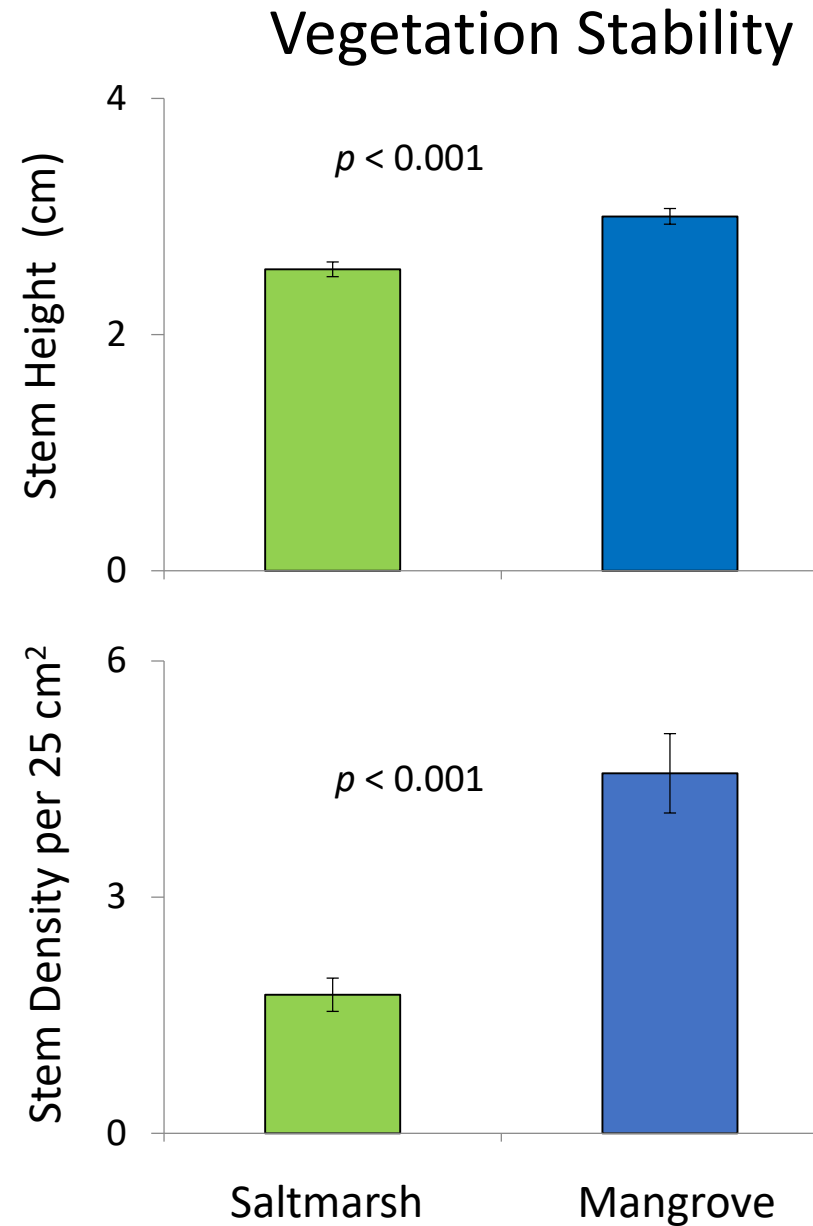
σ_t



Standard Deviation

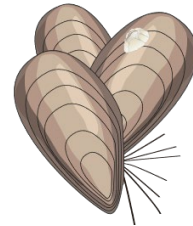
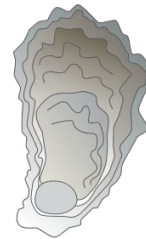
Stability – Results

- Vegetation temporal stability differed between vegetation
- Mangroves have more stable stem height and density



Stability – Results

- No difference in stability of algae biomass or invertebrate stability



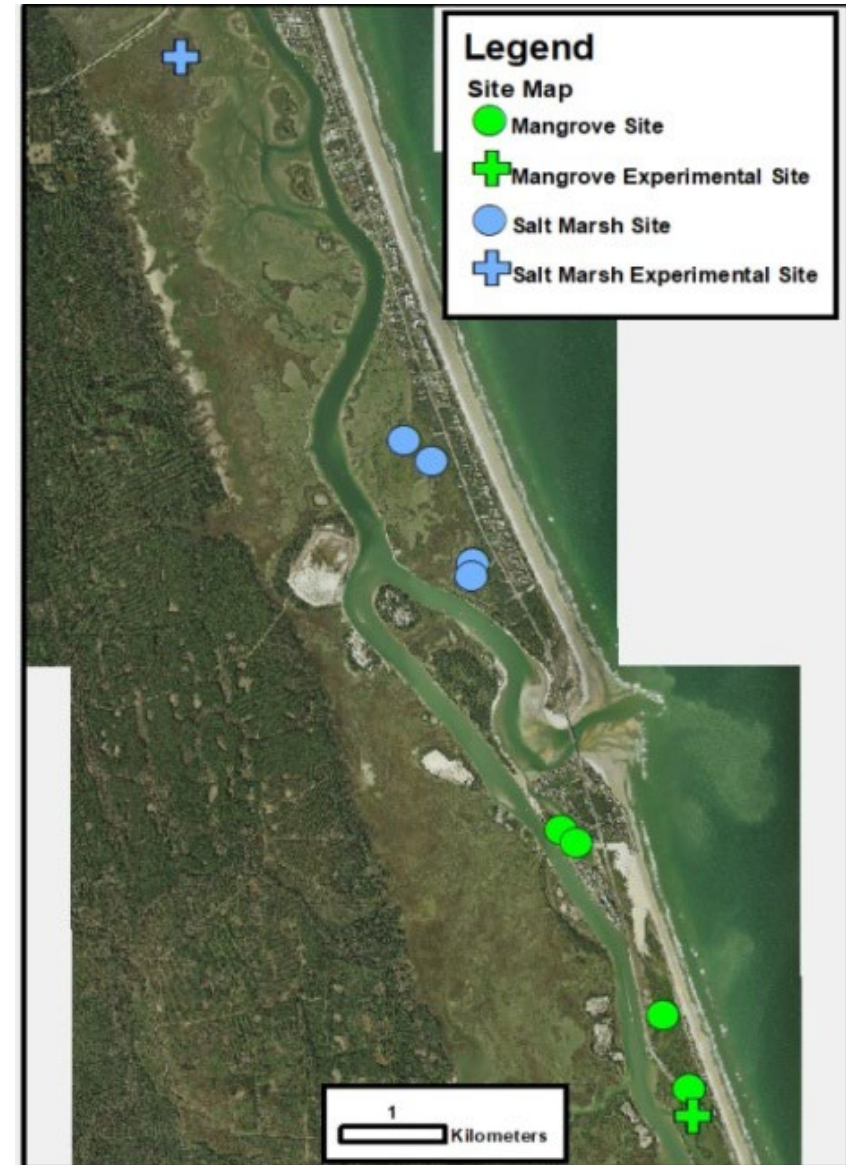
Stability of vegetation structure changes with mangrove introduction, however stability of algae and invertebrate stability does not



Do mangrove and saltmarsh creeks differ in habitat structure, predation, invertebrate community, algae biomass at the ecotone?

Survey

- 10 sites across the Ecotone
 - 5 Mangrove
 - 5 Saltmarsh
- 1st meter of creeks edge



Survey

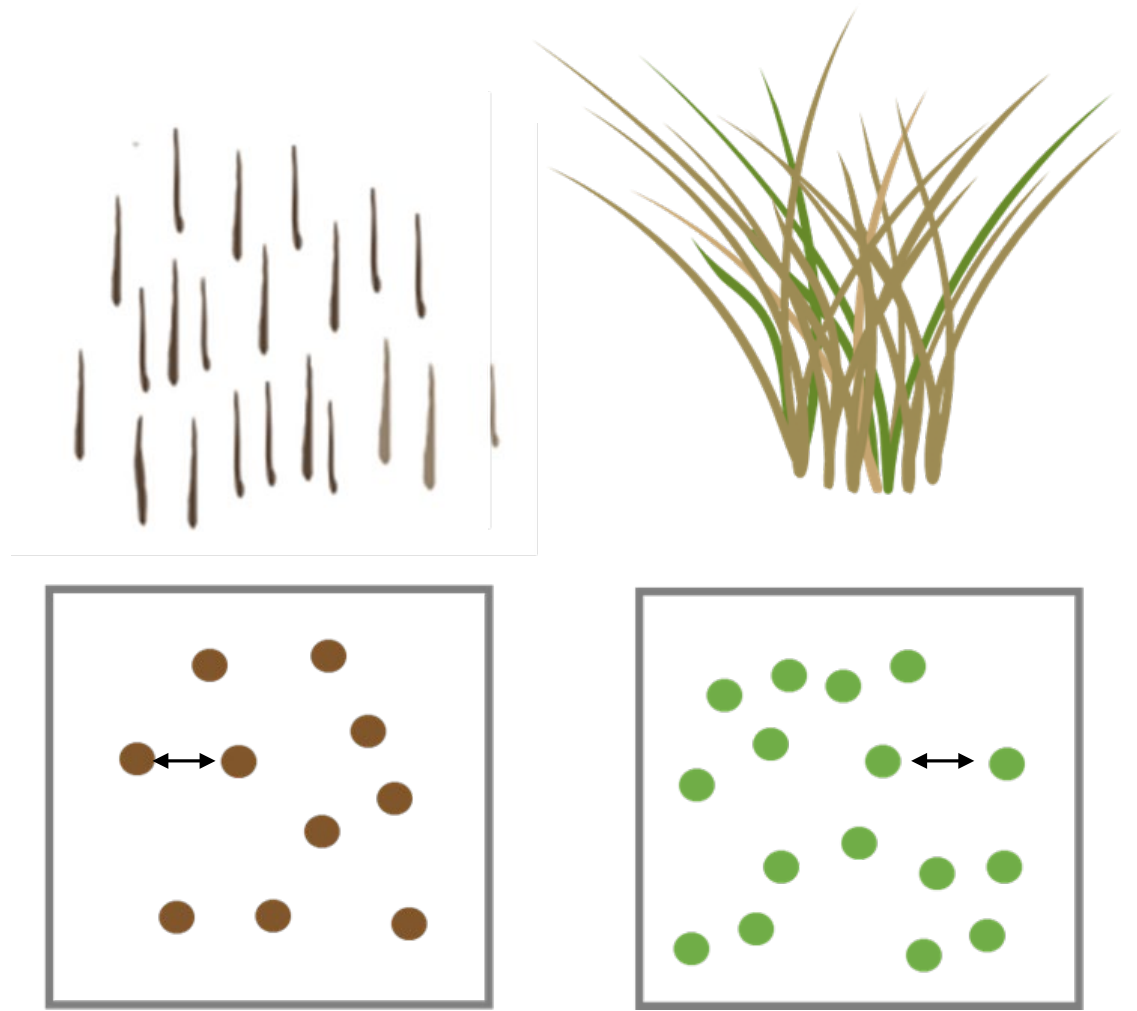
- 10 sites across the Ecotone
 - 5 Mangrove
 - 5 Saltmarsh
- 1st meter of creeks edge



Do mangrove and saltmarsh creeks differ in habitat structure?

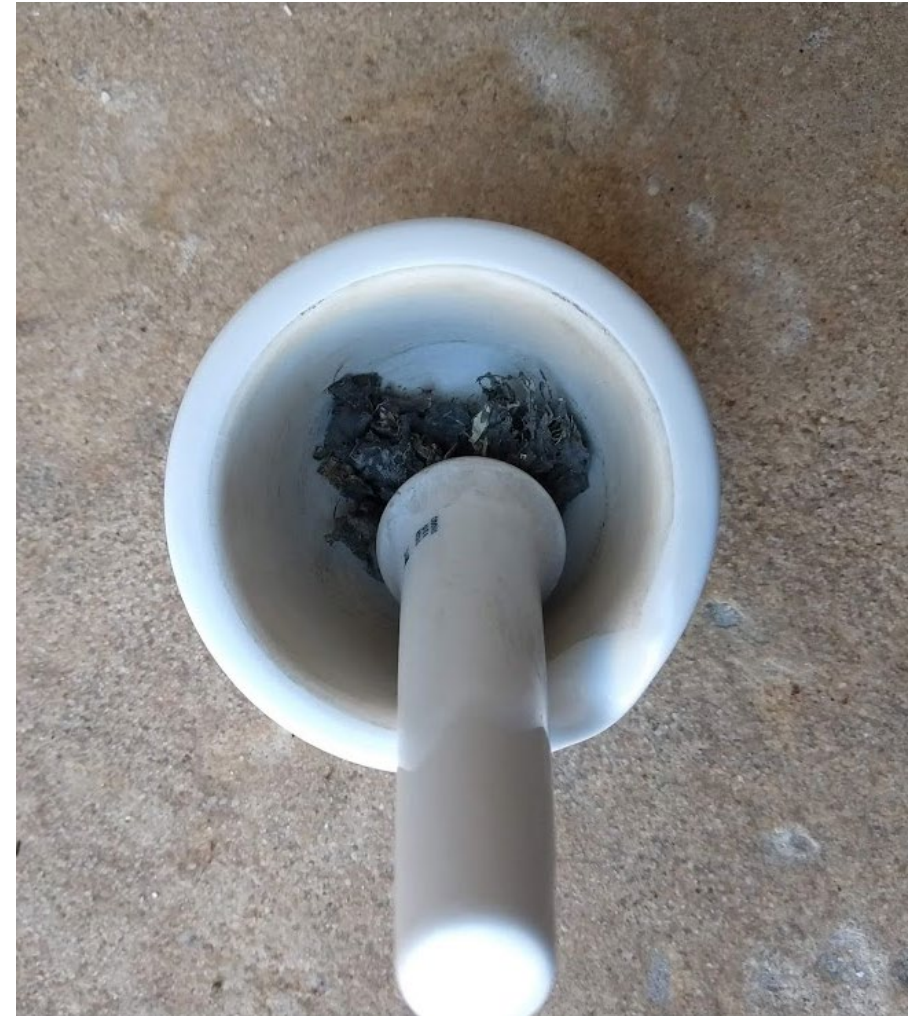
- Vegetation Structure

- Height (n=100 per site)
- Density (n=20 per site)
- Inter-stem Distance (n=100, per site)



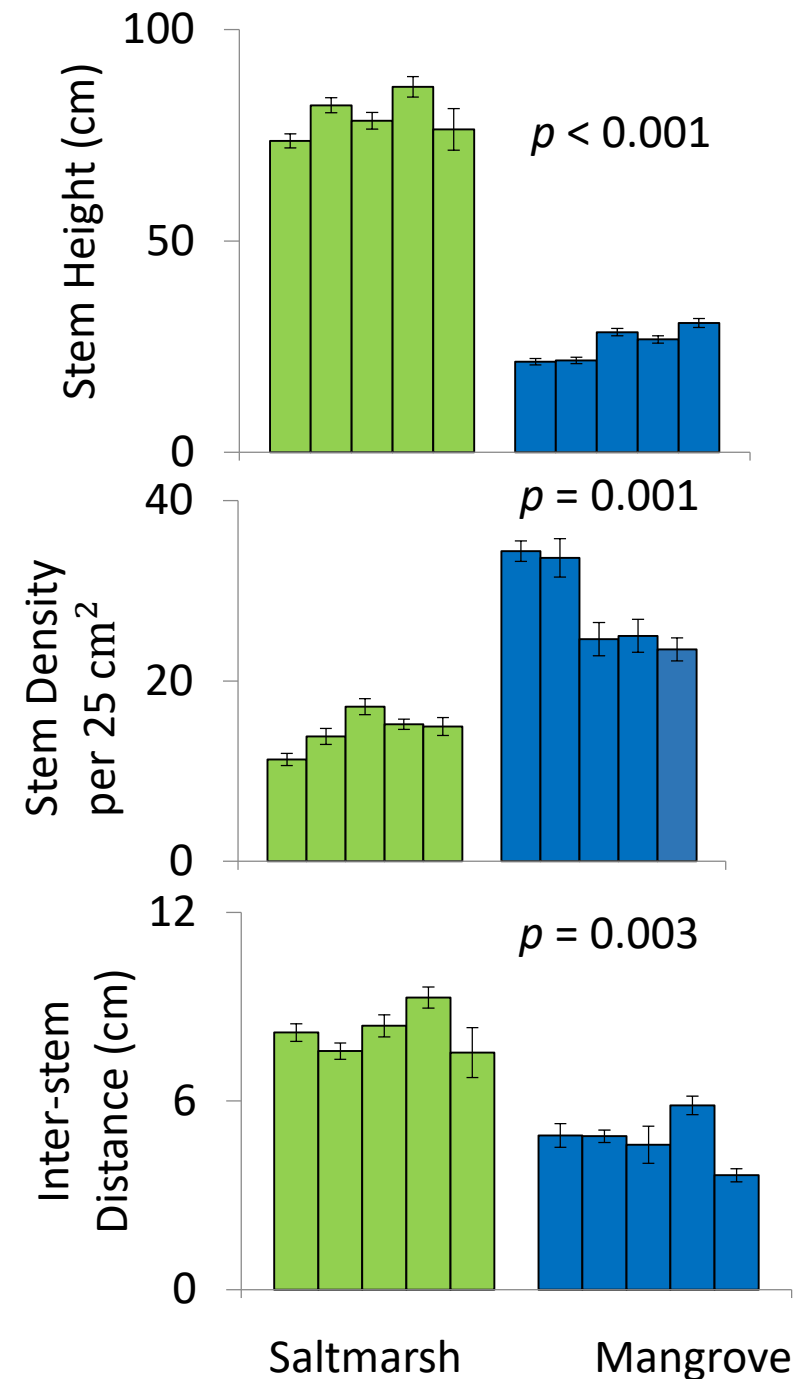
Do mangrove and saltmarsh creeks differ in habitat structure?

- Soil Structure (n=5)
 - Soil Moisture
 - Organic Matter
 - Bulk Density



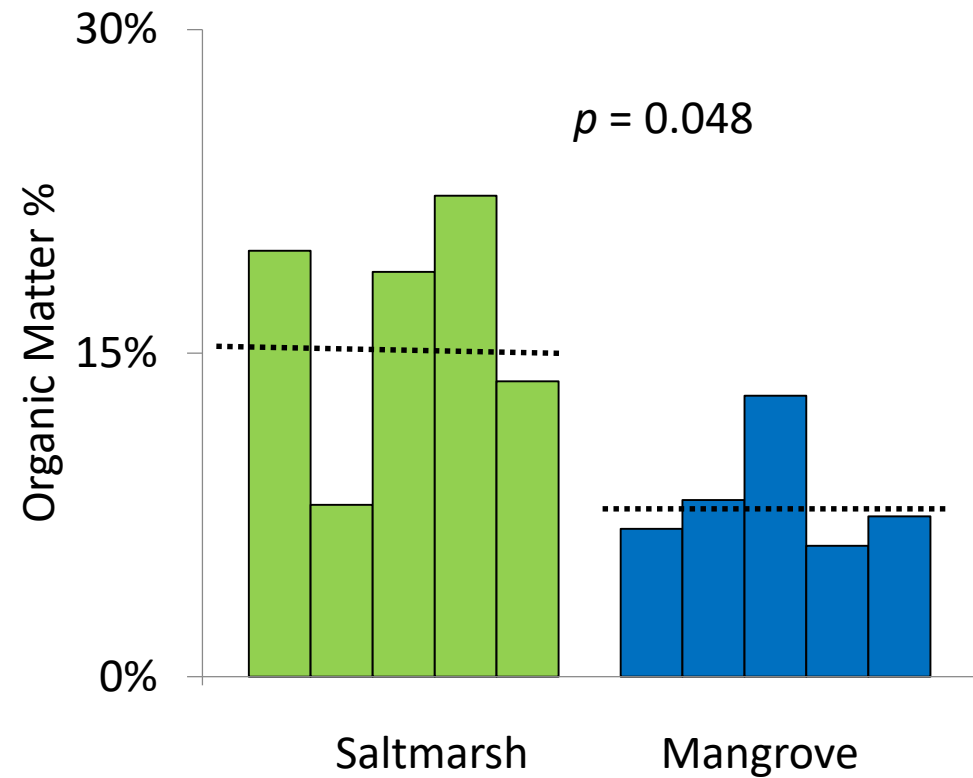
Do mangrove and saltmarsh creeks differ in habitat structure?

- Mangrove and saltmarsh differ in all structural traits
- Saltmarsh - greater stem height and inter-stem distance
- Mangroves – greater stem density



Do mangrove and saltmarsh creeks differ in habitat structure?

- Soil moisture and bulk density were similar in mangrove and saltmarsh
- Organic Matter is higher in the saltmarsh



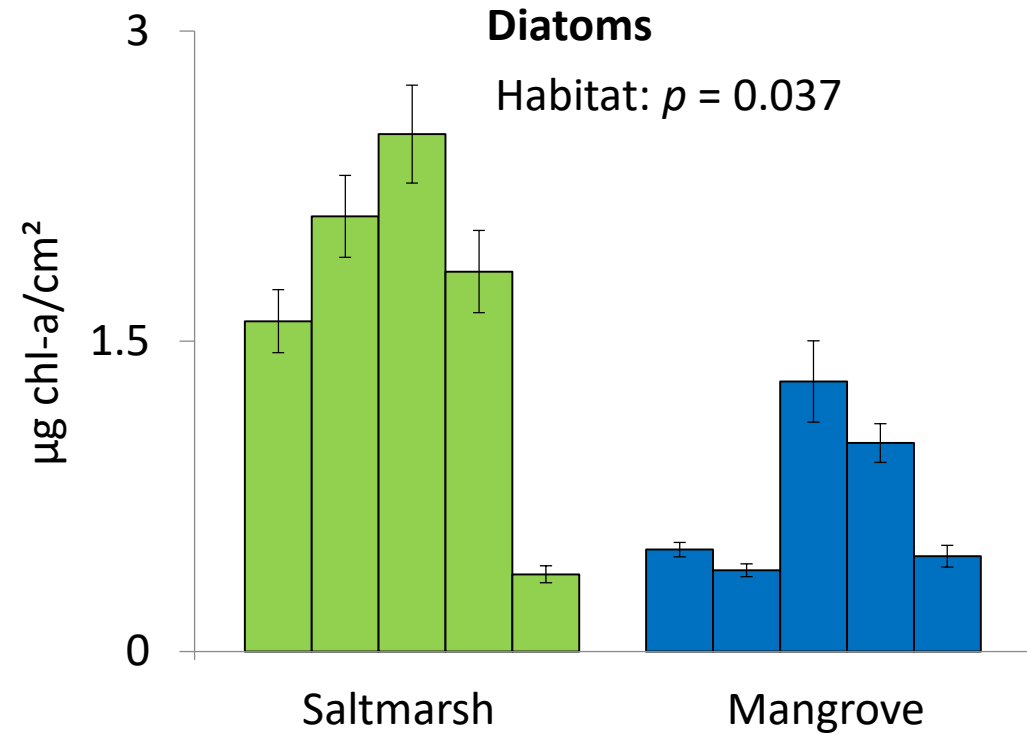
Do mangrove and saltmarsh creeks differ in algae biomass?

- Field Fluorometer (n=50 per site)
- Cyano Bacteria
- Green Algae
- Diatoms



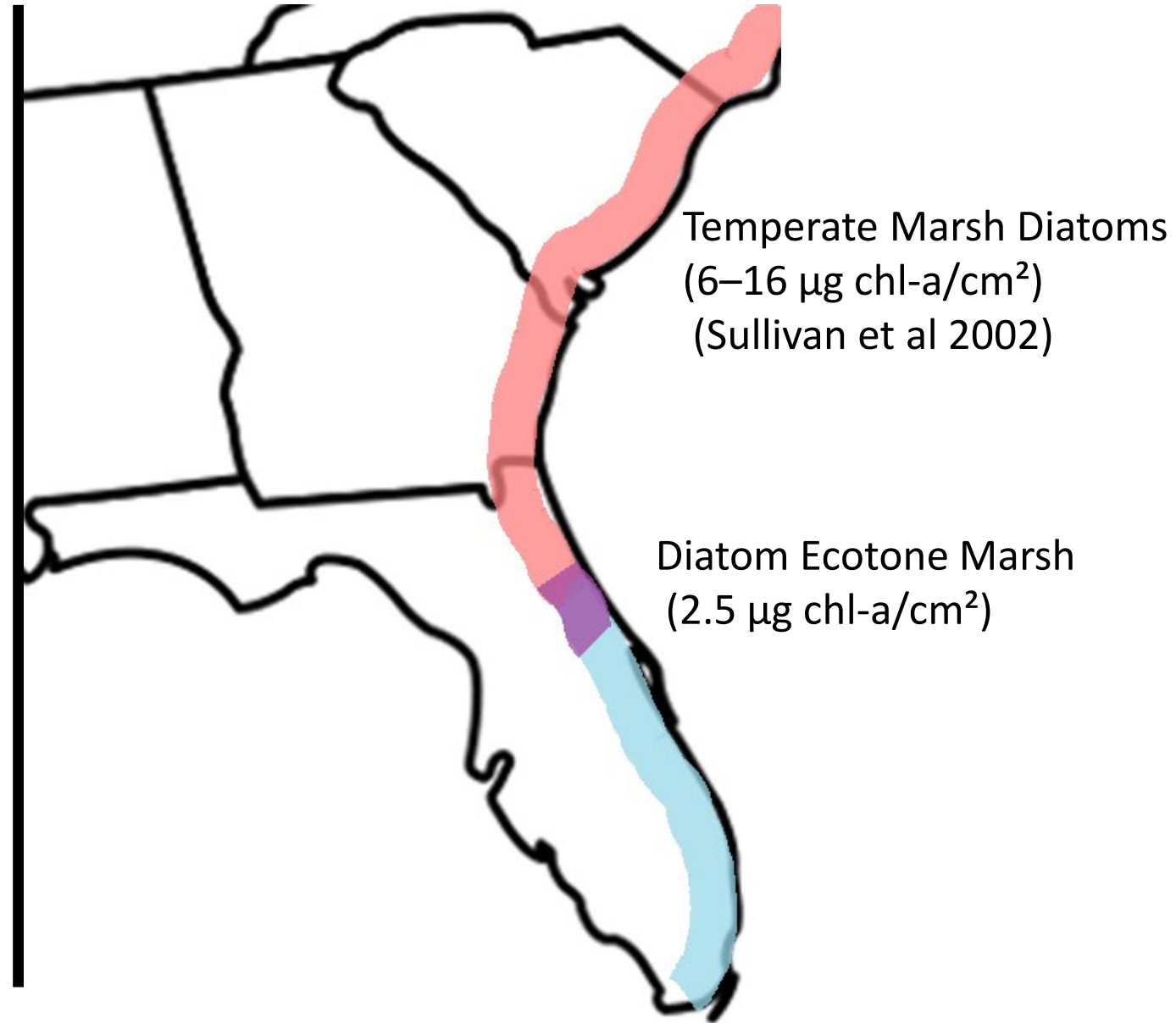
Do mangrove and saltmarsh creeks differ in algae biomass?

- Cyano bacteria and Green Algae were similar in mangrove and saltmarsh
- Diatoms were higher in the saltmarsh



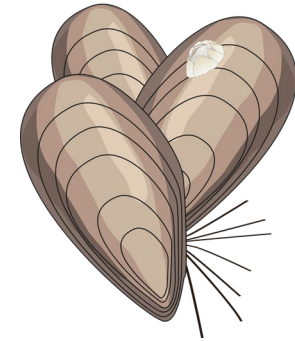
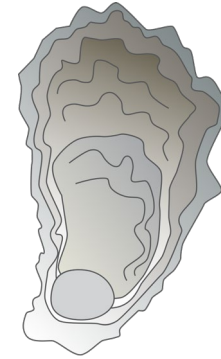
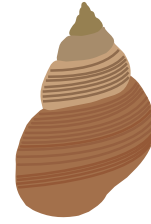
Do mangrove and saltmarsh creeks differ in algae biomass?

- Cyano bacteria and Green Algae were similar in mangrove and saltmarsh
- Diatoms were higher in the saltmarsh
- Diatoms at ecotone significantly lower than temperate regions



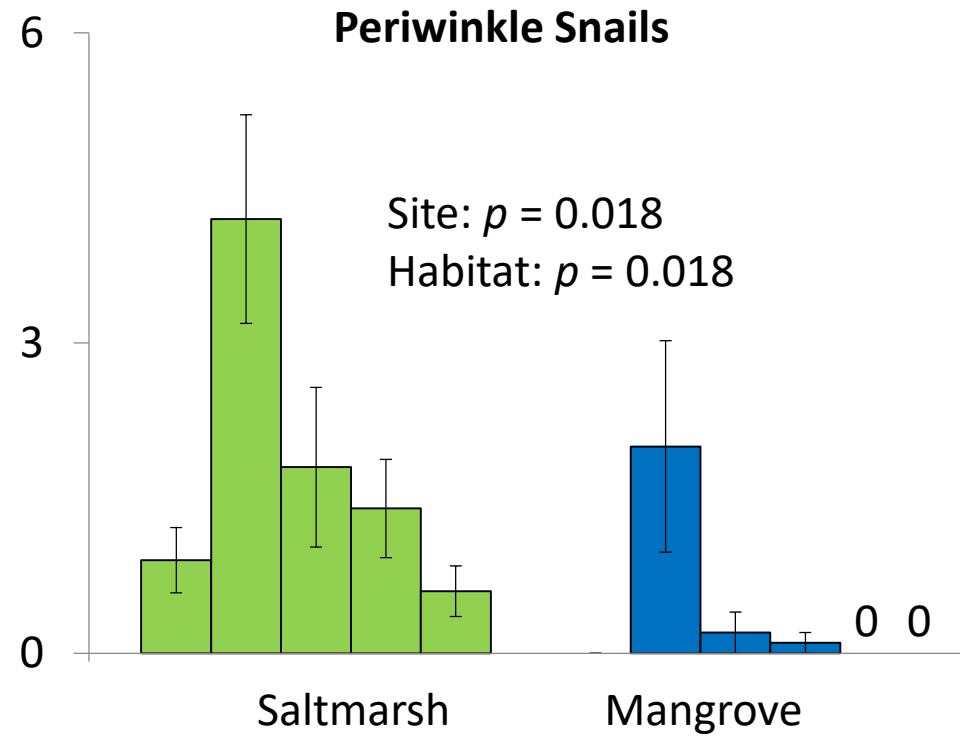
Do mangrove and saltmarsh creeks differ in invertebrate community?

- Densities per 1m² (n=10 per site)
 - Periwinkle snails
 - Oysters
 - Mussels
 - Crab burrows



Do mangrove and saltmarsh creeks differ in invertebrate community?

- Density of mussels, oysters, crab burrows were similar in both habitats
- Snail density were higher in saltmarsh



Do mangrove and saltmarsh creeks differ in invertebrate community?

- Density of mussels, oysters, crab burrows were similar in both habitats
- Snail density were higher in saltmarsh
- Snail densities were lower than temperate regions



200–800 Snails per m²
Temperate
(Silliman et al 2003)

0-6 Snails per m²
Ecotone

Do mangrove and saltmarsh creeks differ in Predation?

- Tethered dried squid (squidpops)
 - 10 per site
 - 24 hours
 - 50% or more presence / absence



Do mangrove and saltmarsh creeks differ in Predation?

- No difference in predation between vegetation types

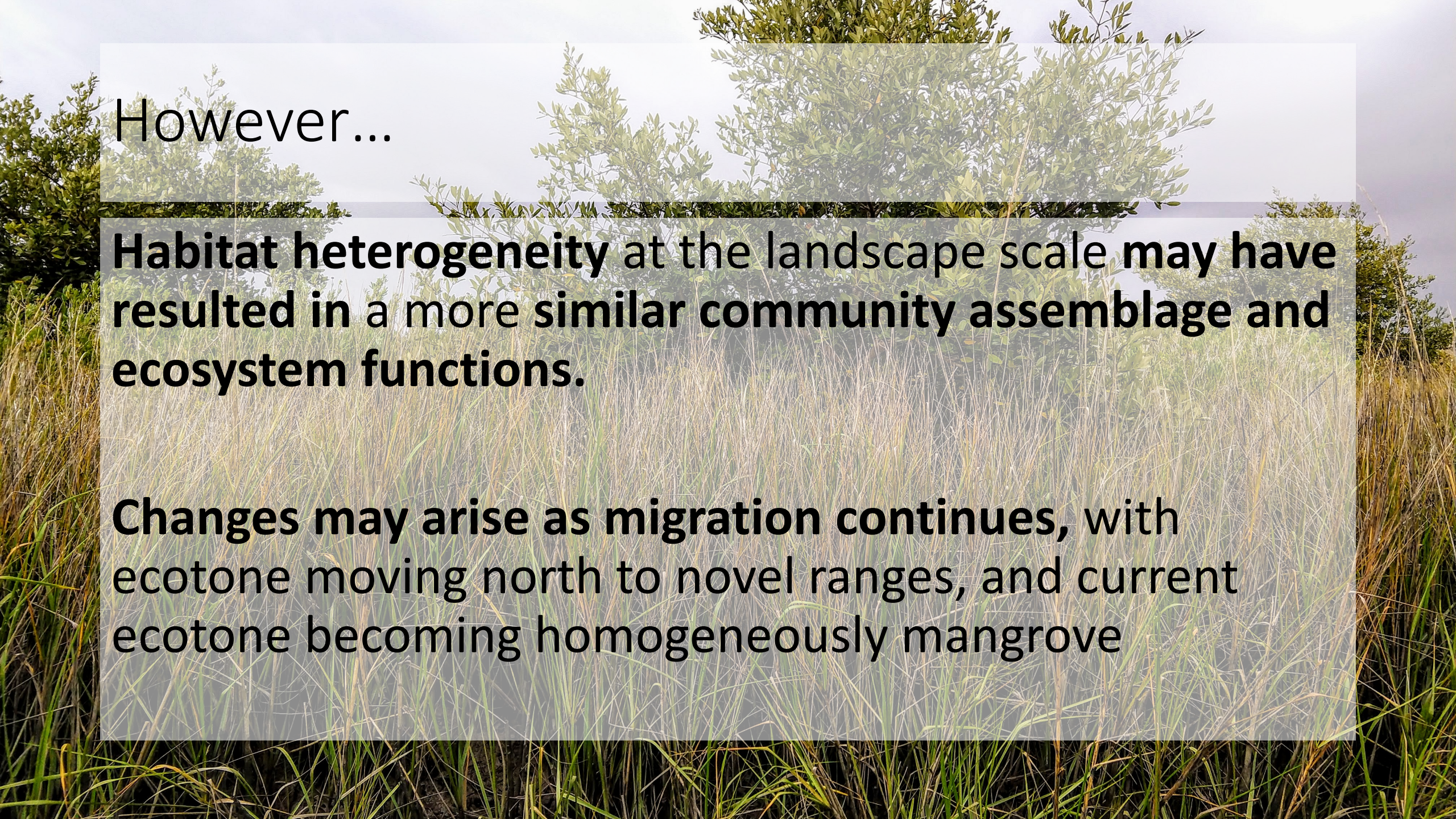


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Conclusions

Mangrove trees are changing the physical structure and stability of intertidal coastal vegetation at the ecotone.

Change in structure is **not** resulting in change **top-down predation, predation rates, invertebrate densities, algae biomass, or stability of any of these factors**

The background of the slide is a photograph of a coastal landscape. In the foreground, there are tall, thin grasses, some green and some yellowed. In the background, there are dense green trees and shrubs under a clear sky.

However...

Habitat heterogeneity at the landscape scale **may have resulted in a more similar community assemblage and ecosystem functions.**

Changes may arise as migration continues, with ecotone moving north to novel ranges, and current ecotone becoming homogeneously mangrove

Thanks!

Committee: Todd Osborne, Christine Angelini, Andrew Altieri, Charles Martin
Funding: UF School and Natural Resources and the Environment
UF-STRI Marine Conservation Fellowship

Animations: Integration and Application Network, University of Maryland Center for Environmental Science
(ian.umces.edu/imagelibrary/)

Questions?

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Diversity 2019, 11(11), 208; <https://doi.org/10.3390/d11110208>

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Article

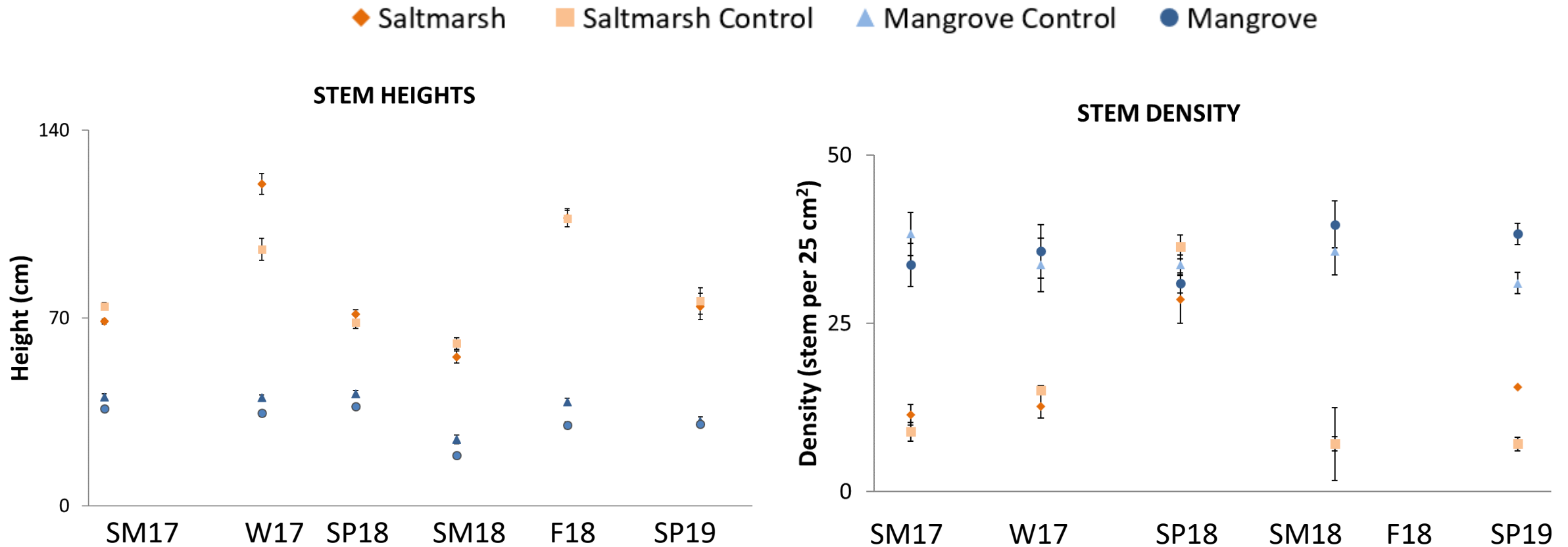
Effects of Changing Vegetation Composition on Community Structure, Ecosystem Functioning, and Predator–Prey Interactions at the Saltmarsh-Mangrove Ecotone

by  Julie E. Walker ^{1,*} ,  Christine Angelini ² ,  Ilgar Safak ³ ,
 Andrew H. Altieri ²  and  Todd Z. Osborne ⁴ 



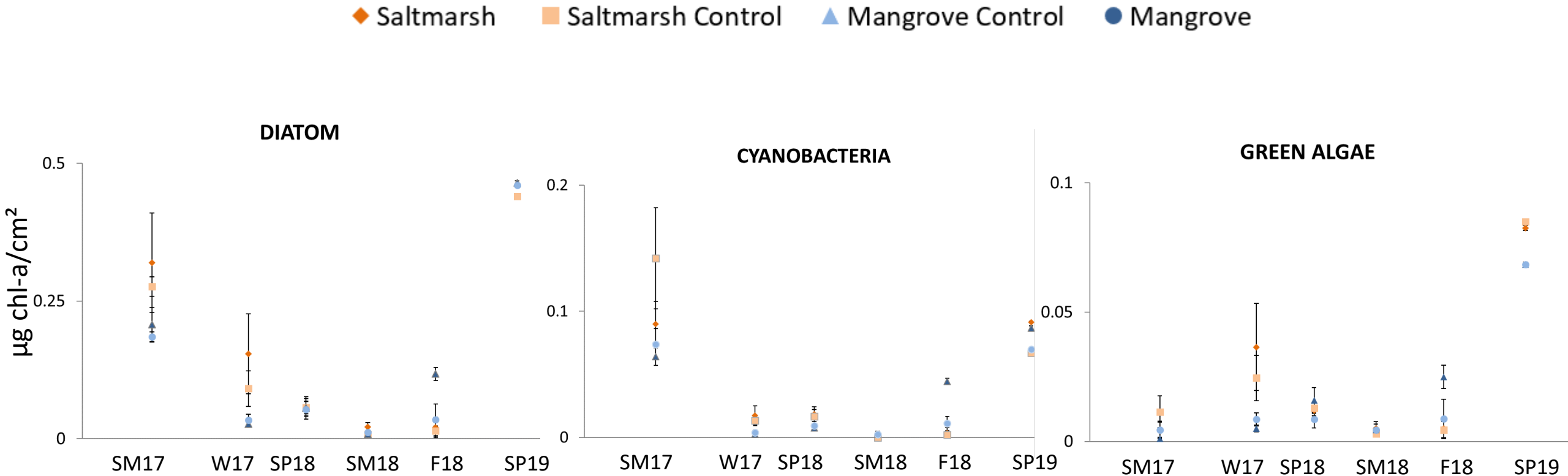
Experimental Results

Predation has no real effect on either habitat at the Ecotone



Experimental Results

Predation has no real effect on either habitat at the Ecotone

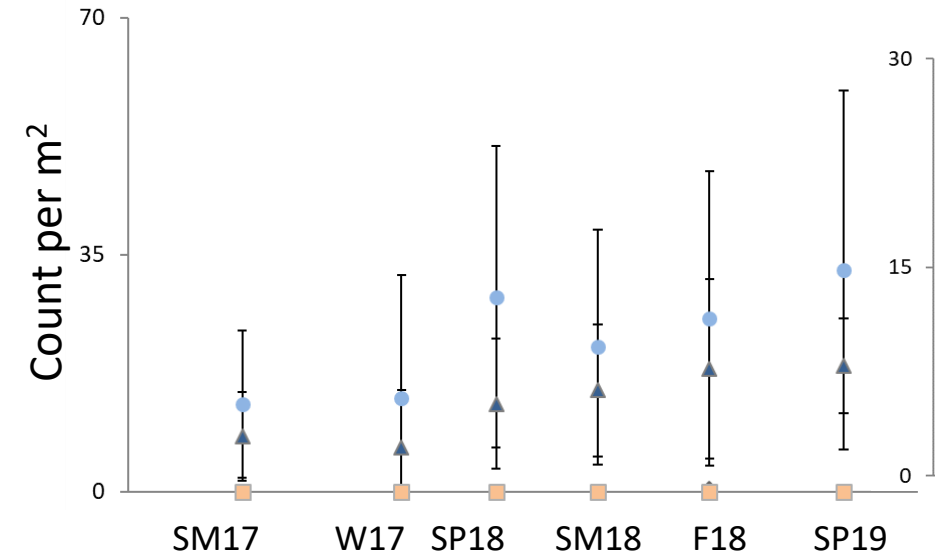


Experimental Results

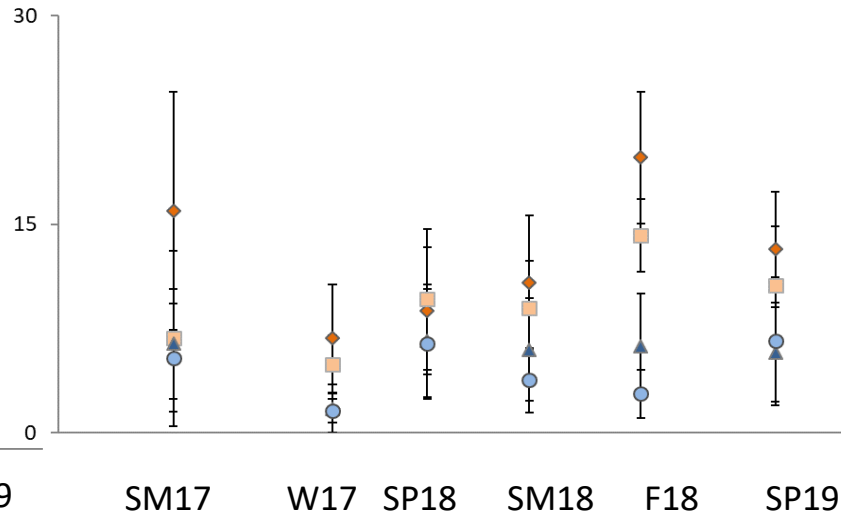
Predation has no real effect on either habitat at the Ecotone

◆ Saltmarsh ■ Saltmarsh Control ▲ Mangrove Control ● Mangrove

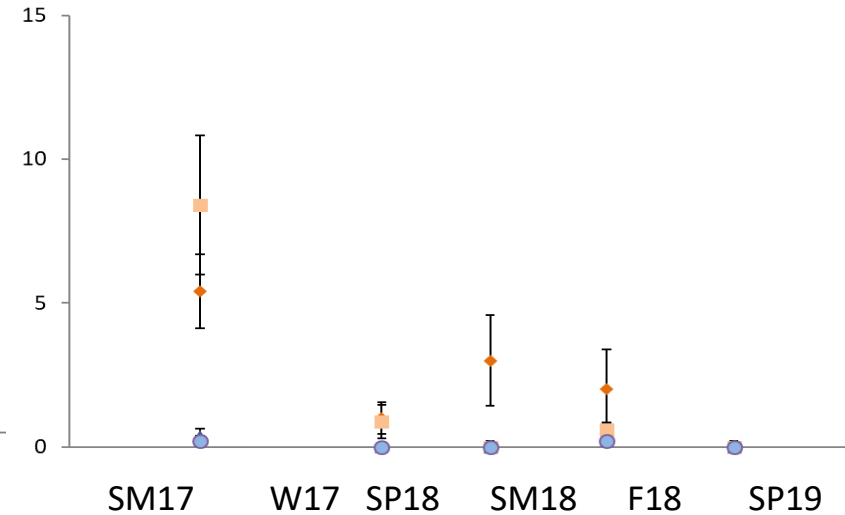
OYSTERS



MUSSELS



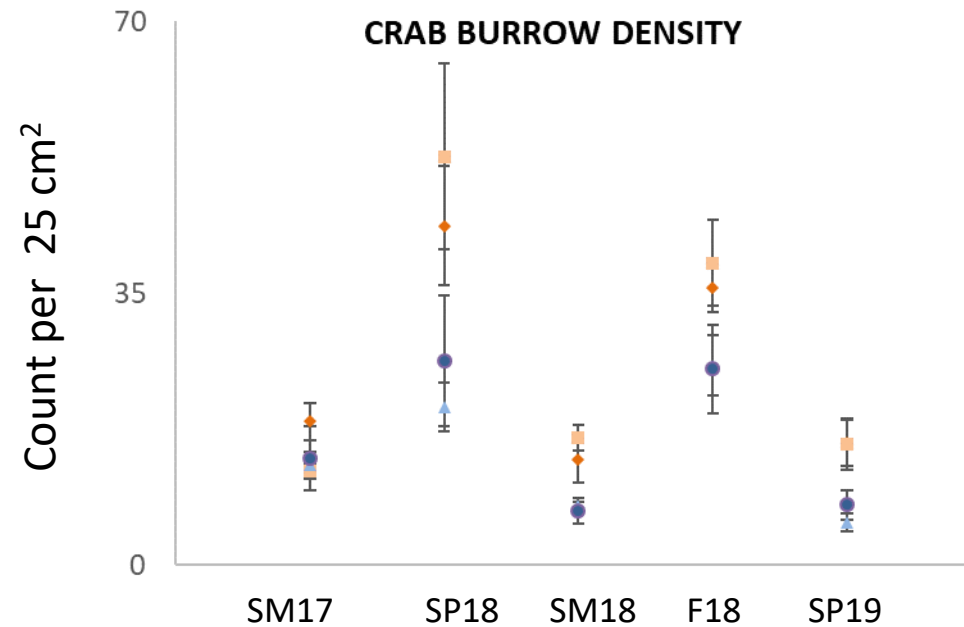
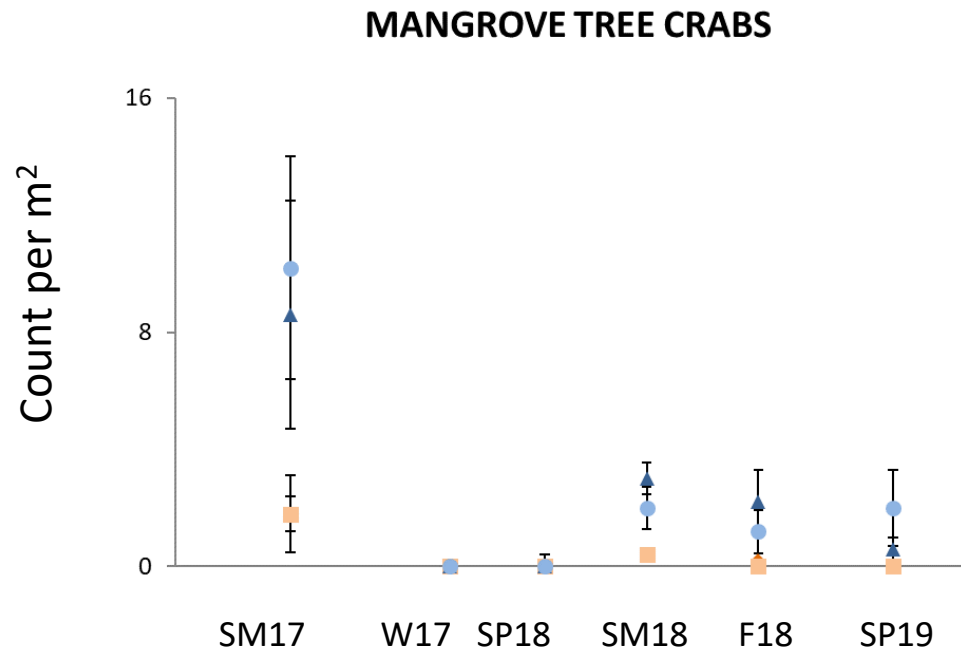
SNAILS



Experimental Results

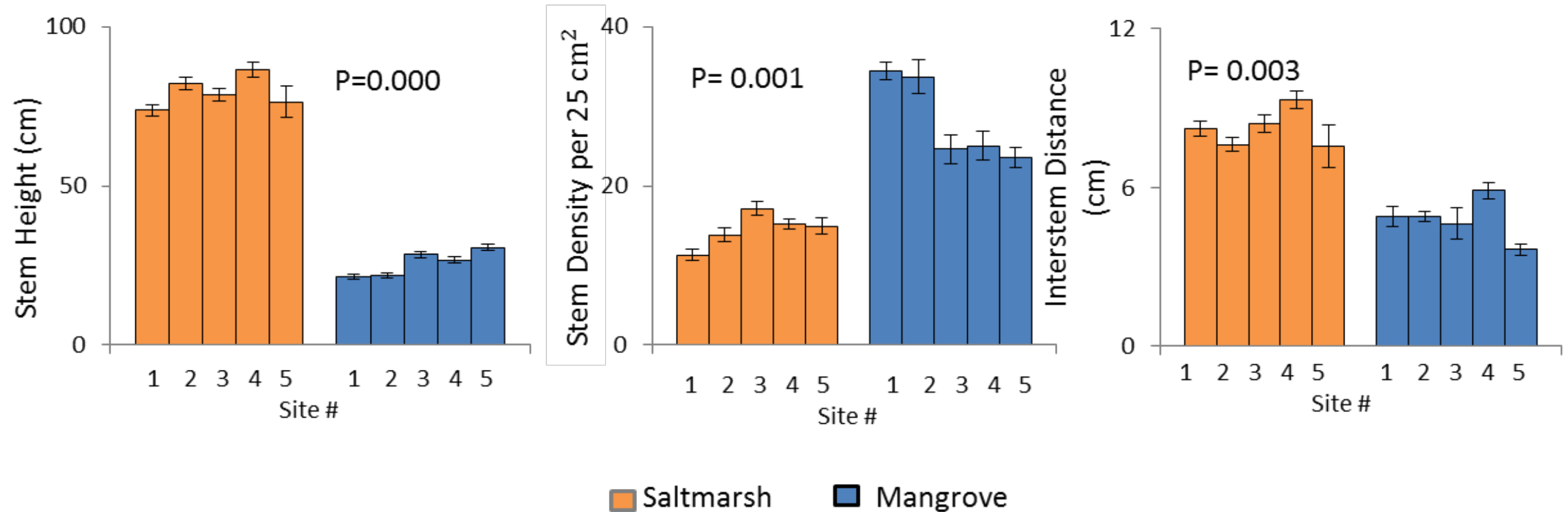
Predation has no real effect on either habitat at the Ecotone

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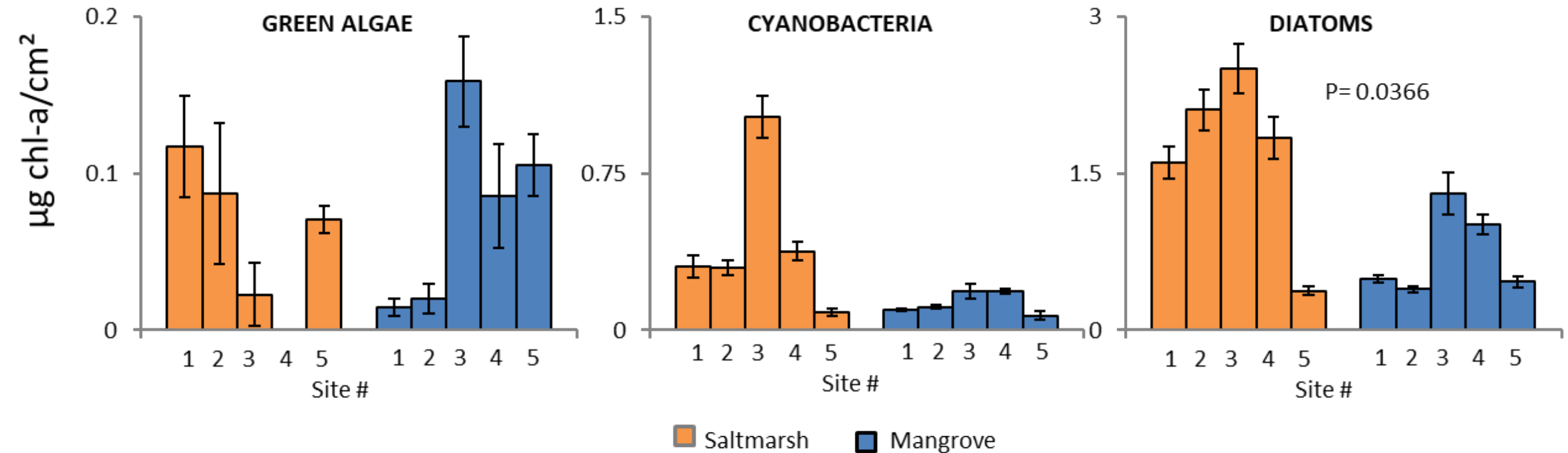
Survey Results

All Structural Metrics Differed by Vegetation type



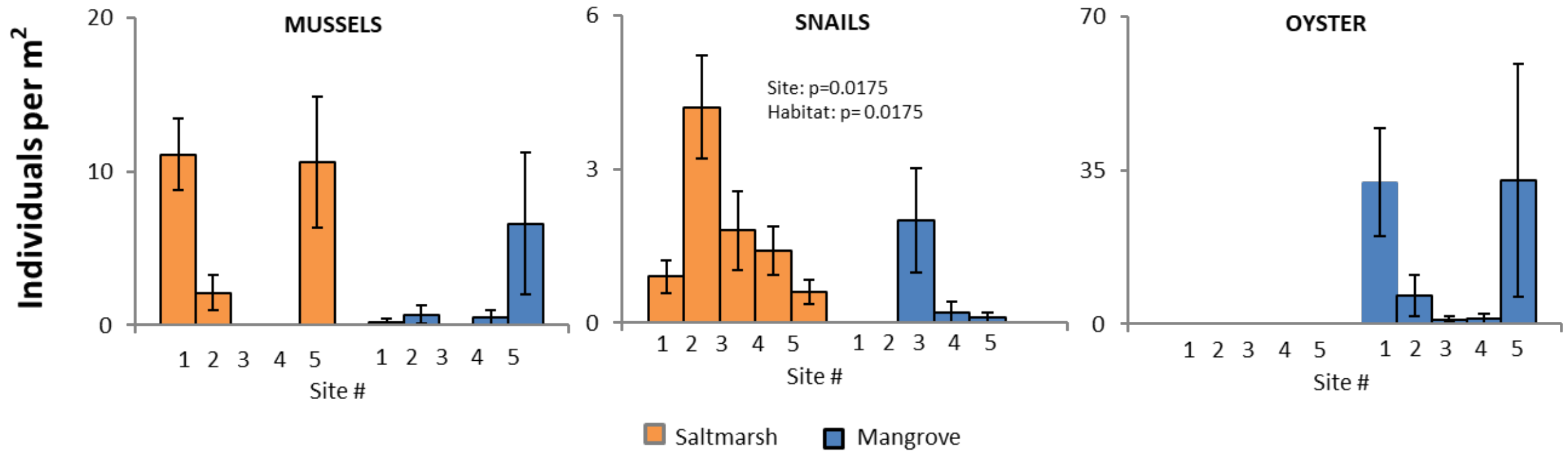
Survey Results

Algal Biomass was Similar in Both Vegetation Types



Survey Results

Invertebrate Community was Similar in Both Vegetation Types



Survey Results

Invertebrate Community was Similar in Both Vegetation Types

