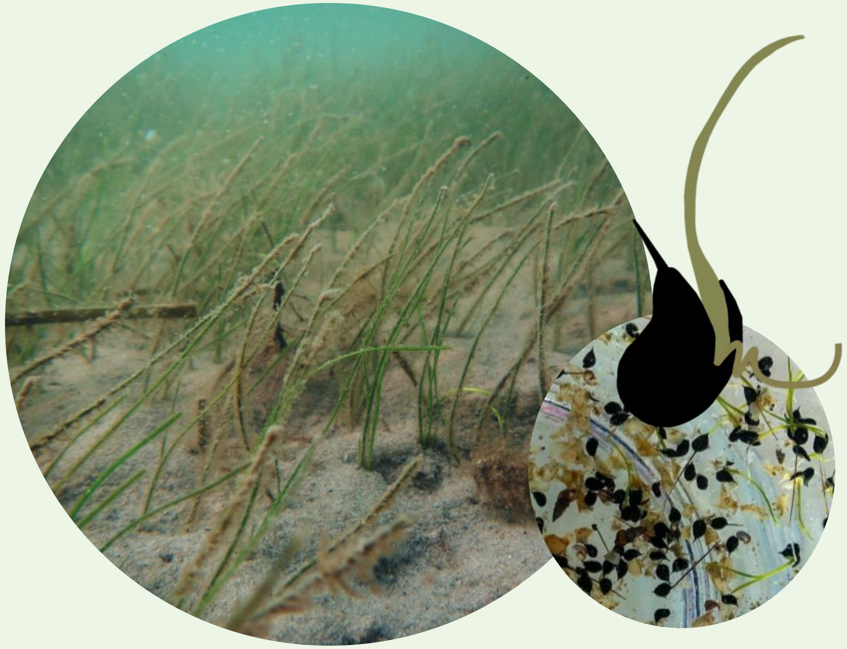
Adaptive seagrass restoration

comparing *Zostera marina* & *Ruppia maritima*



Coauthors, and data & field contributors: Stephanie J. Wilson, Christopher J. Patrick, Bongkeun Song, Robert J. Orth and Betty B. Neikirk, Erin C. Shields, & William G. Reay

SHORT RESULTS TO UPDATE CHESAPEAKE BAY SAV WORKING GROUP October 2022, *results not finalized, manuscript in prep.*

presented by

Enie Hensel

ehensel@vims.edu | Postdoctoral Researcher | Coastal Estuarine Ecology Lab | @eniehensel (she/her/hers)

VIMS | William & Mary

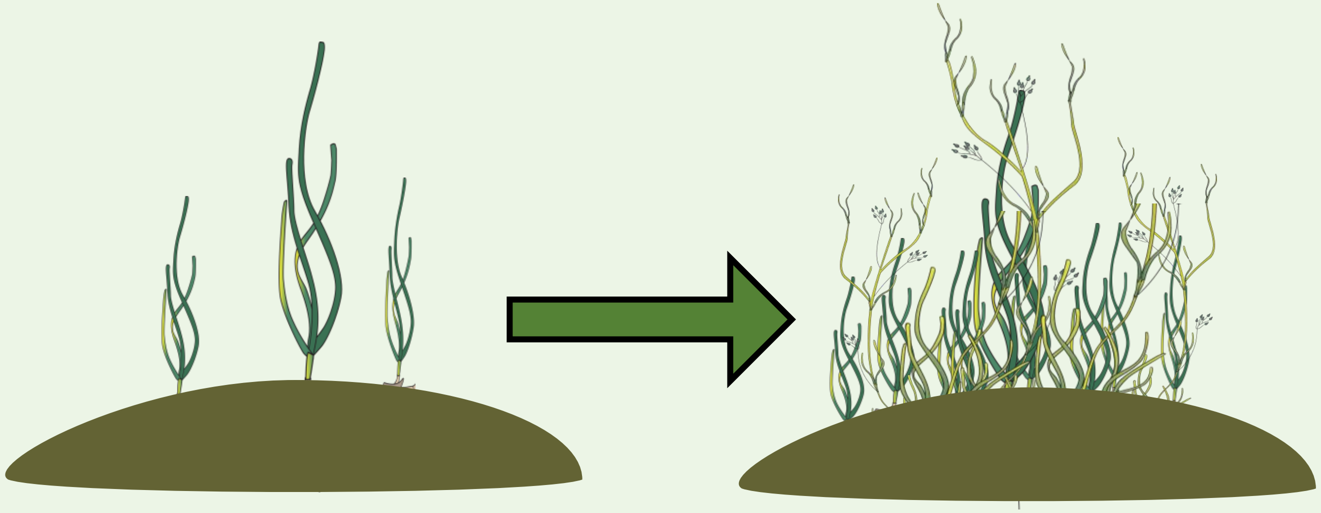
Virginia Institute of Marine Science

Images by E.Hensel, ian.umces.edu

habitat restoration is a powerful tool to help mitigate the loss of seagrass.

- Diversity of restoration methods are growing

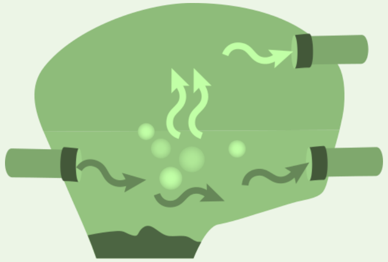
- Restoration efforts need to parallel current and future conditions



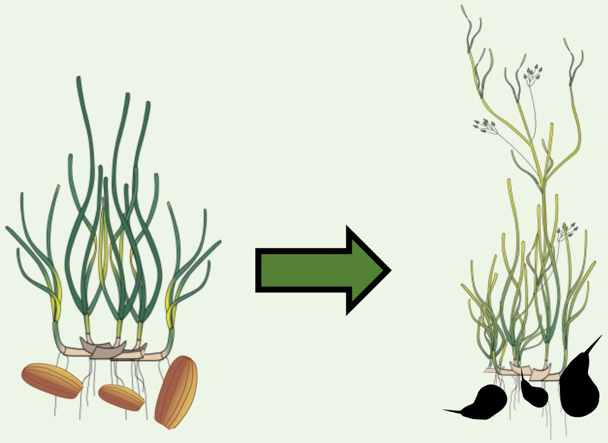
conservation practices must adapt with natural community shifts

- Seagrass seascapes are changing in the lower Chesapeake Bay due largely to climate change & human activities
- In addition to decline trends, dominant species shifts from *Zostera marina* → *Ruppia maritima*

heat waves



run-off pollution

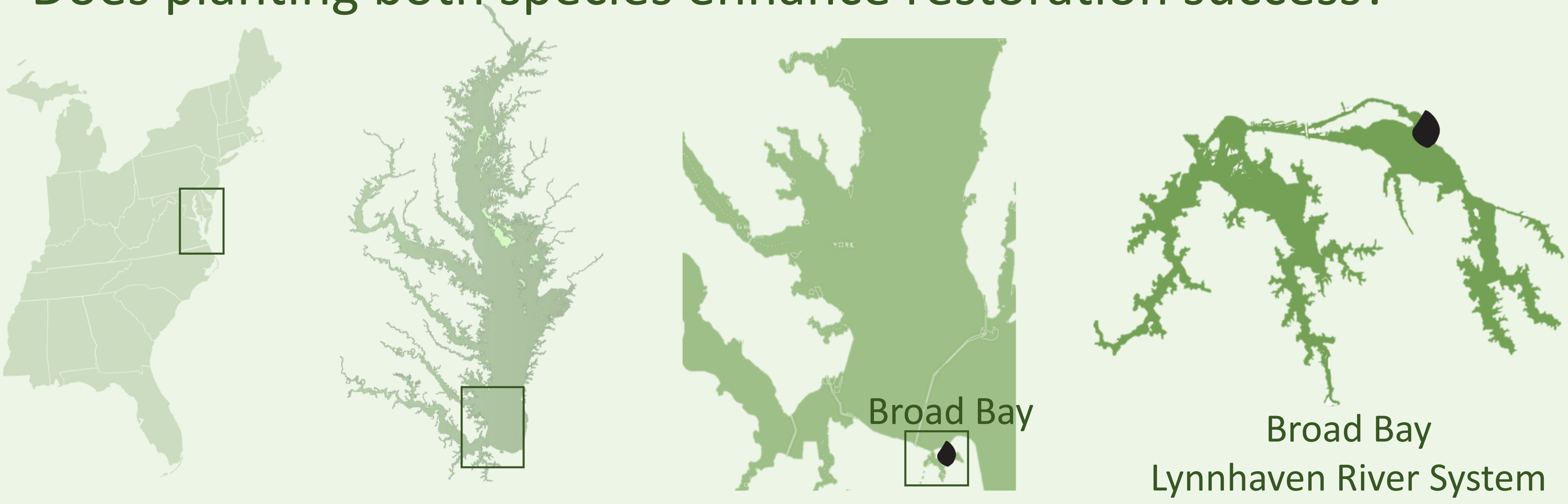


dominant species shifts

broadcast seed restoration

here we conducted a restoration field experiment with *Zostera marina & Ruppia maritima*

- Tested for best Ruppia maritima planting practices
- Compared how species alter bed structure and function
- Does planting both species enhance restoration success?



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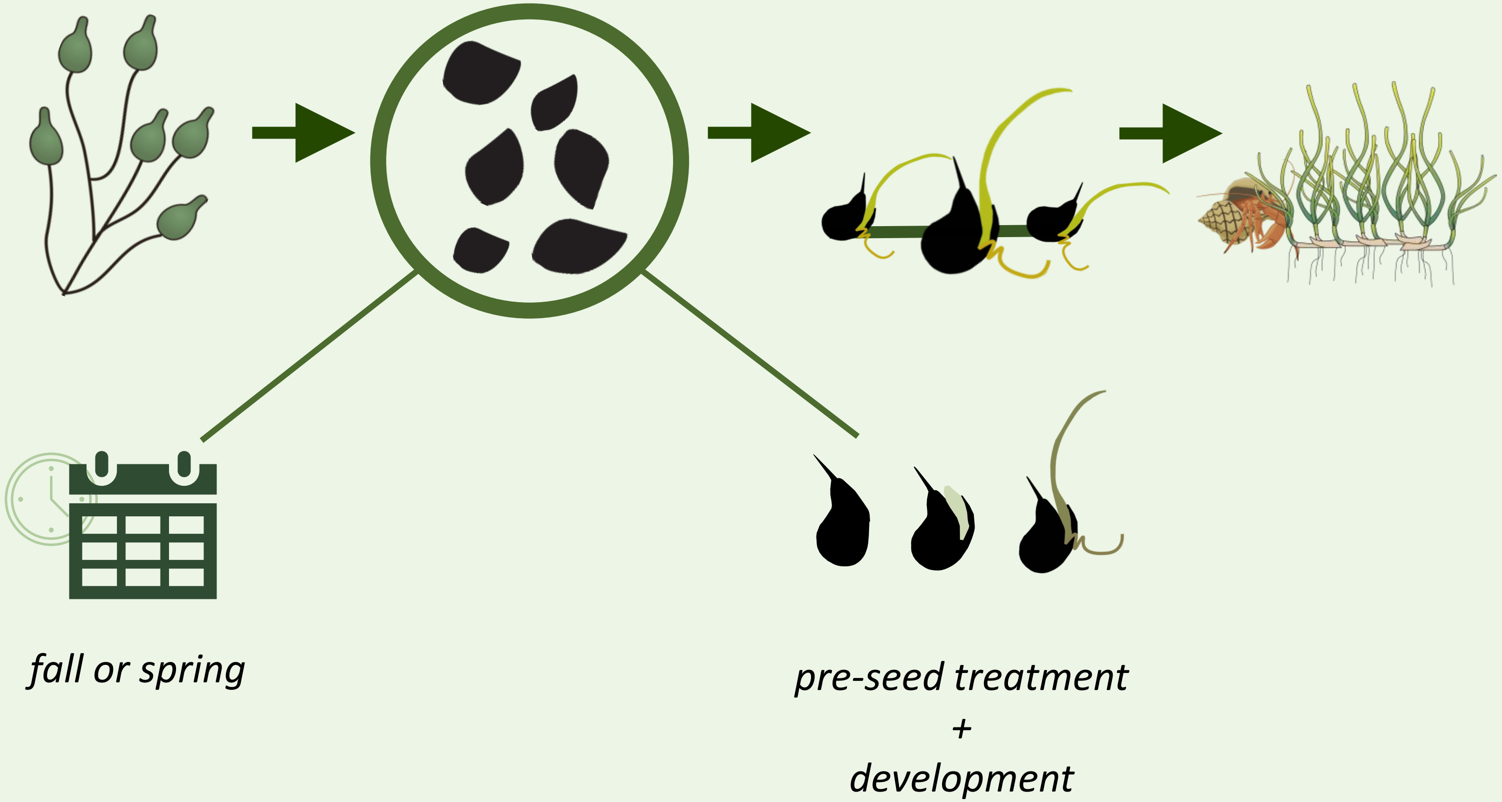
How does *Ruppia maritima* broadcast seed dispersal method alter bed establishment and composition?



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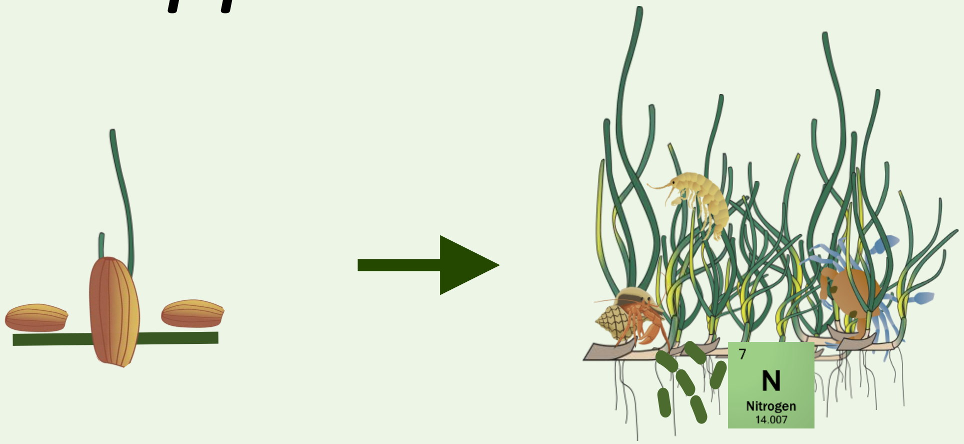
comparing *Zostera marina* & *Ruppia maritima*

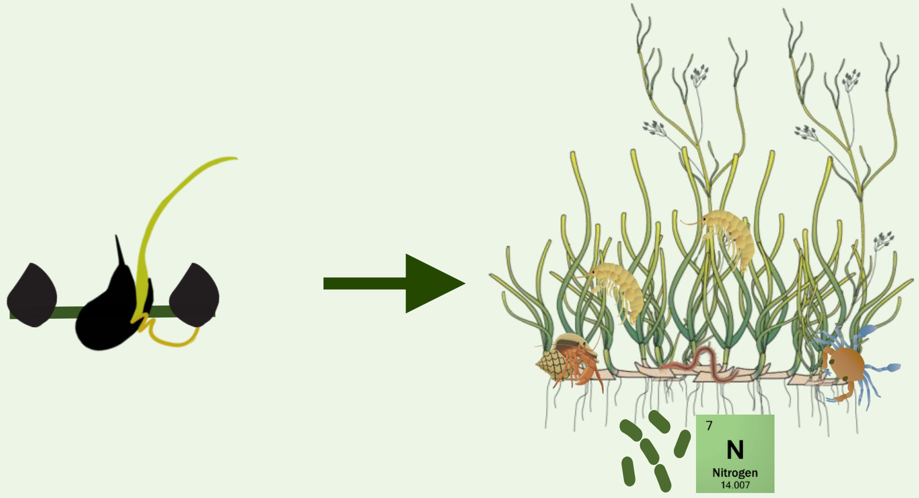
Structure

- bed area cover
- shoot density
- canopy height
- macroalgae presence



Function

- primary production (biomass)
- habitat provision (fauna composition)
- sediment microbial activities (DNF & DNRA)



experimental design

TREATMENTS

Zostera maritima – seeded in fall

Ruppia maritima – seeded in fall

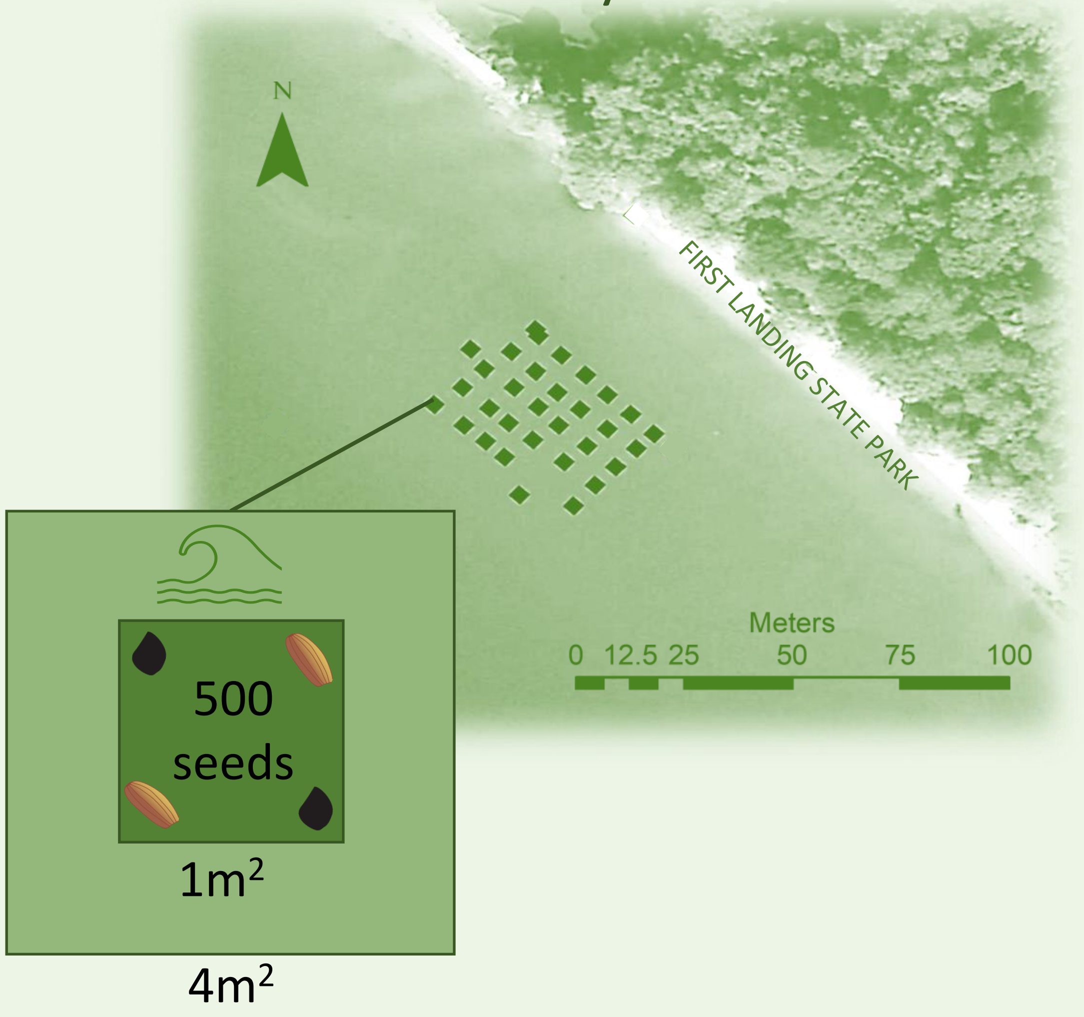
Ruppia maritima – seeded in spring

Ruppia maritima – seeded in spring, seeds had 48-hour freshwater shock

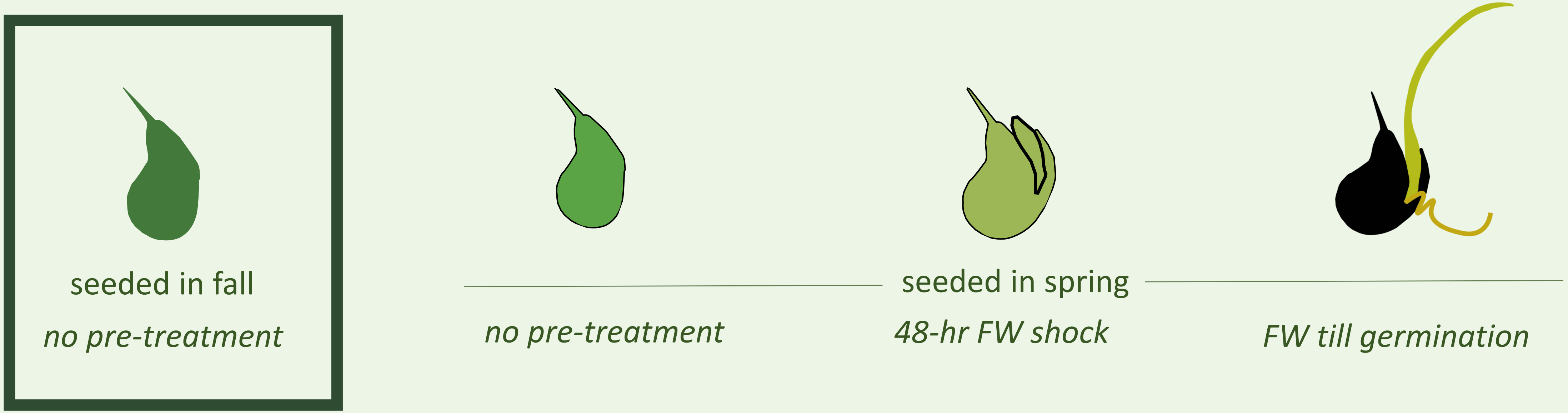
Ruppia maritima – seeded in spring, seeds had freshwater shock until germination

bare sediment control

study site



Ruppia maritima broadcast in the fall with no pre-treatment established bigger and denser plots



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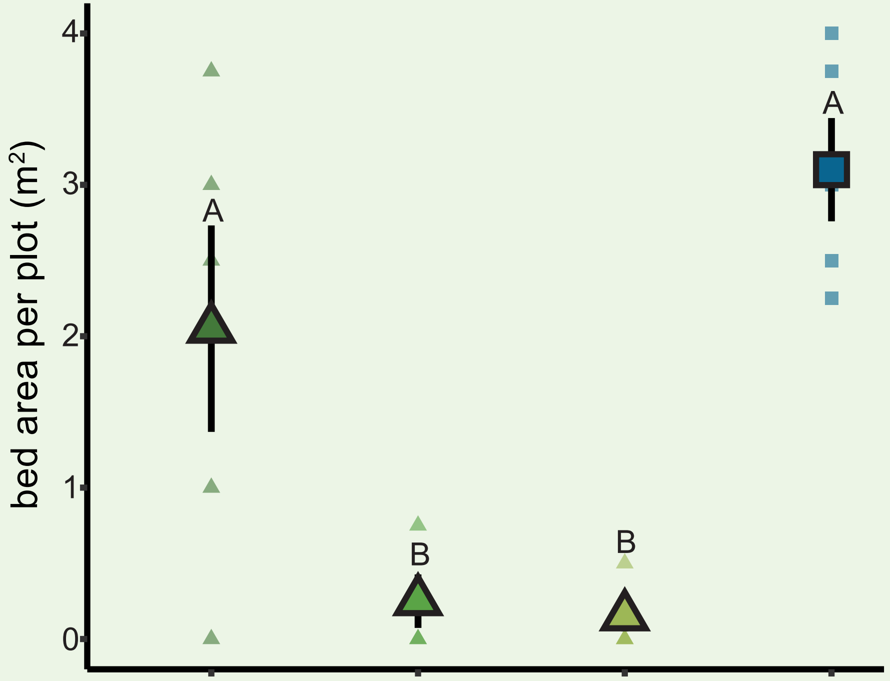
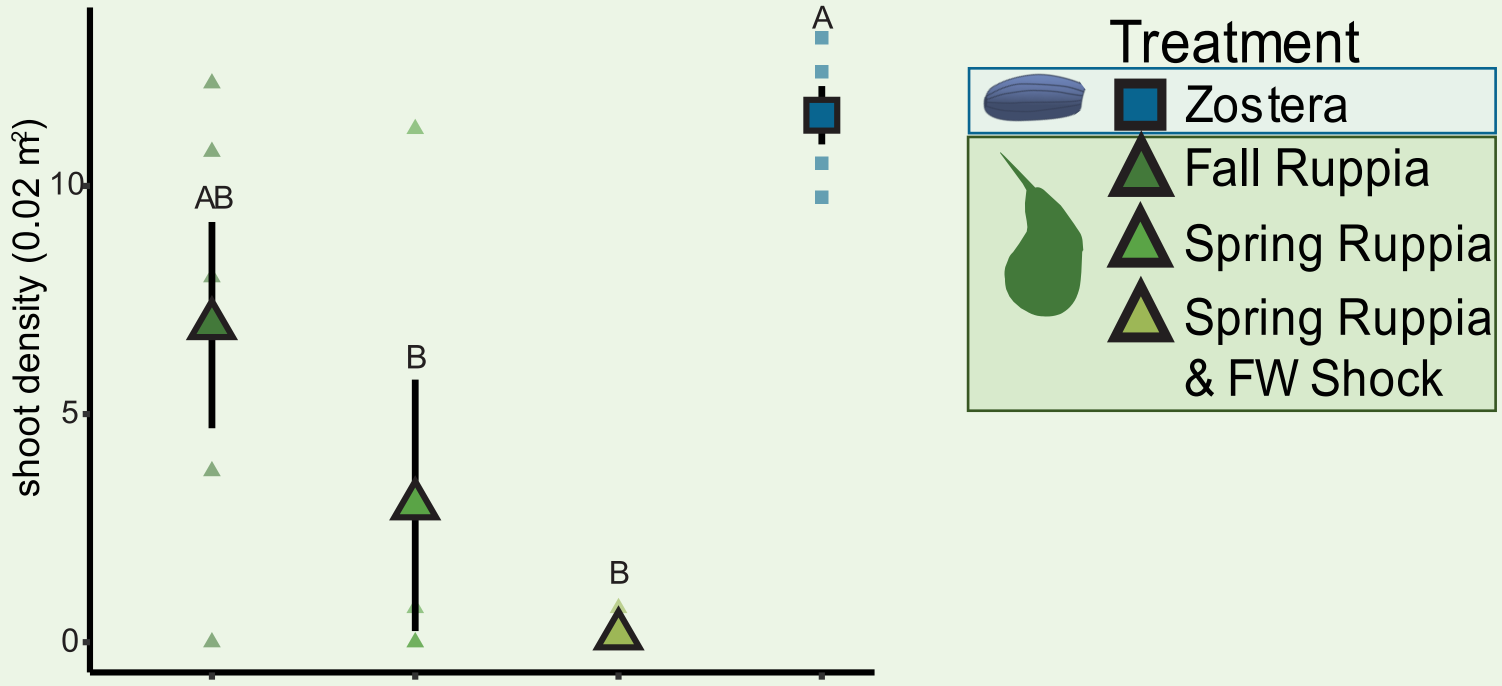
Zostera and *Ruppia* established similar bed area and shoot density

areal cover of 2-3 m^2



adj.R^2 = 0.65, $F(1,8)$ = 9.6, **$p < 0.01$**

shoot density of 15-18 shoots



adj-R^2 = 0.49, $F(1,8)$ = 9.6, **$p < 0.01$**

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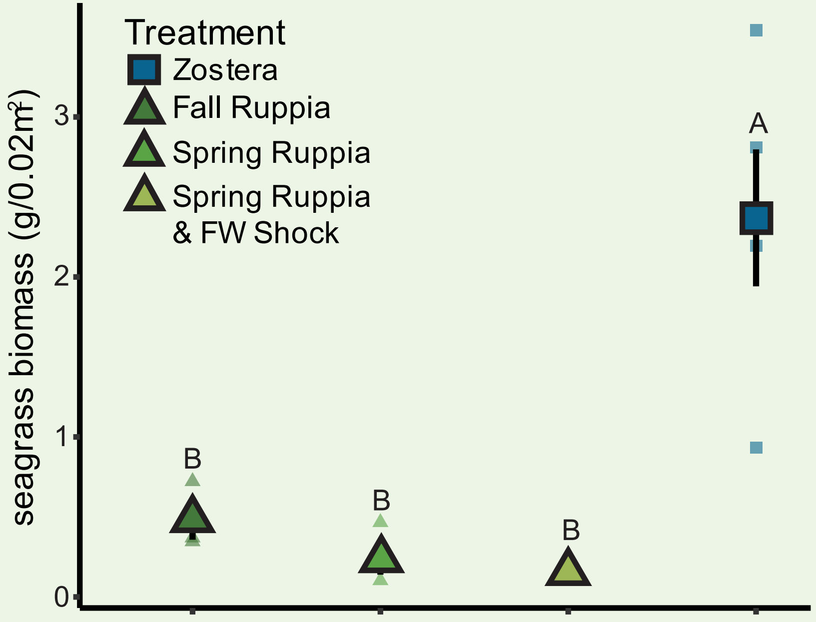
primary production and habitat structural diversity differed between plant species

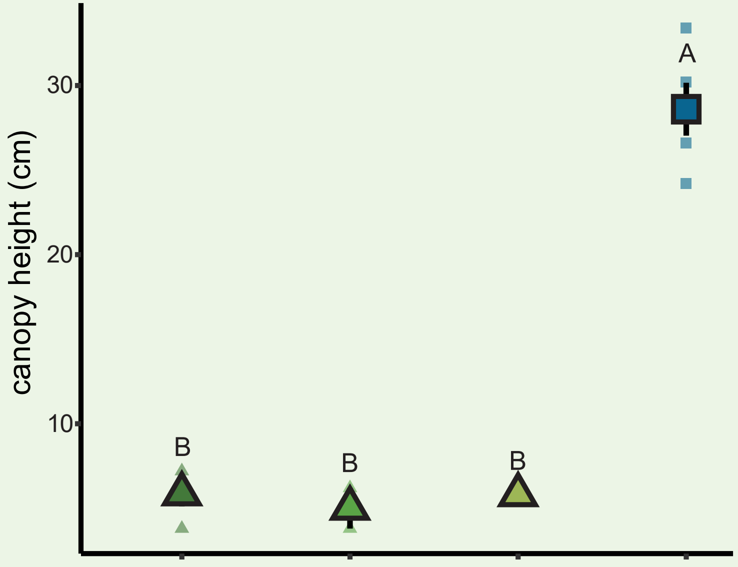
- Zostera produced 3x more plant biomass
- Ruppia beds had more structurally complex macroalgae

plant biomass



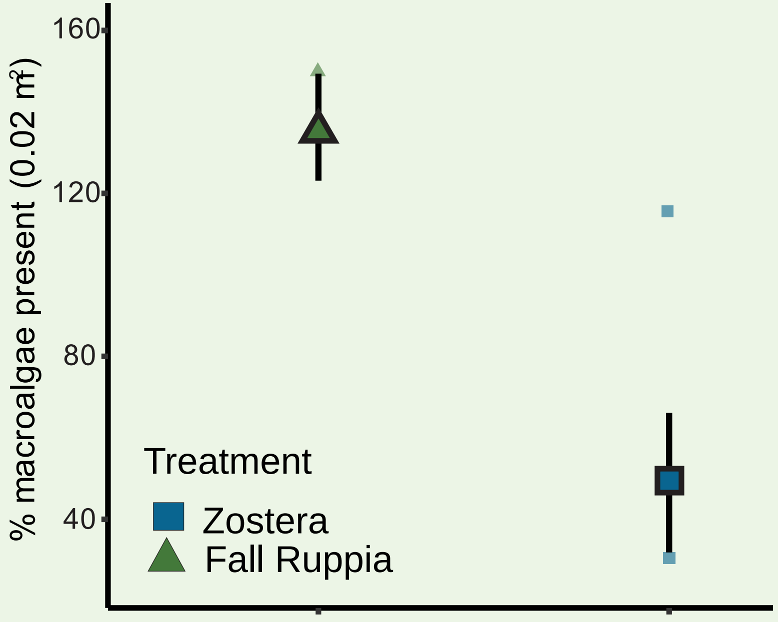
adj-R^2 = 0.77, $F(1,8)$ = 9.6, **$p < 0.01$**

canopy height



adj-R^2 = 0.95, $F(1,8)$ = 9.6, **$p < 0.01$**

macroalgae % cover



adj-R^2 = 0.64, $F(1,8)$ = 9.6, **$p < 0.01$**

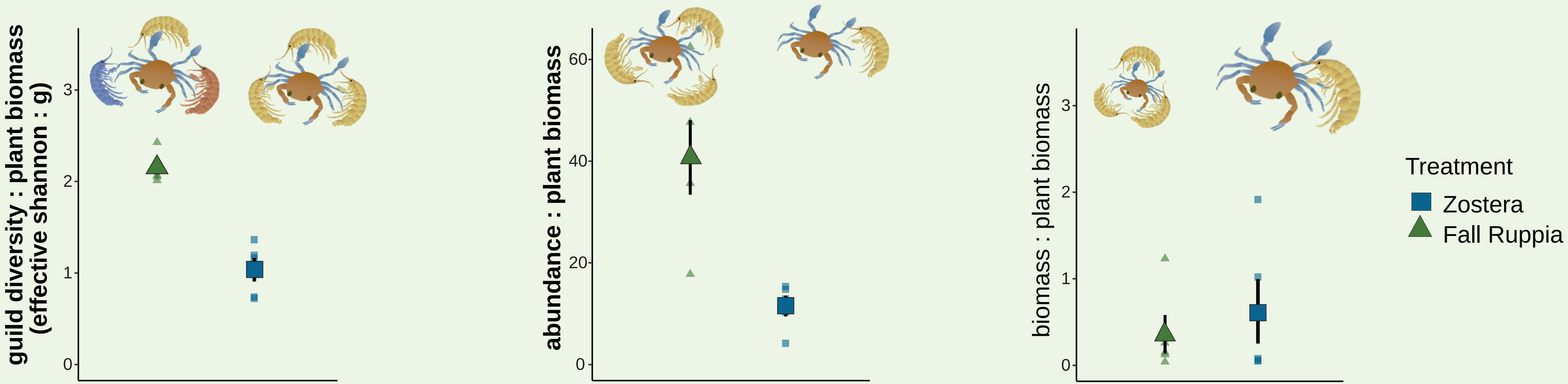
faunal differences were sensitive to amount of plant biomass per area

Ruppia plots had higher fauna diversity and abundance per plant biomass present

guild diversity

abundance

biomass



adj-R^2 = 0.86, F(1,8) = 55.0 , **p < 0.01**

adj-R^2 = 0.60, F(1,8) = 14.7, **p < 0.01**

adj-R^2 = -0.08, F(1,8) = 0.37, p = 0.56

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planting both species enhance restoration success

Broad Bay
Lynnhaven River System

- Increased viable area to plant
  - *Exact measurements currently being measured for potential difference*
  - Vary environmental tolerances between species
- Future potential benefits
  - Seagrass bed presistance
  - Positive feedback mechanisms
    - water quality
    - grazers

planting both species can enhance restoration success

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  - *Exact measurements currently being measured for potential difference*
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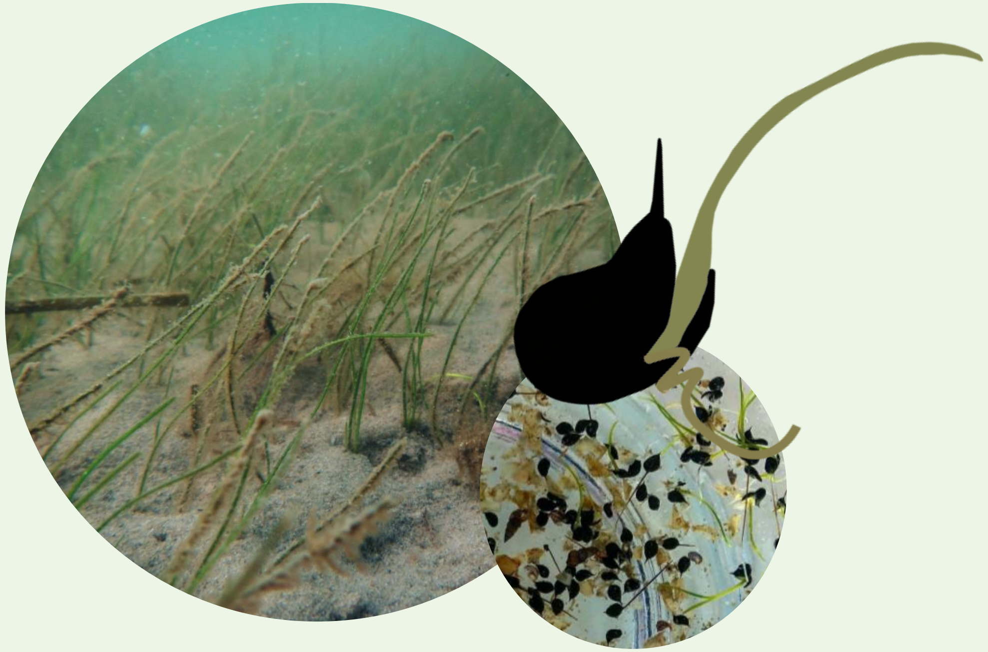
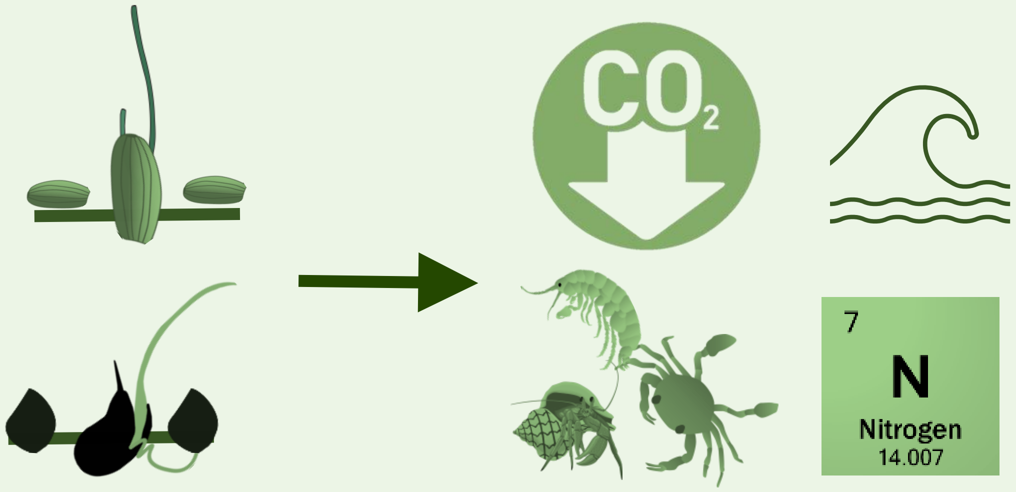
seagrass restoration efforts should seek effective practices for future conditions & restoration goals

- *Ruppia maritima* can be planted by seed and establish in nature
- Ruppia maritima is a heat tolerant species that may aid existing, stressed seagrass meadows



seagrass restoration efforts should seek effective practices for future conditions & restoration goals

- Practitioners should be mindful that seagrass species' choice can alter bed structure and function
- Practitioners may want to reflect on priority services desired from restoration



Thank You for listening

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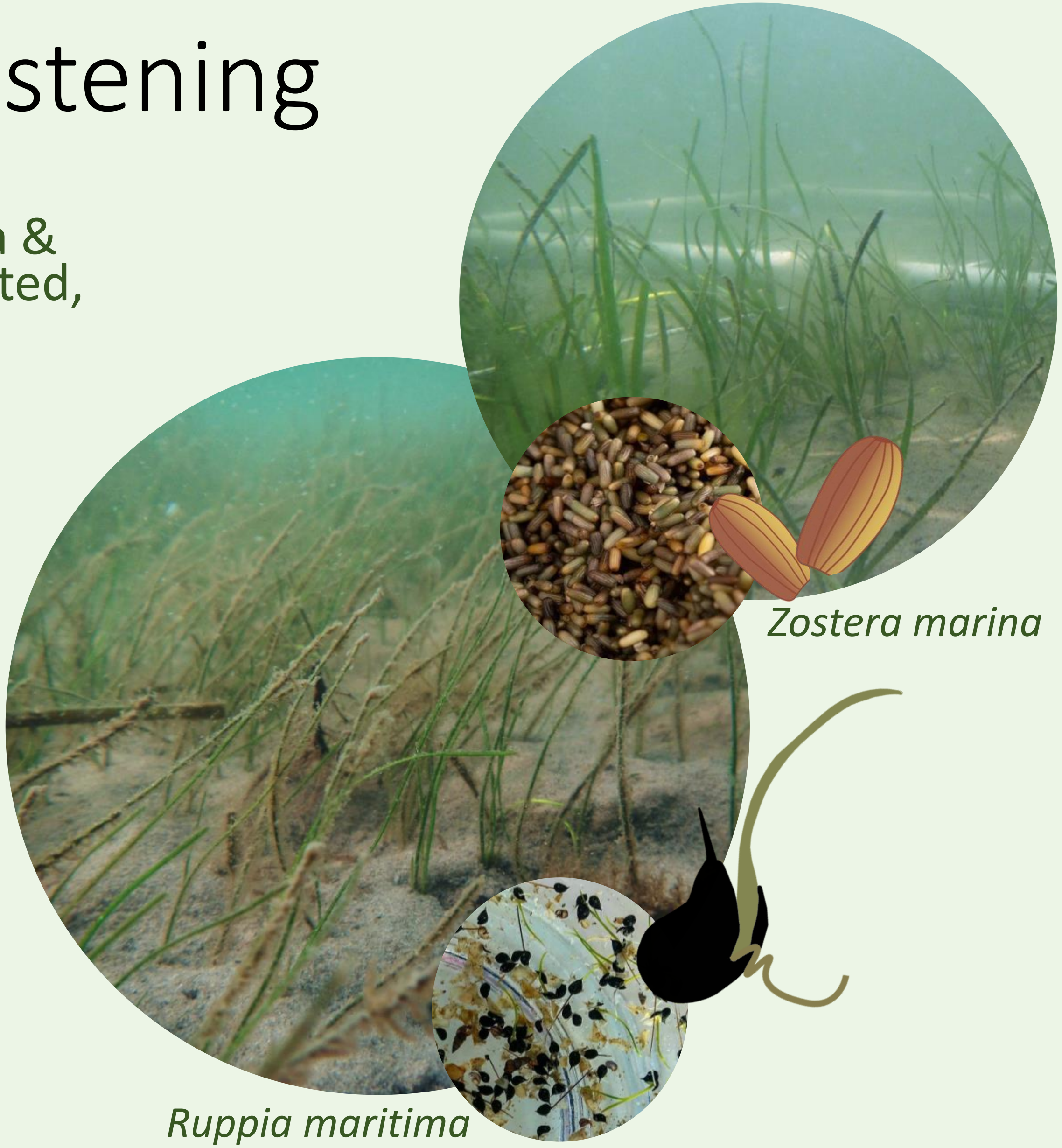

Zostera marina

Ruppia maritima

Chesapeake Bay National Estuarine Research Reserve

US Army Corps of Engineers®

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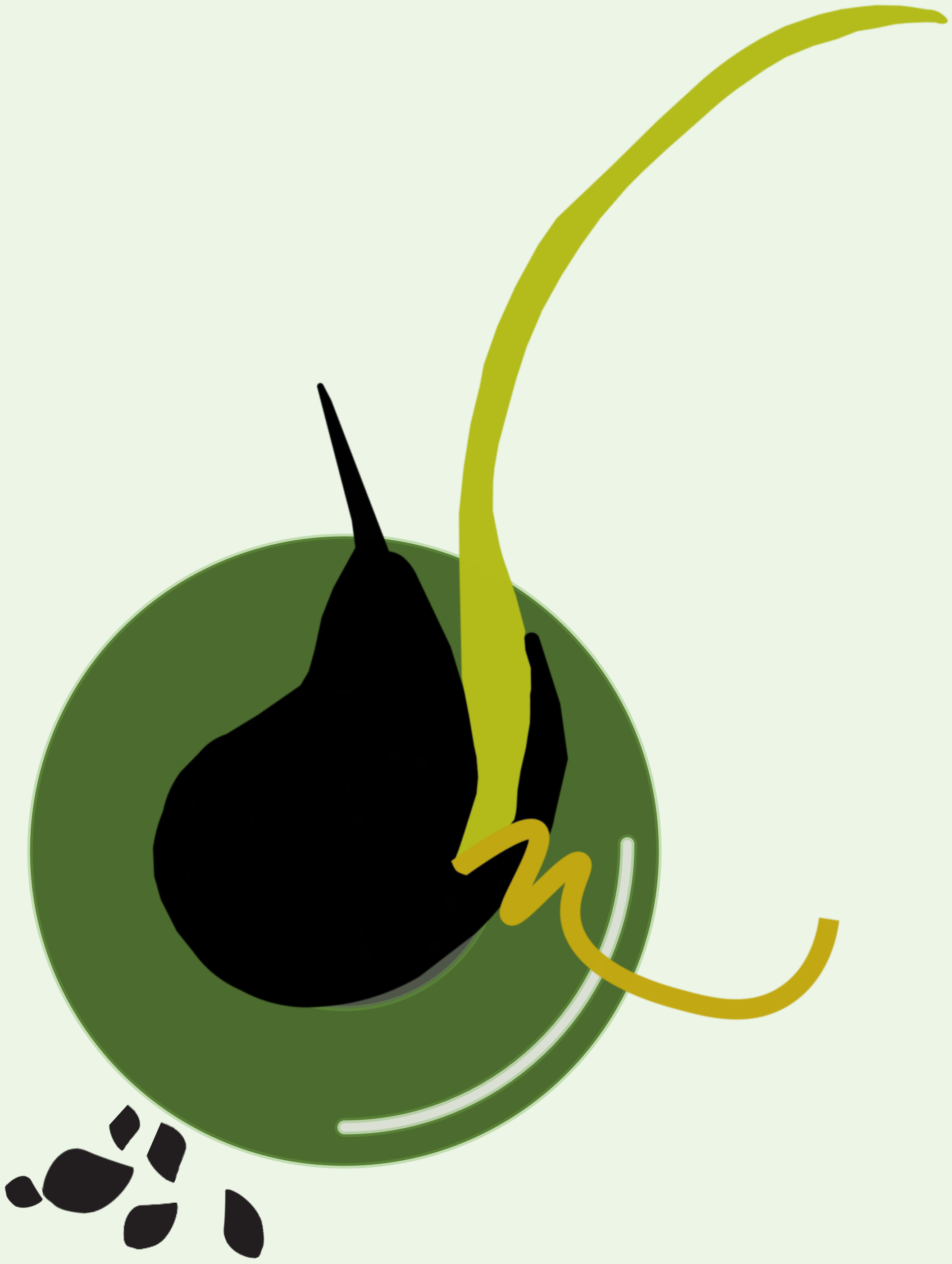

sediment microbial nitrogen recycling slightly higher in Zostera than Ruppia or control plots