Mispillion Living Shoreline

Milford, Delaware

Partnership for the Delaware Estuary

Project Details

Goals:

- Erosion control
- Water quality enhancement via increases in shellfish populations

Energy Environment:

- Moderate
  The primary source of energy is the ebb and fold tides; secondary energetic source is direct wave inundation when storm water levels surpass the height of the seawall between the river and the Delaware Bay

Construction Dates:

- June 2014 : three initial coir cusps and breakwaters
- June 2016: eroded coir replaced with shell bags
- March 2019: shell bag cusps in former control areas

Partners:

- DNREC Division of Fish and Wildlife, DuPont Nature Center

See the Site Before and After

Initial Installation June 2014(a)—June 2018 (b)

2019 Augmentation April (a) - November (b)

Baseline Conditions

The existing salt marsh was experiencing excessive erosion, moving towards the upland fringe

March 2014
Salt marsh erosion

June 2014
Extensive intertidal oyster reef condition

Baseline Conditions

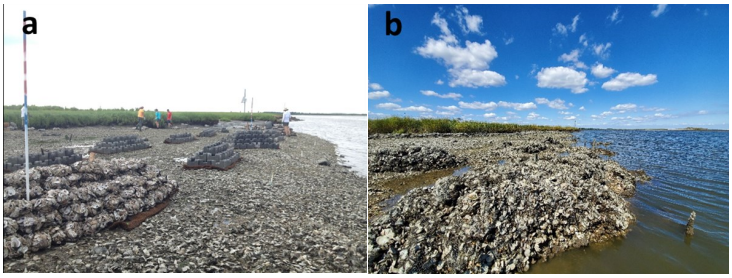
Issues:

- Excessive salt marsh erosion
- Standing water in some areas of the high marsh

Site Characteristics/Important Features to Consider:

- Existence of the DuPont Nature Center at site
- Presence of an extensive intertidal oyster reef
- Moderate energy due to the position of the site along a bend in the river, and the large fetch beyond periodically overtopped seawall across the river from the site
- Substrate variability across the site from soft near the nature center to firm and rocky along the upriver portion
- Scoured wave-break just landward of the oyster reef

Breakwaters: June 2014 (a) - September 2019 (b)



Living Shoreline Installation

Design Elements:
- Breakwaters
- Salt marsh toe
- Salt marsh terrace
- Internal compartmentalization

Permitting:
- State — Delaware Subaqueous Land Permit, Delaware Statewide Activity Approval (SAA) for Shoreline Stabilization Projects
- Federal — Army Corps Nationwide Permit No. 27 Aquatic Habitat Restoration

Materials and Placement:
- Oyster shell bag and oyster castle breakwaters
- Coir log toe (2014 eroded)
- Oyster shell bag toe (2016 replacement for coir)
- Coir log terrace/compartmentalization
- Coir log terrace

Monitoring Efforts

Metric	Method
Horizontal shoreline position	RTK-GPS
Vertical position	RTK-GPS
Vegetation robustness	Fixed plot light meter and veg board
Bearing capacity	Fixed plot slide hammer
Shellfish density	Full and random counts
Shellfish filtration	See Moody et al, 2022

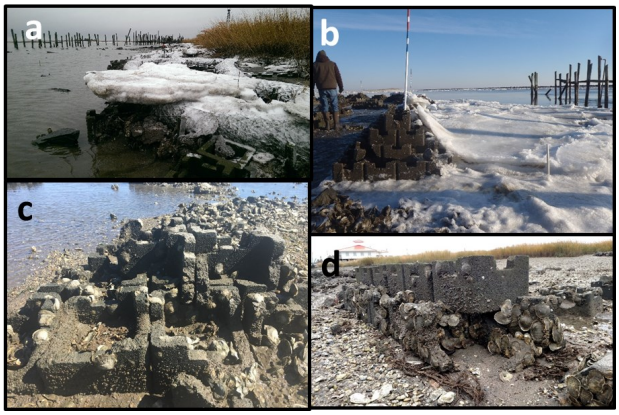
Measured Environmental Results

- Net gain of 6,027 ft.^{2} salt marsh
- Living shoreline materials successful in building elevation and promoting vegetation growth
- Oyster and ribbed mussel populations grew as they colonized the materials
- Currently the living shoreline is still growing and functioning
- This project is a good example of using materials to build shellfish populations while controlling erosion
- Resulted in ~6,700kg seston filtration since 2014

Moody, J.A., Bouboulis, S.A., Haaf, L., Rothermel, E.R. and Kreeger, D.A., 2022. The spatiotemporal development of two shellfish populations and their associated filtration capacity on a living shoreline near Milford, Delaware, USA. *Ecological Engineering*, *180*, p.106661. https://doi.org/10.1016/j.ecoleng.2022.106661

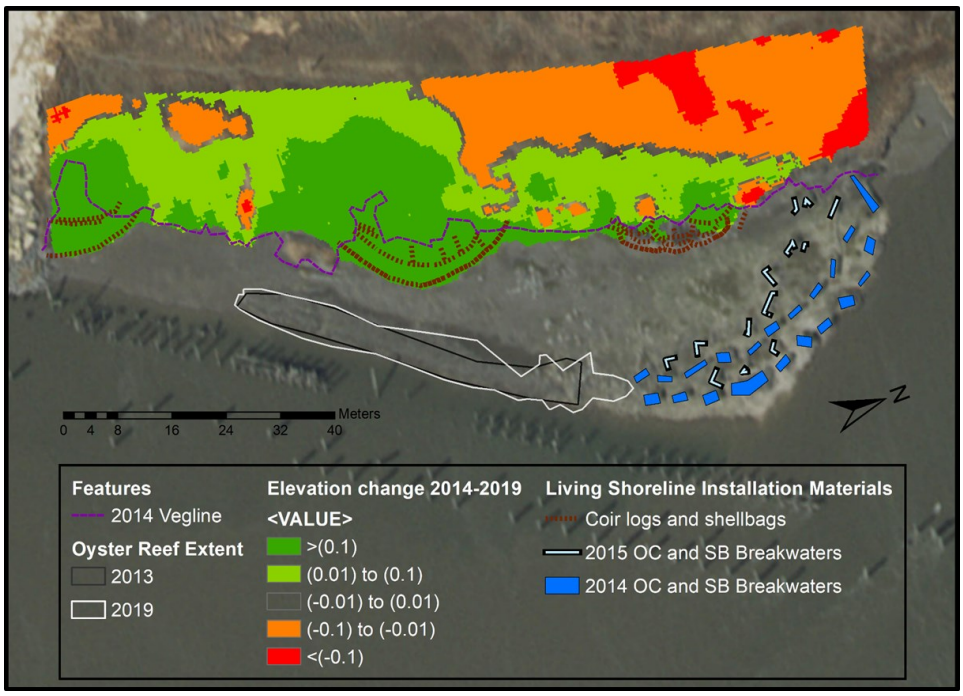
Adaptive Management/Lessons Learned

Design Elements:
- Coir logs inappropriate as toes due to energy
- Shell bags successful as toes under energy
- Shell bags breakwaters became completely encrusted with oysters
- Shell bags and Oyster Castles withstood multiple severe icing events (right, a and b)
- Oyster Castles that did not completely colonize and began to deteriorate by 2019 (right, c and d)

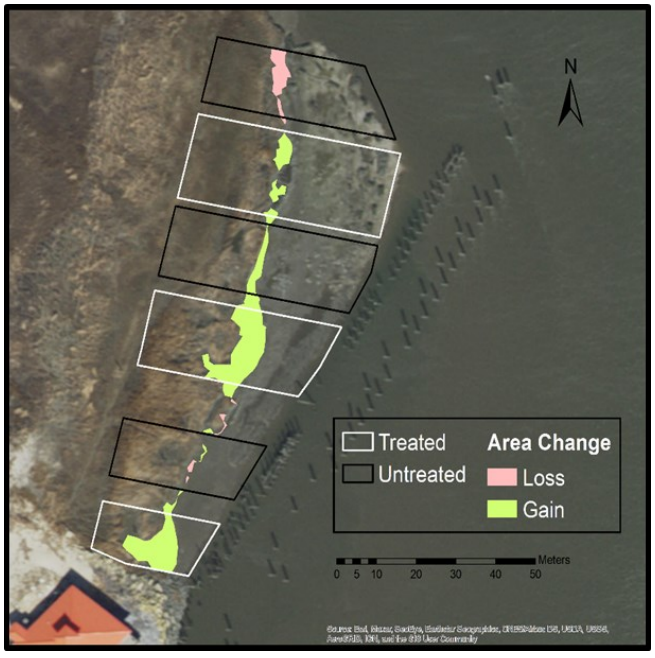


Monitoring Results

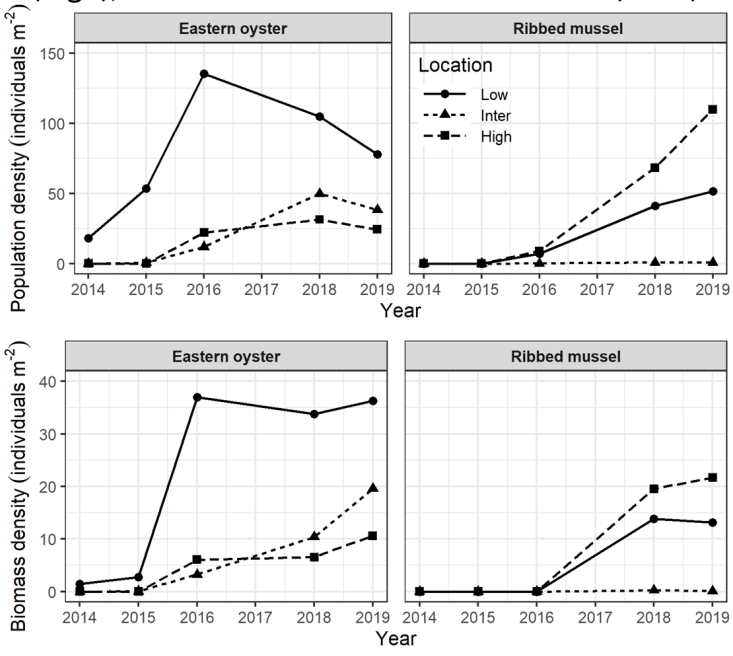
Site-wide 2014-2019 elevation change as measured with annual RTK-GPS grid survey ($3m^2$), relative to the positions of the installed materials (pre-augmentation)



Salt marsh area change 2014-2019 between treated and control areas.



Changes in shellfish population and biomass density at 3 positions along the living shoreline—on the breakwaters (low), along the marsh edge materials (high), and between on the bare substrate (inter)



DELAWARE LIVING SHORELINES COMMITTEE

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