Ecological responses to an experimental living shoreline design for high energy environments

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Intracoastal Waterway (ICW)

3,000 miles of natural waterways & dredged channels

Artery for commerce & recreation
High energy and boat wakes drive habitat loss

Dead reefs (purple) line the ICW

1m lateral marsh erosion per year

Rakes (piles of oyster shell) widespread across GTM NERR
Boat highway through low-energy coastal wetlands

Mulberry Island, LA

Palm Valley, Florida

Little River, SC

Wilmington, NC
Can we protect shorelines from boat traffic without armoring?
Many living shoreline designs fail

Shipworms chewed through stakes & wakes blew apart oyster bags & coir logs in < 3 weeks
We are testing a natural, cost-effective method for:

1) Dissipating waves and boat wakes (breaks)
2) Increasing oyster reef habitat (BESE/gabions)
3) Reducing, or even halting, salt marsh erosion
Semi-permeable branch-filled break walls

Oyster shell-filled gabions

Potato-based BESE-elements
6 Sites in Northern GTM NERR
We are studying:

• Wave/wake profiles
• Wake effects on sediment transport
• Energy dissipation & displacement of breaks
• Break biofouling & degradation
• Oyster growth on BESE/Gabions
• Marsh plant and animal responses
• Changes in bathymetry
Mitigating Erosional Effects Induced by Boat Wakes with Living Shorelines

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BESE versus Gabions

Very few oysters in 2017!

Spring 2018 Oysters on BESE and Rebar

- % on Rebar
- % on BESE

Shell Height (mm)

Frequency (%)

5 10 15 20 25 30 35
Gabions: Great Recruitment!
Percent Cover

Oyster Density & Size
Percent cover by live oysters on gabions

Avg natural reefs in Tolomato (n=20)

Fall 2017
Spg2018
Fall 2018

% cover by live oysters

site

1 2 3 4 5 6
Site 1

Percent cover by live oysters on gabions:
- Fall 2017
- Spg2018
- Fall 2018

Site 1

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<th>Spg2018</th>
<th>Fall 2018</th>
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Oyster density on gabions

Mean oyster density (#/0.1 m²)

Site

- Fall 2017
- Fall 2018
Oyster size frequency on gabions

Frequency (% of total)

Shell Height (mm)

Fall 2017
Oyster size frequency on gabions

Frequency (% of total)

Shell Height (mm)

- Fall 2017
- Spg 2018
Oyster size frequency on gabions

- Fall 2017
- Spg 2018
- Fall 2018

Frequency (% of total)

Shell Height (mm)

Values range from 5 to 80 mm in increments of 5 mm.
Tracking salt marsh response: 15 poles, 1m apart
Post breakwall construction: overall trend of progradation
Especially in breakwall treatments
CONCLUSIONS

• Promising results
• Site differences
  • Elevation
  • Bathymetry
  • Submergence time
• Flow
CONCLUSIONS

• Promising results
• Site differences
• Maintenance challenge
• Public awareness