Using Positive Interactions Between Bivalves and Seagrass as a Community Based Approach for Habitat Management

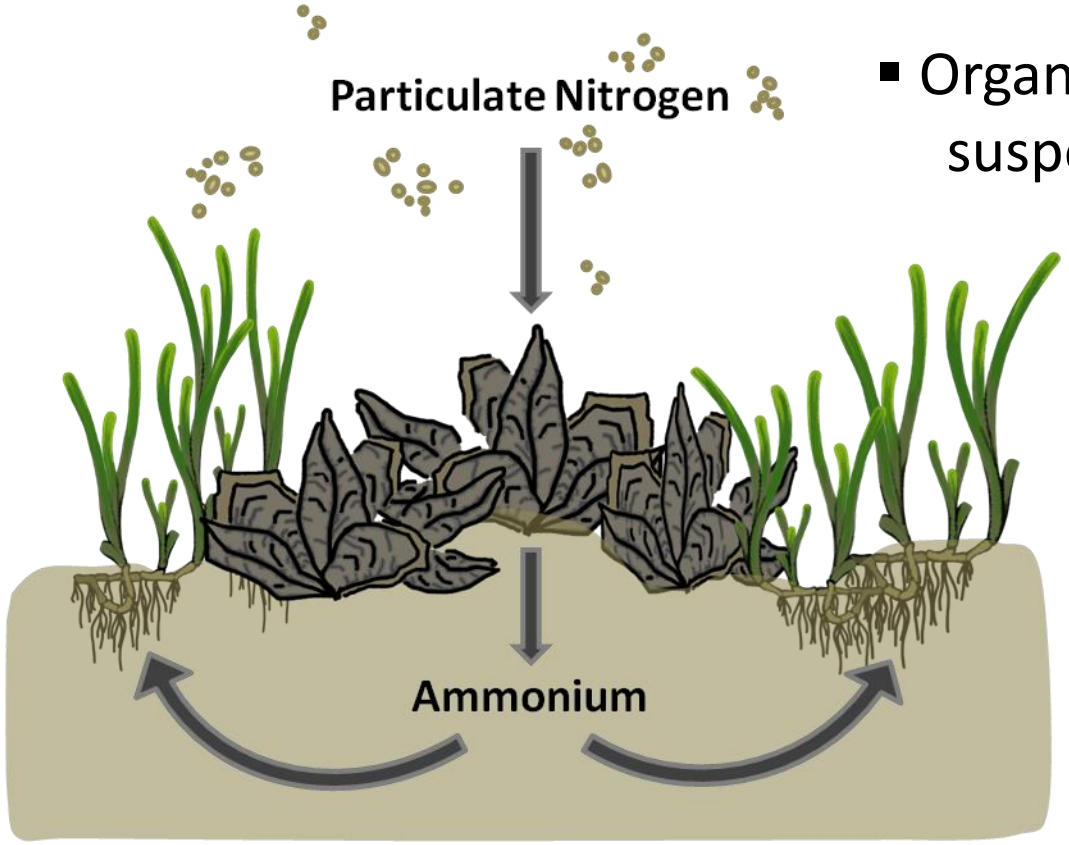
Abigail K. Poray, Michael F. Piehler and F. Joel Fodrie

THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

Positive Interactions

"Any direct or indirect interaction among two or more organisms that positively affects the growth or reproduction of one or more organisms without negatively affecting the other(s)." - Bertness and Leonard, 1997

Positive Interactions Between Bivalves and Seagrass

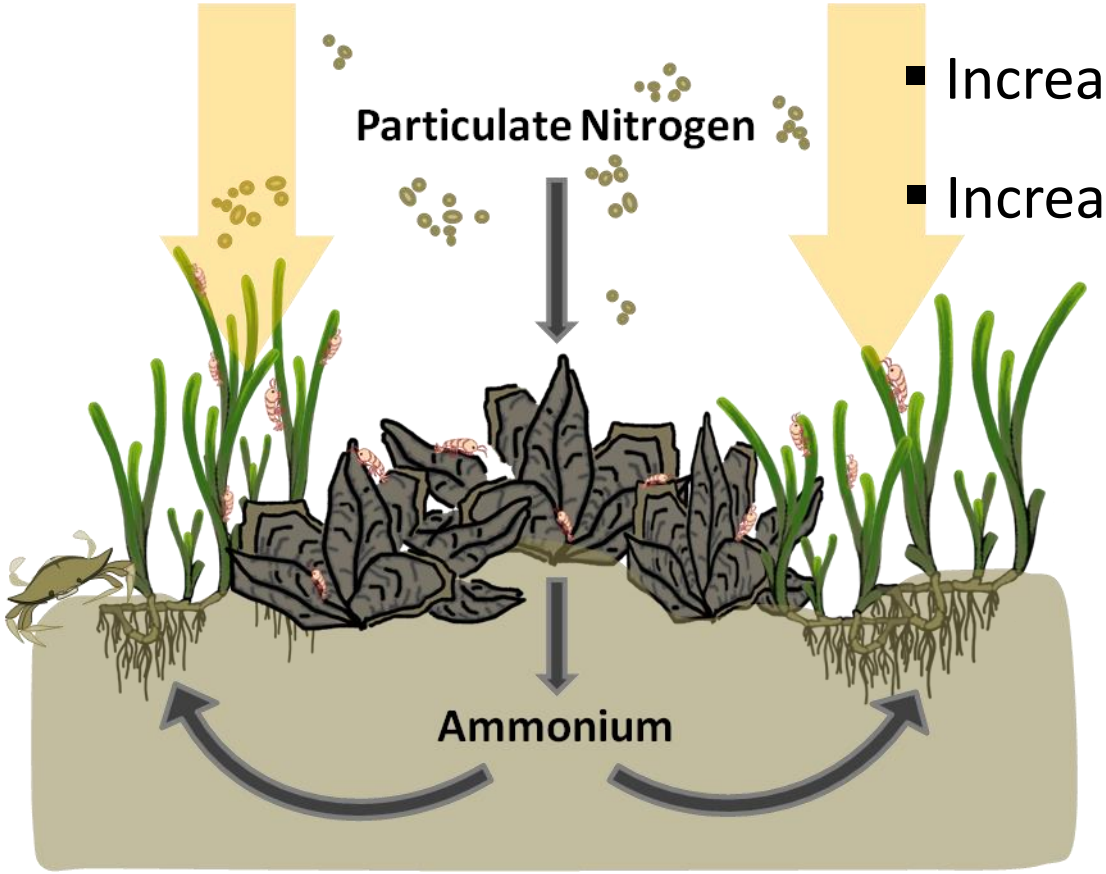


- Organic matter consumed by suspension feeding bivalves
- Re-mineralized and available for plant growth

Positive Feedback Loop

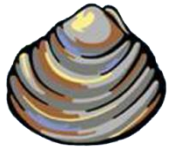
-Dame et al. 1985

Positive Interactions Between Bivalves and Seagrass

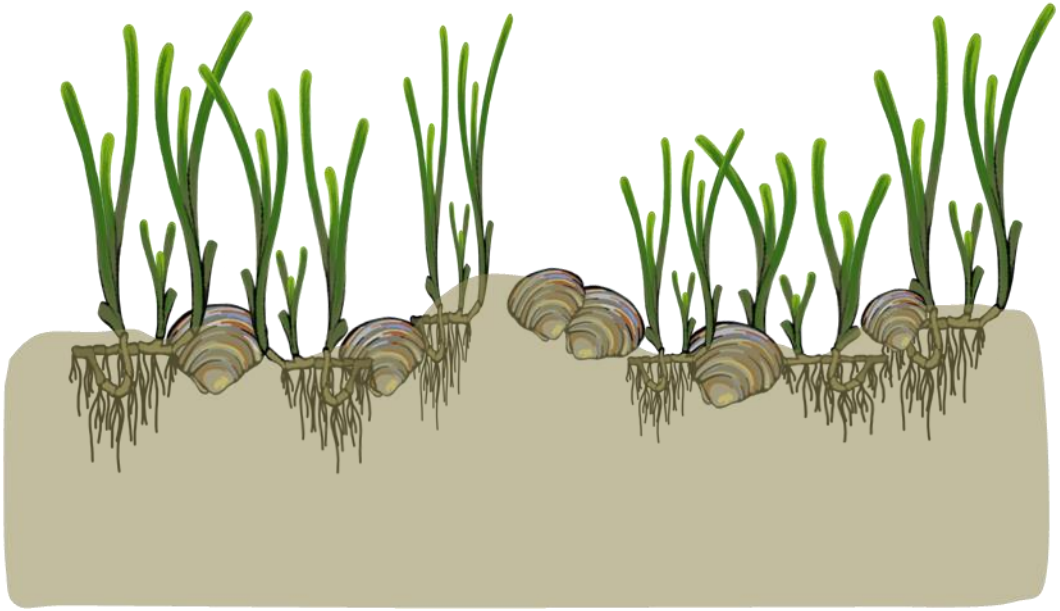


- Increase in nutrient availability
- Increase light penetration
- Increase grazers
- Reduced epiphytic biomass
- Reduce bivalve mortality

Experimental Hypothesis



- Can *Mercenaria mercenaria* be utilized to enhance the condition of *Zostera marina*?



- As a potential tool for future restoration efforts in North Carolina.

Mercenaria mercenaria

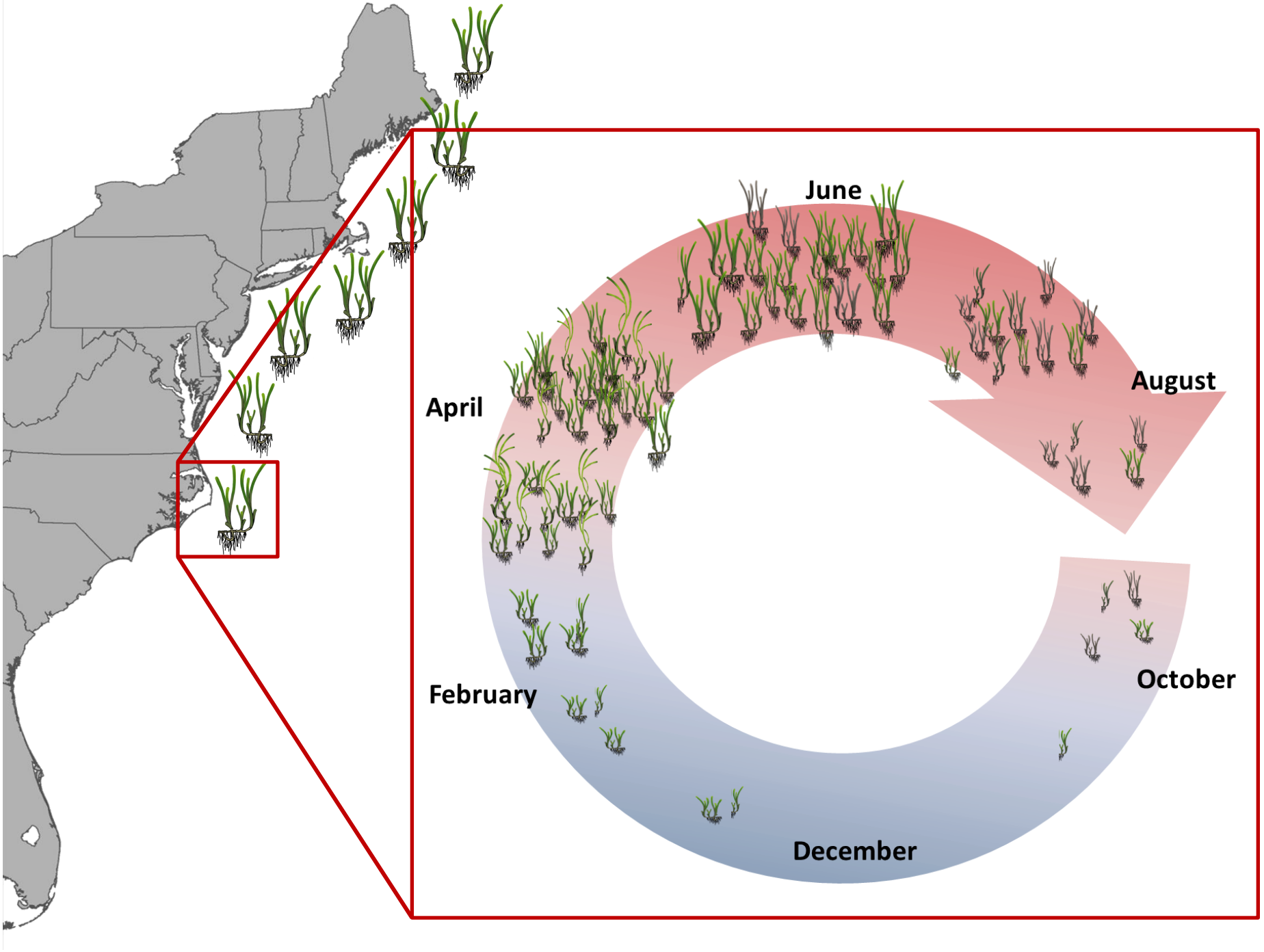
- 1978 - 2001
  - 24-83% Decline in Spawning Stocks
  - 65-72% Decline in Recruitment

- Peterson 2002

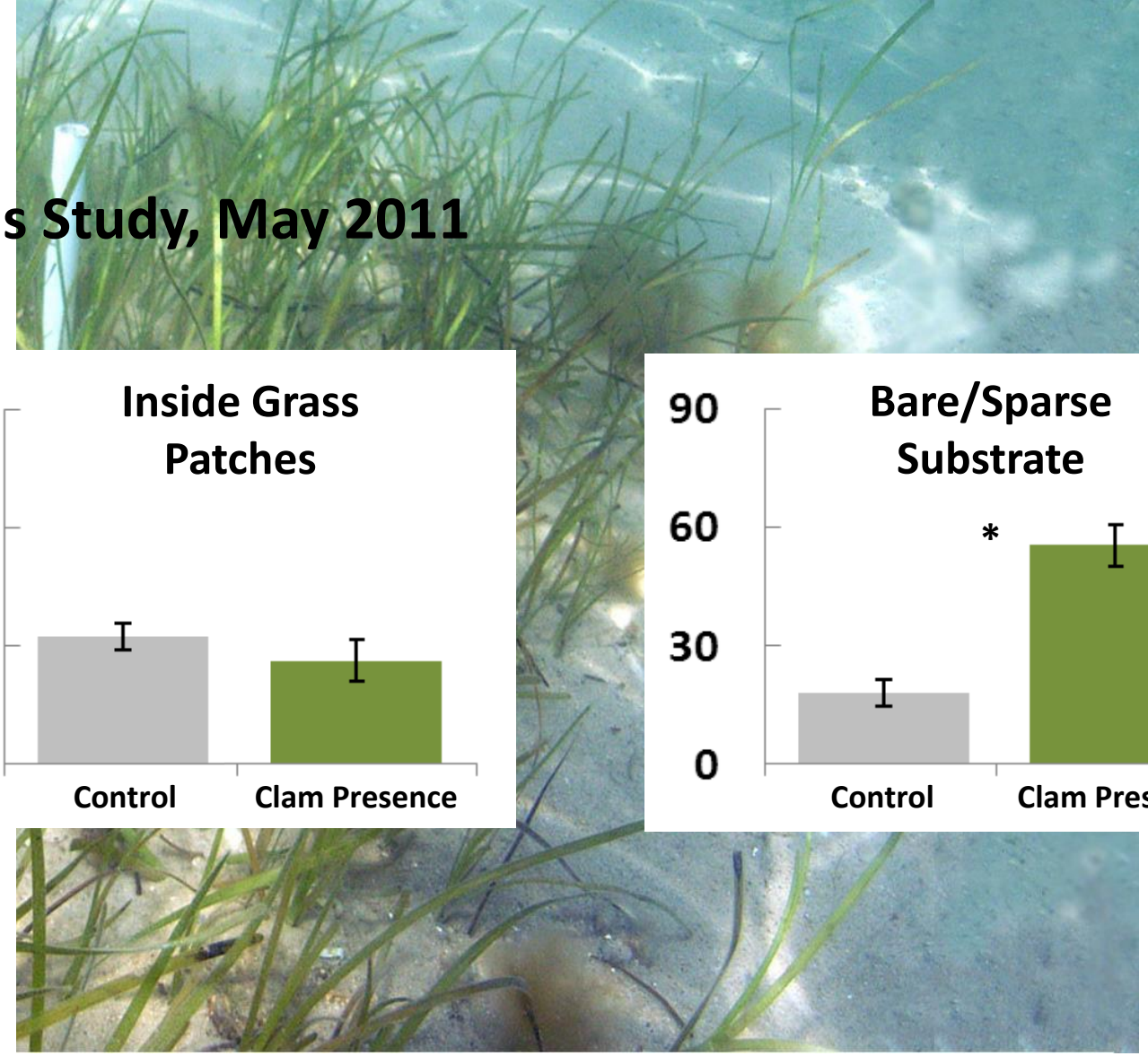
Zostera marina

- Increasing temperature constraints
  - 1985 - 2004 declines in biomass and shoot density

- Micheli et al 2008

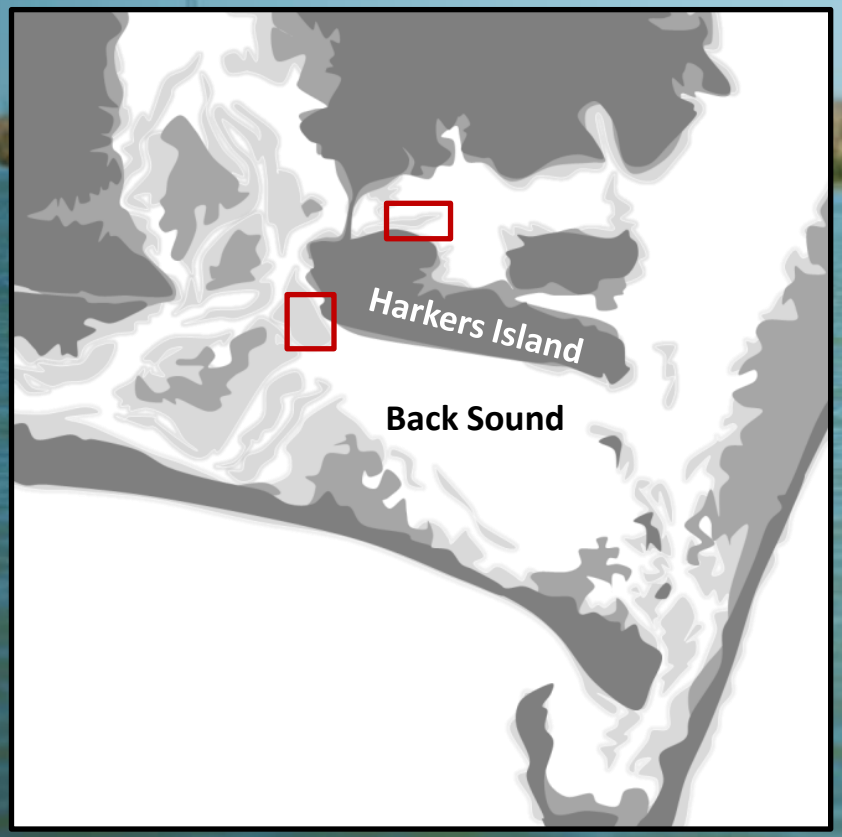

June
August
April
February
October
December

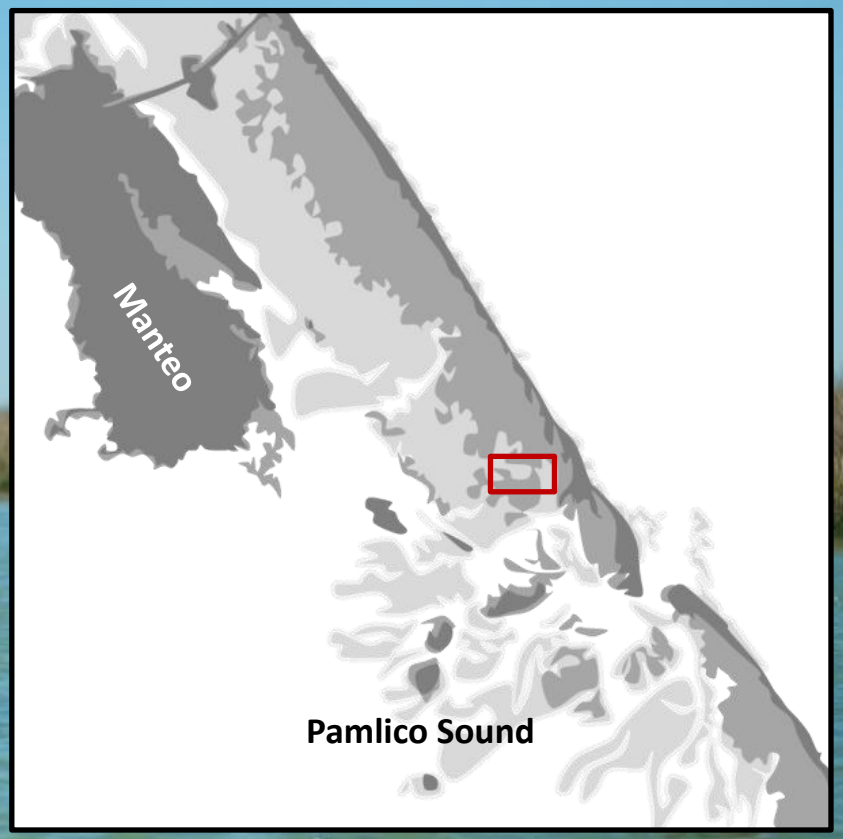
Previous Study, May 2011

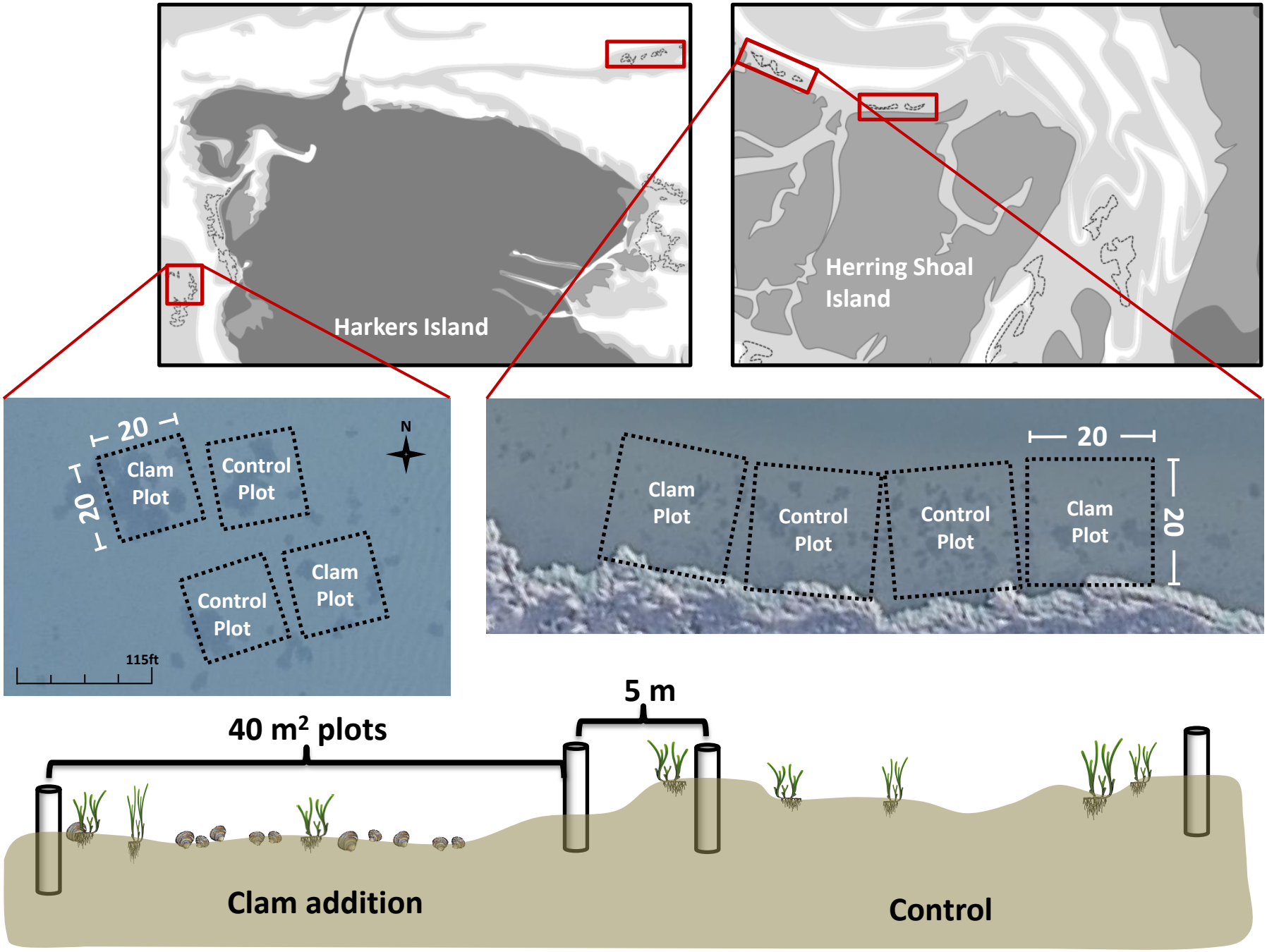


- Significant increase in above ground biomass as a result of clam treatments in bare/sparse plots

Study Sites






Harkers Island
Herring Shoal Island
20
20
Clam Plot
Control Plot
Control Plot
Clam Plot
N
115ft
Clam Plot
Control Plot
Control Plot
Clam Plot
20
20
5 m
40 m² plots
Clam addition
Control

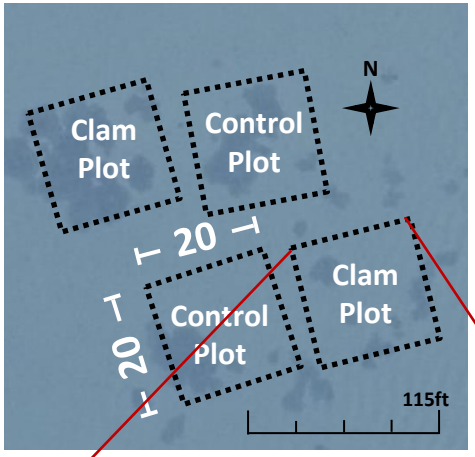
Clam Deployment

- 15-20 mm seed clams

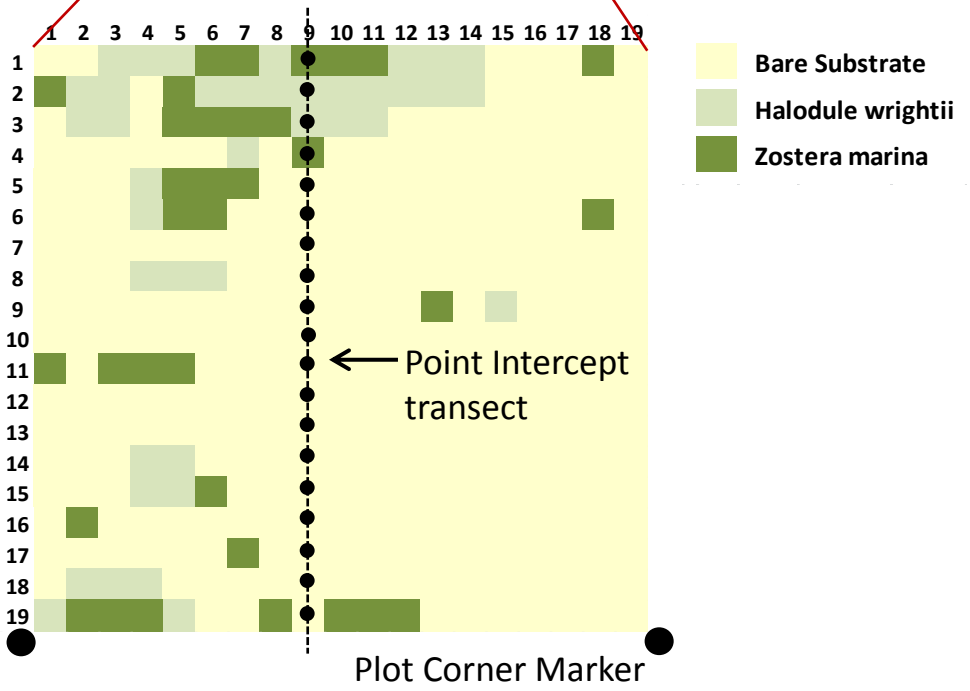
- ~160 clams•m^{-2}
  - Deployed in May 2013
  - Water temps > 60° F

> 500,000 clams
seeded a total of 0.7 acres

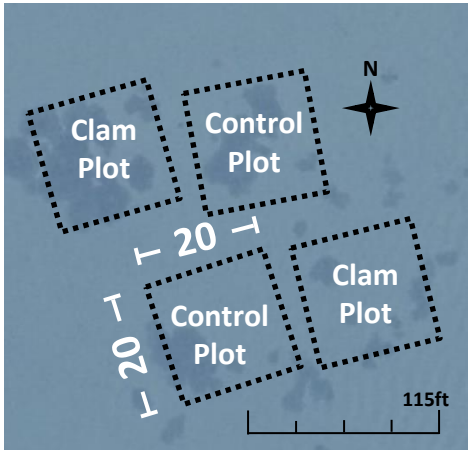
Monitoring



- Seagrass Mapping
  - Percent Cover
  - Line Point Intercept transects



Monitoring



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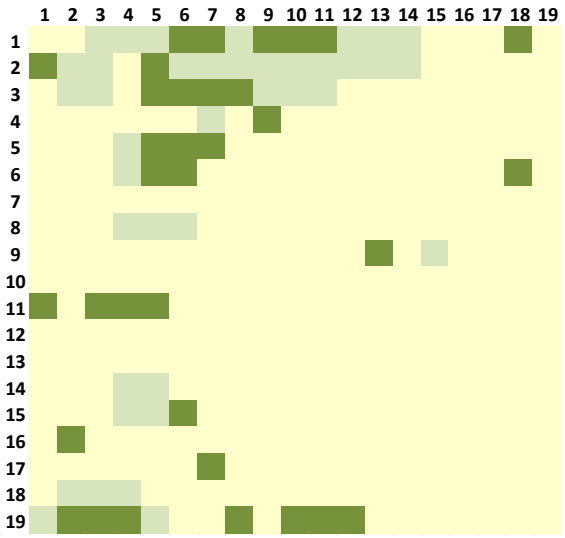
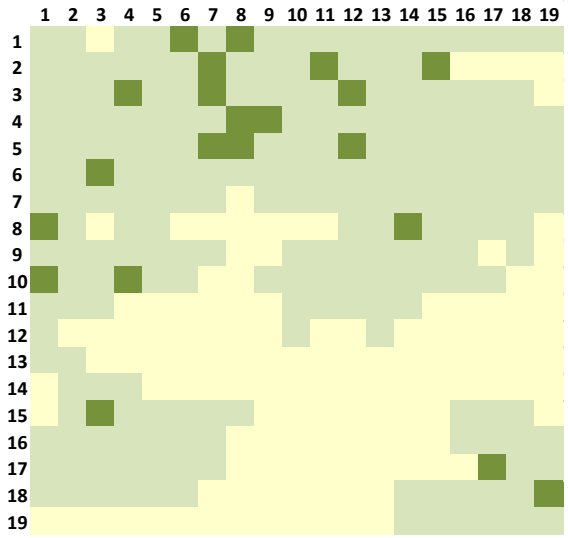
May, 2013



July, 2013

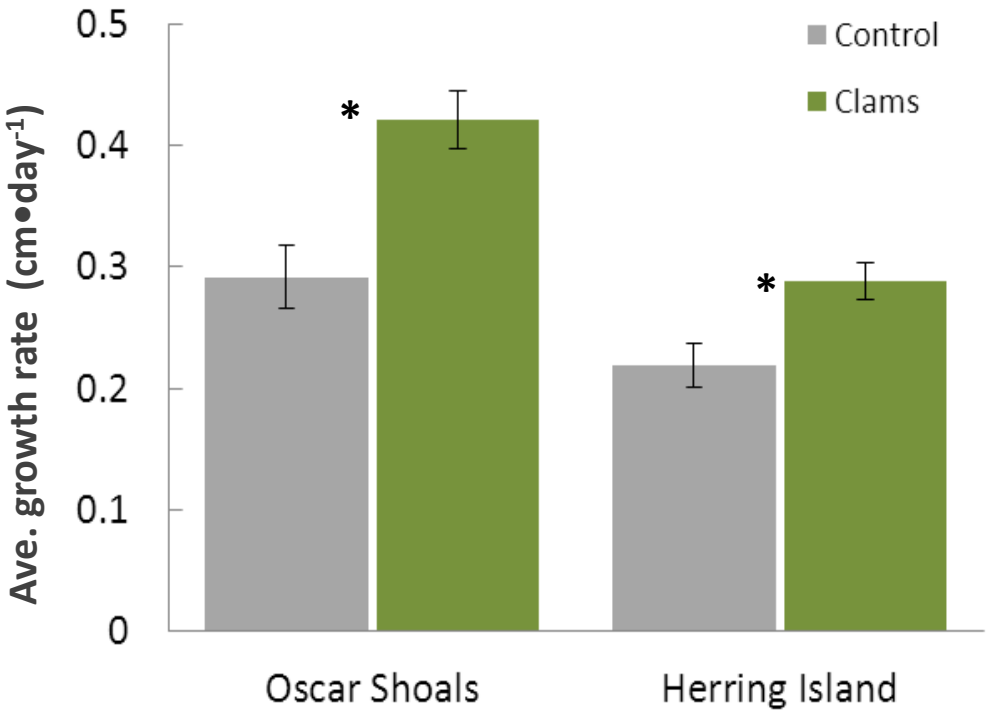


Monitoring

- Sediment Nutrients
  - Inside grass patches and bare substrate
- Seagrass Nutrients

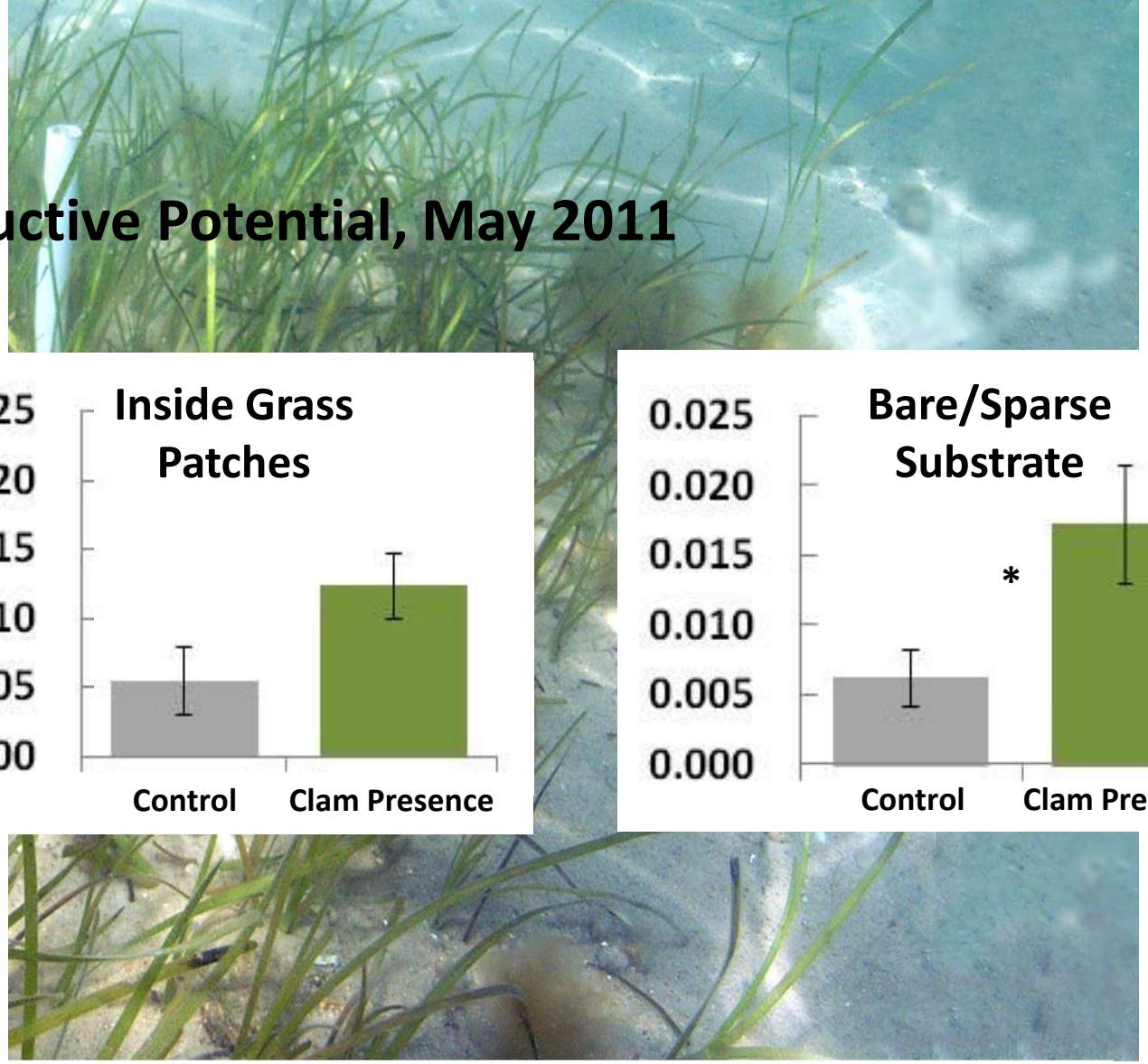
- Seagrass Growth Rates
  - Used a needle to make a scar in the seagrass shoot
  - Collected 14 days after marking and measured the distance between leaf scars
- Seagrass Reproductive potential
  - Flowering shoots and Reproductive structures

Growth Rates

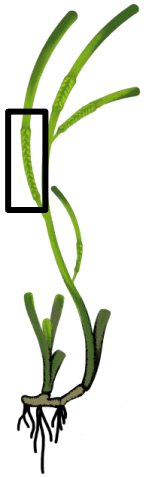


- Significant increase in growth rates in the presence of clams

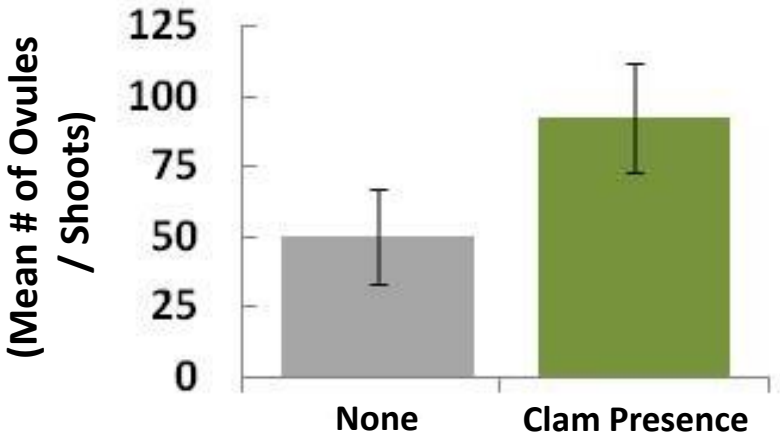
Reproductive Potential, May 2011



- Flowering effort is highest in the presence of clams



Reproductive Potential, May 2011



- Suggestive trends indicating a greater reproductive effort with the clams

- **Regular summer turnover in eelgrass biomass represents a substantial contribution of organic matter to estuarine sediments**

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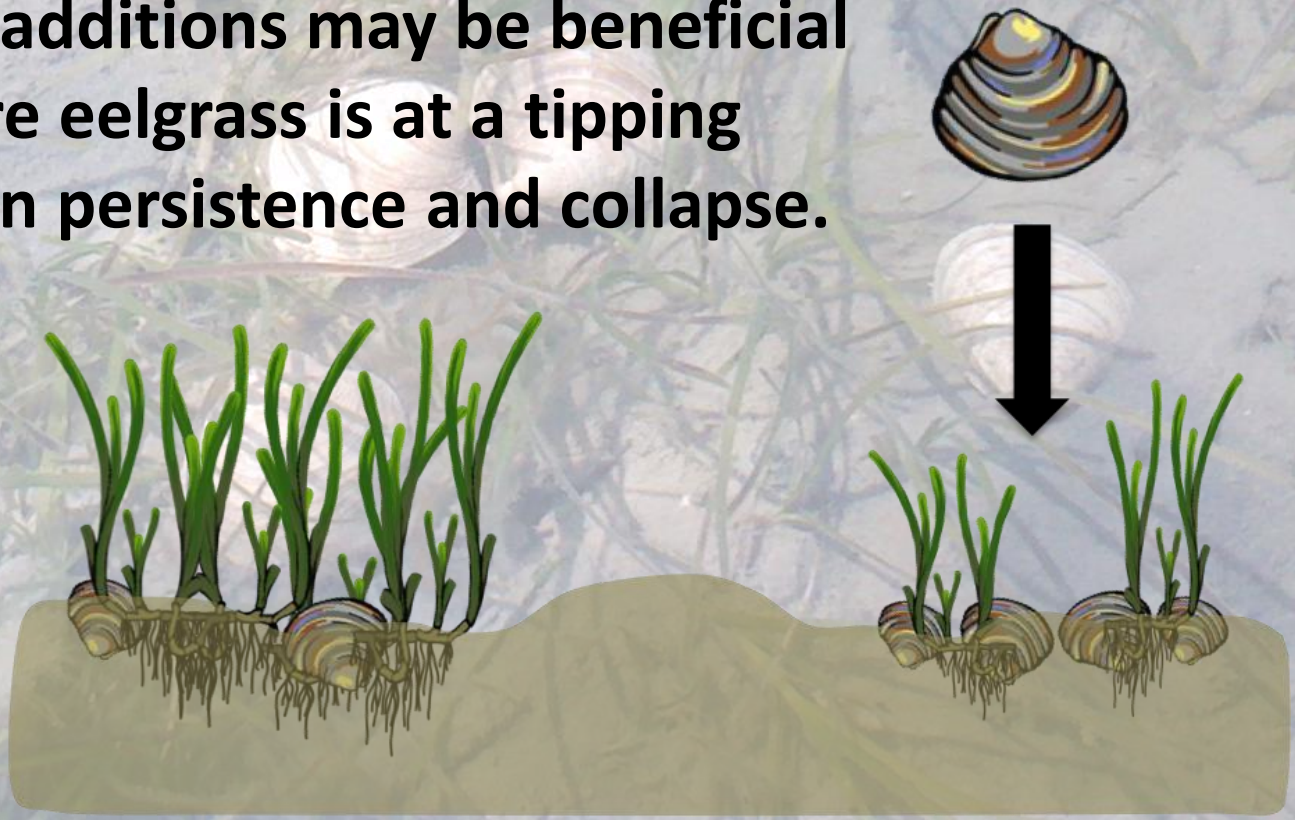
- **However, indications of a clam-seagrass interaction suggest clam additions may be beneficial in areas where eelgrass is at a tipping point between persistence and collapse.**



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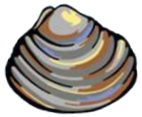
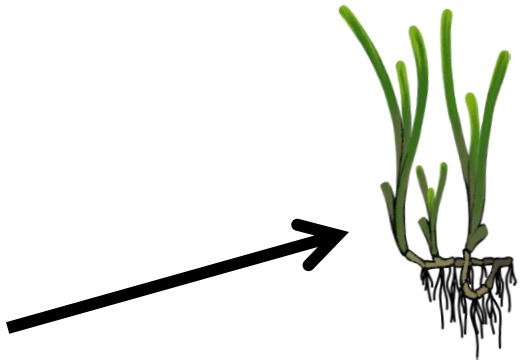
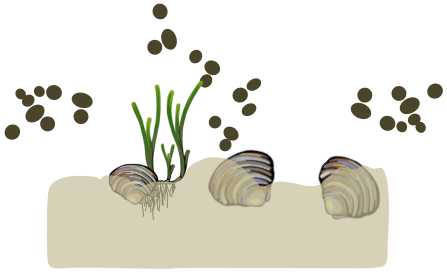
- **However, indications of a clam-seagrass interaction suggest clam additions may be beneficial in areas where eelgrass is at a tipping point between persistence and collapse.**

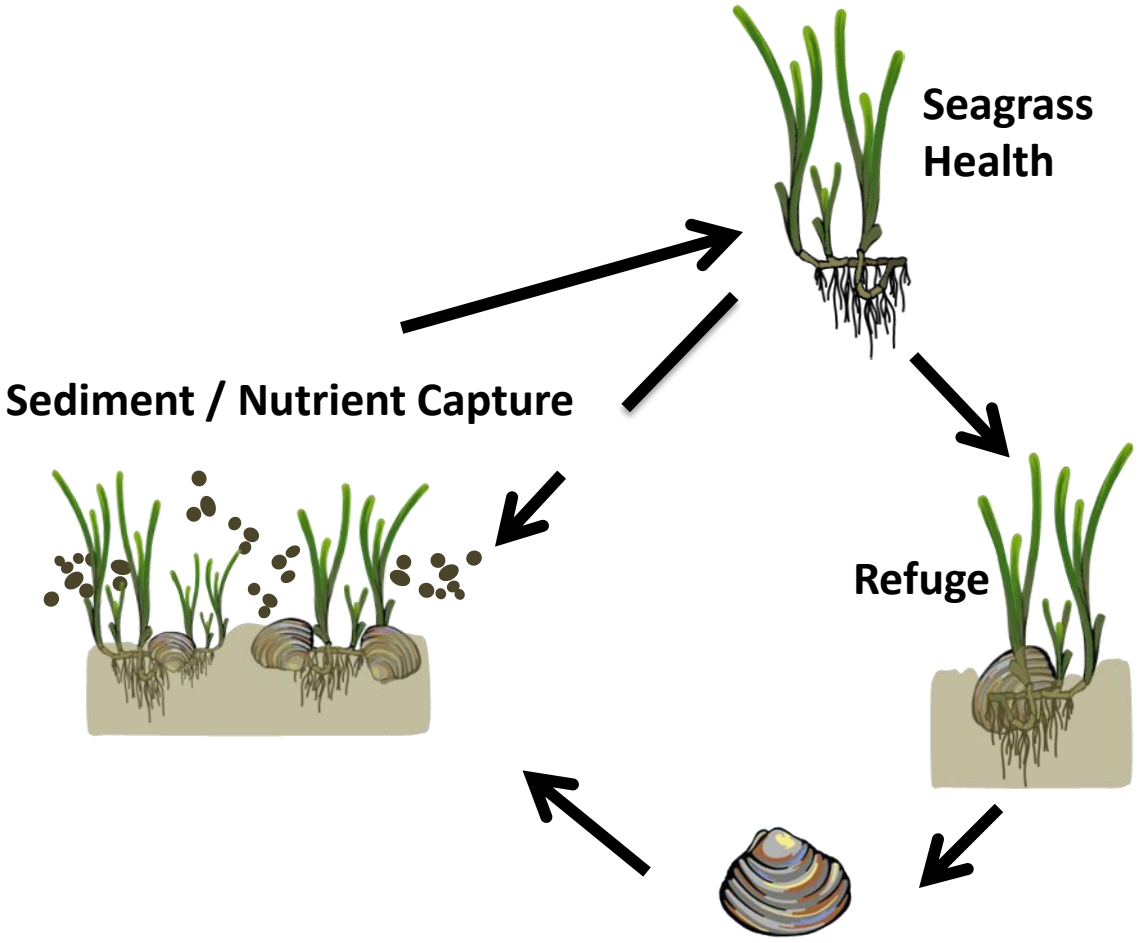
    - **Enhanced colonization = increased above ground biomass**
    - **Elevated growth rates**
    - **Evidence for enhanced reproductive potential**

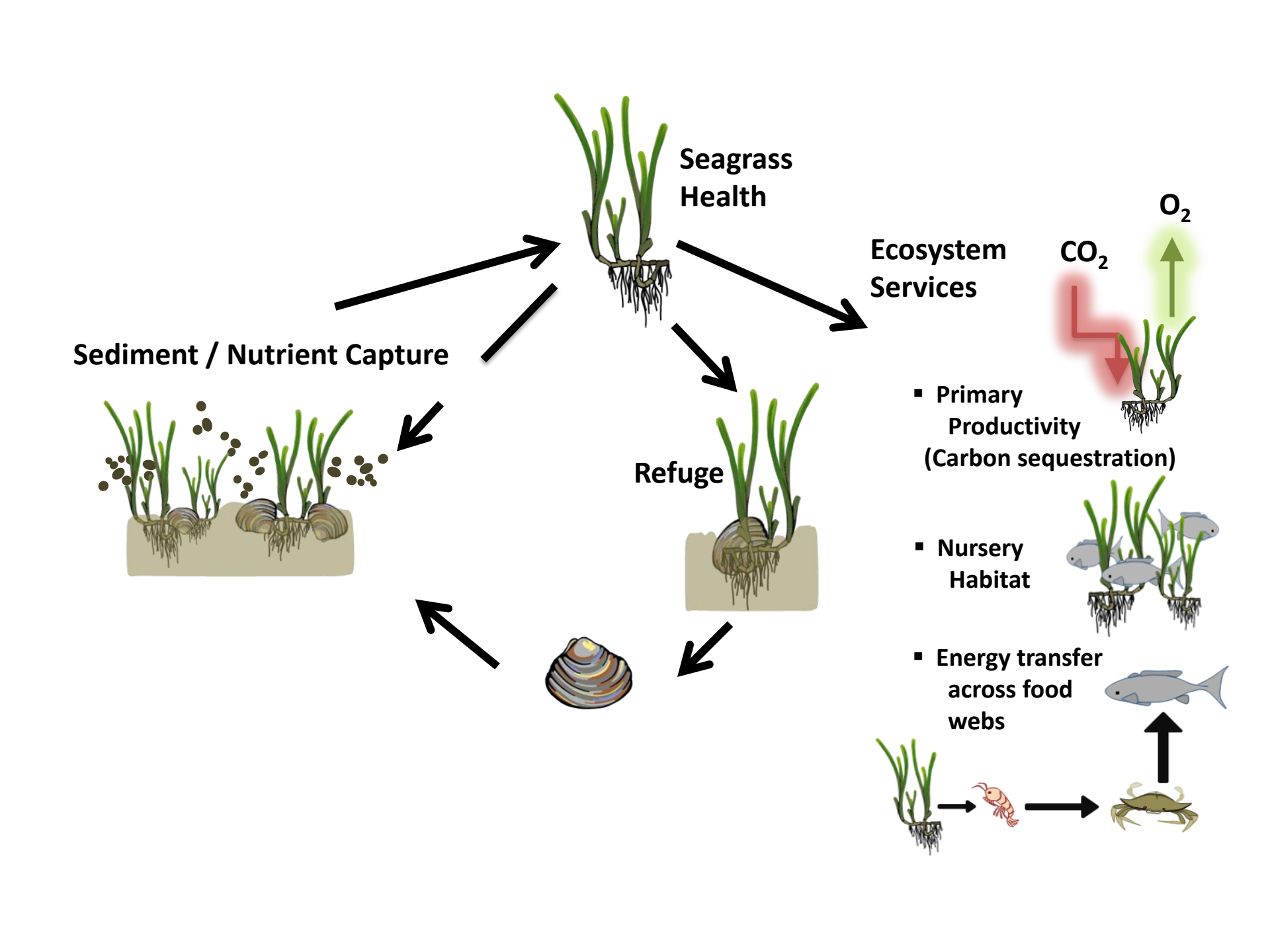


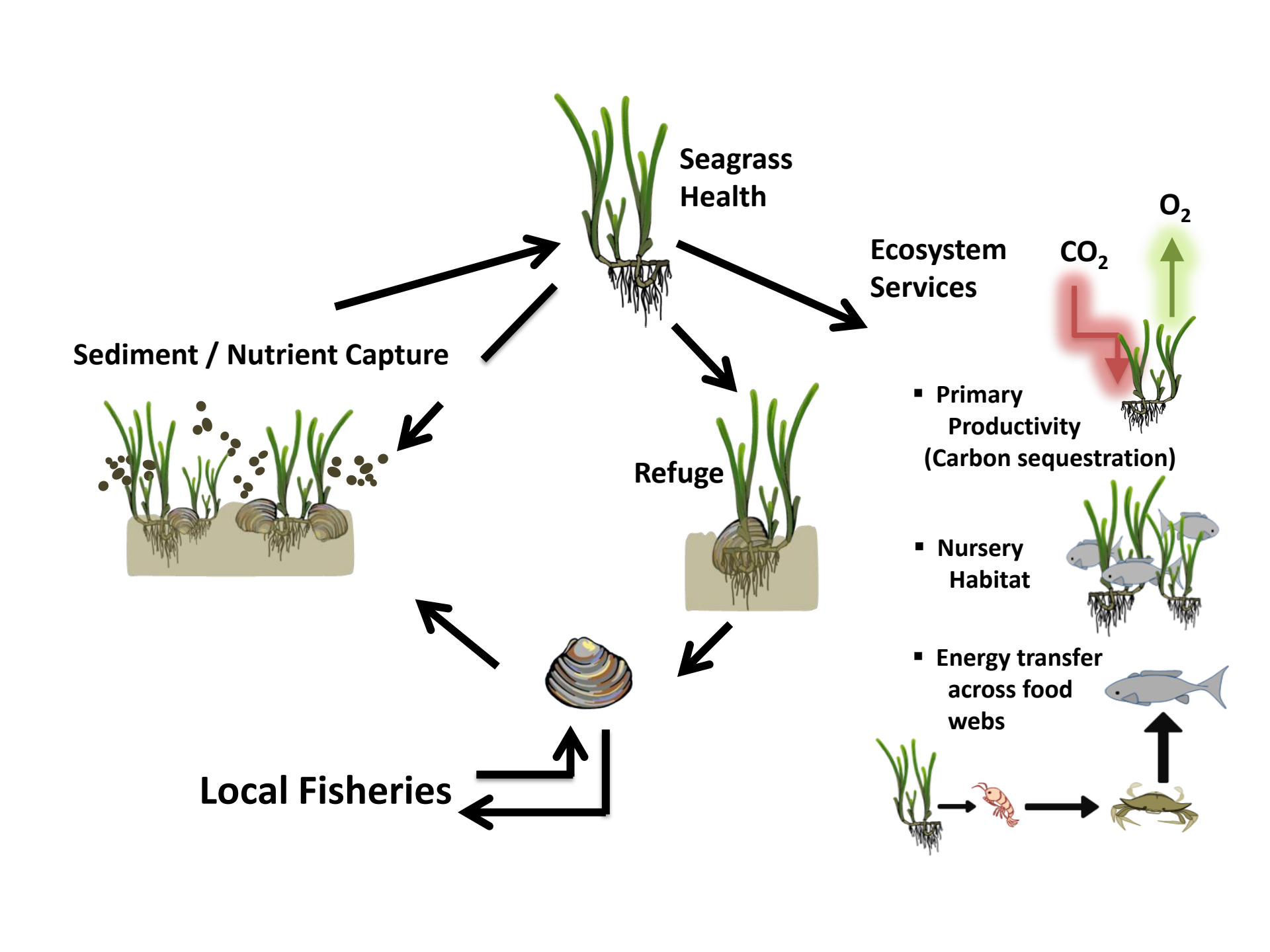


Sediment / Nutrient Capture




Seagrass
Health
Refuge
Sediment / Nutrient Capture


Seagrass Health
Ecosystem Services
O_2
CO_2
Sediment / Nutrient Capture
Refuge
▪ Primary Productivity (Carbon sequestration)
▪ Nursery Habitat
▪ Energy transfer across food webs


Seagrass Health
Ecosystem Services
O_2
CO_2
Sediment / Nutrient Capture
Refuge
Primary Productivity (Carbon sequestration)
Nursery Habitat
Energy transfer across food webs
Local Fisheries

Funding and Support

Albemarle-Pamlico National Estuary Partnership

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Joel Fodrie

UNC Institute of Marine Sciences

Mike Piehler

UNC Institute of Marine Sciences

Coastal Studies Institute

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National Estuarine Research Reserve

North Carolina Coastal Federation

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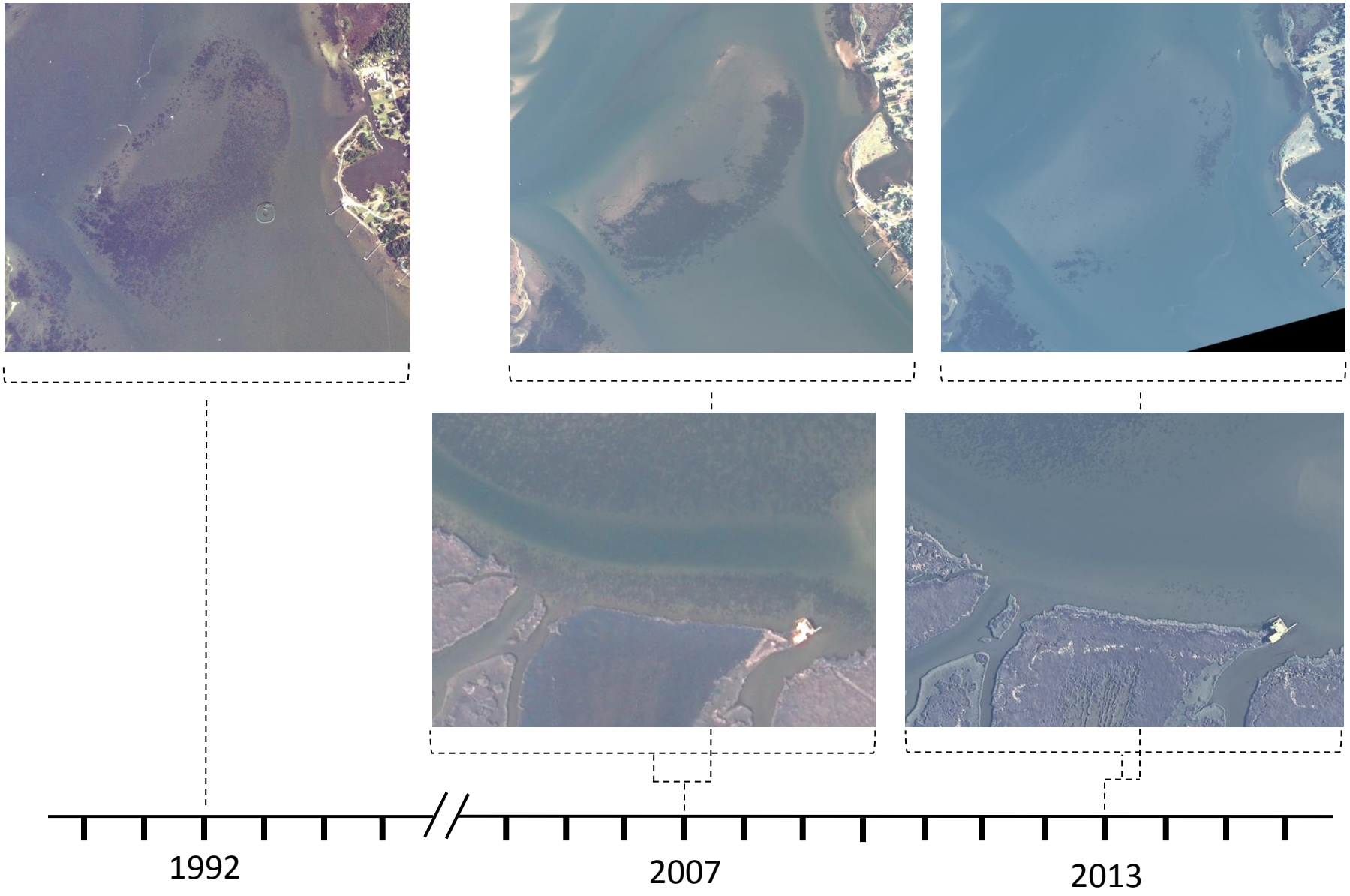
1992
2007
2013