



SUBMERGED AQUATIC VEGETATION (SAV) MITIGATION THROUGH WIND WAVE AND BOAT WAKE REDUCTION

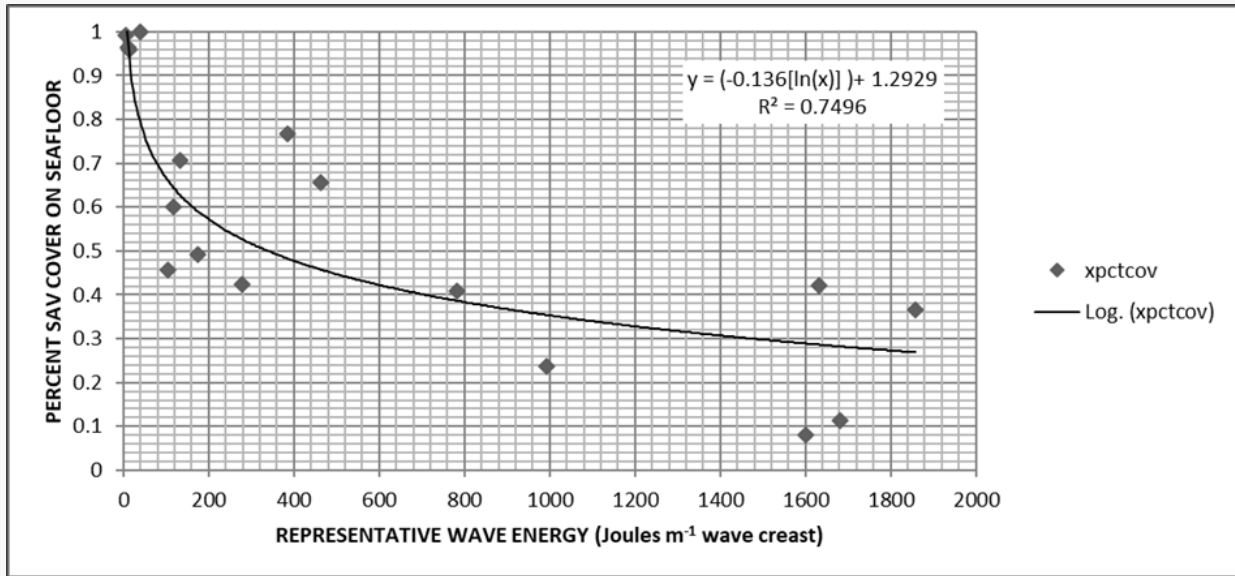
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Phillip Todd, Atlantic Reefmaker
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Background: Guiding Principles



1) As wave energy ↓ cover of SAV ↑

2) SAV abundance ↑ in lee of formations



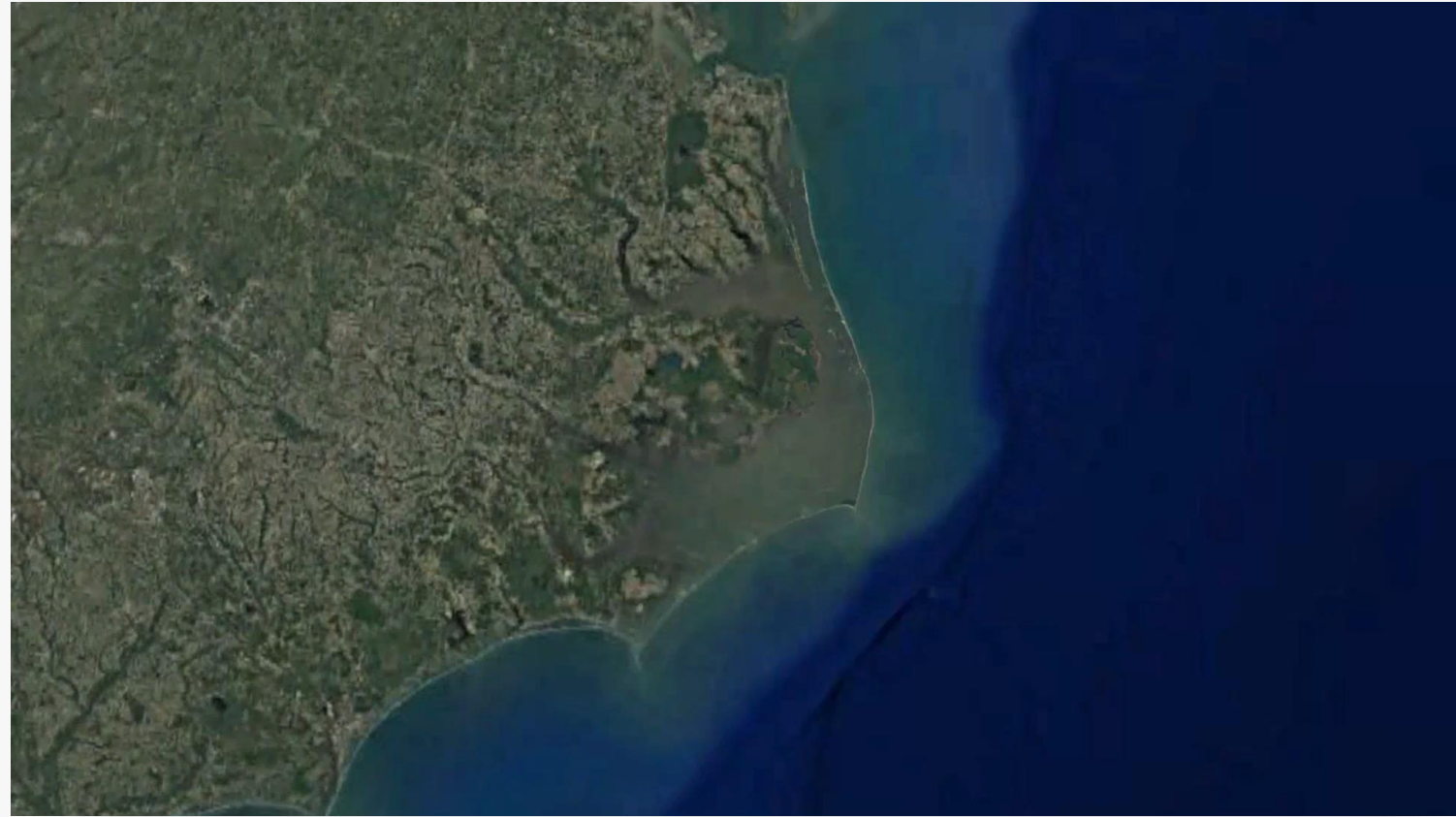
Recomputed from Fonseca & Bell, 1998



Project Concept – Bonner Bridge SAV Mitigation



- Impacts to SAV from bridge construction estimated at 1.28 acres
- Lack of injury sites for traditional SAV mitigation methods
- Employ “green engineering” to encourage natural coalescence of patchy SAV
- NCDOT funded an experimental mitigation project via installation of a 500 ft-long “wavebreak”



Wavebreak Construction Using Reefmaker Units



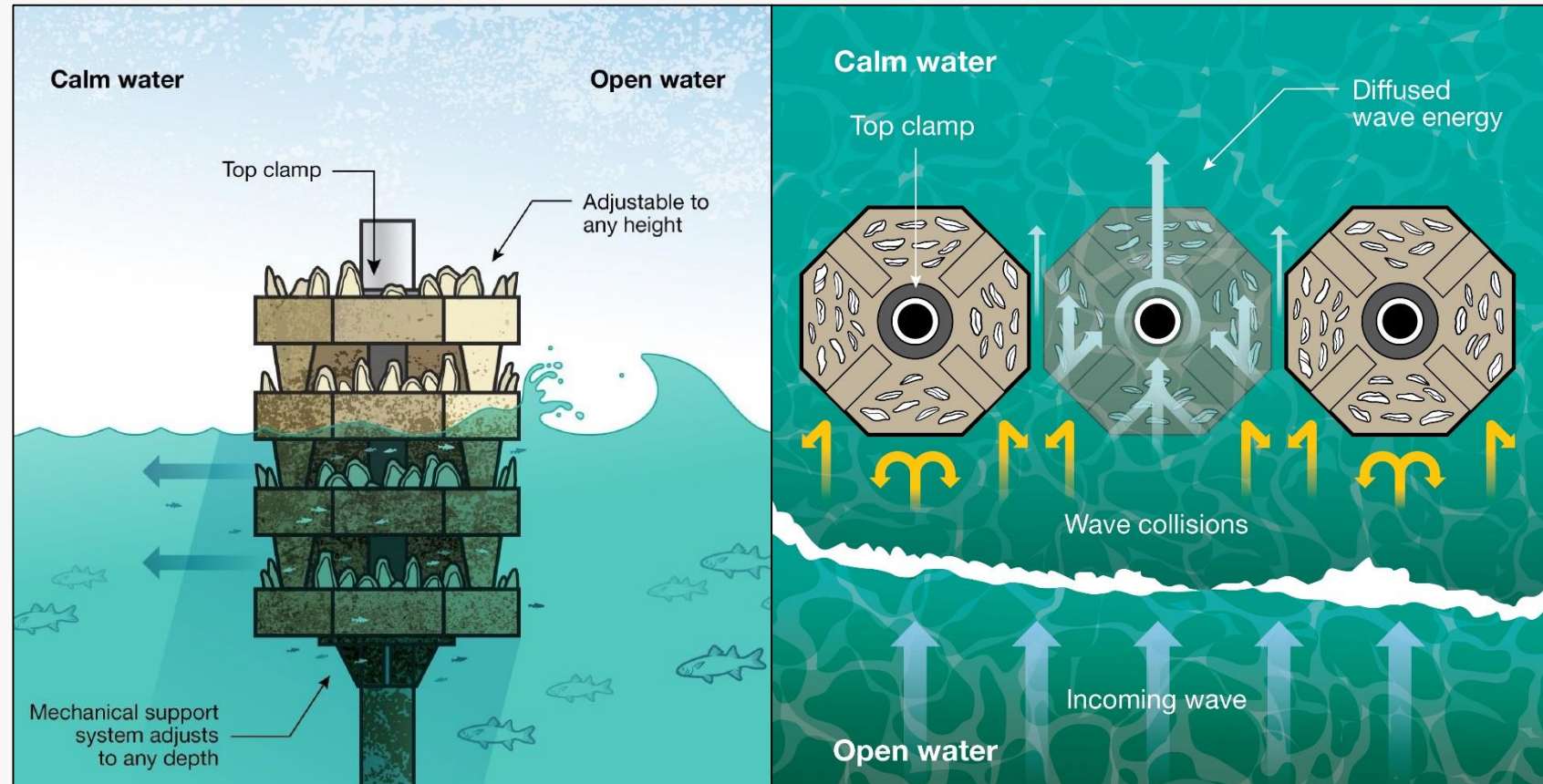
- Chevron shape, due North
- 101 square-shaped units; 500 ft long
- Wave energy dissipation with flow through system (20% porous)
- SAV from construction footprint relocated
- No construction access channel, all work from barges



Wavebreak Construction - Reefmaker Units



- Pile-based, flow through system
- Mechanical support system – set disks at designated design height
- Modularly constructed – easy modification for SLR adjustments
- Perched above substrate – movement of sand & marine life

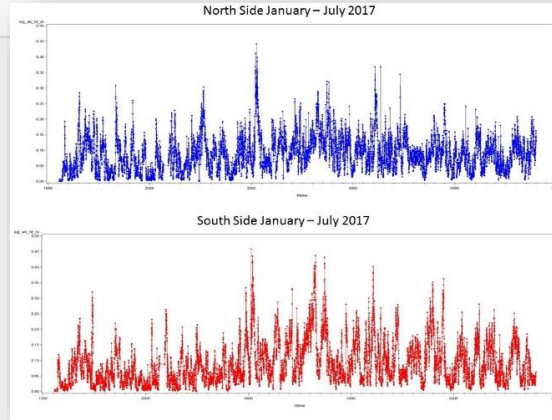


67-84% decrease in wave energy (ERDC, 2020)

Monitoring Program

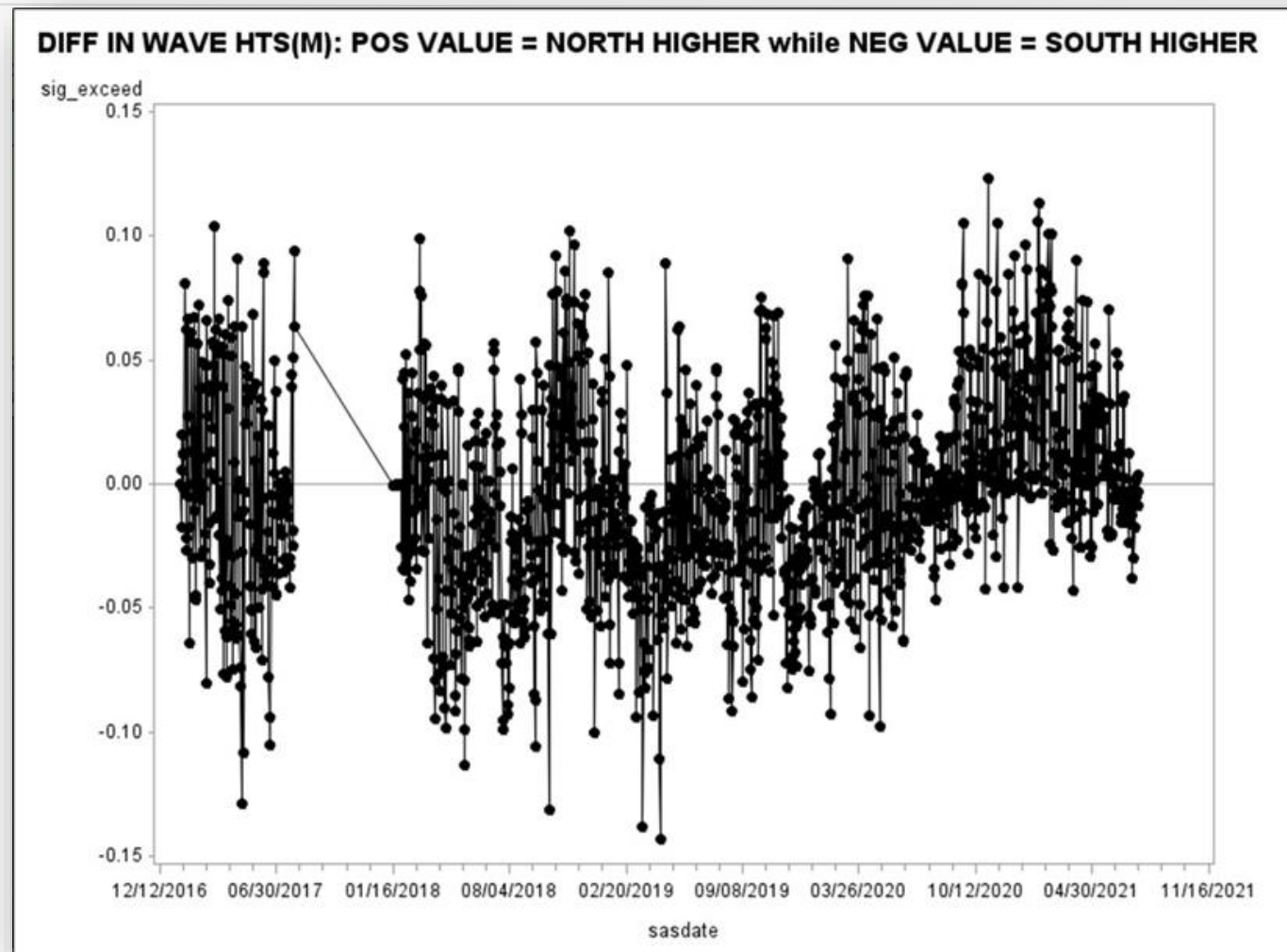


- Wave heights – north & south
- Sediment elevation – near-field & far-field
- Epibiota colonization of wavebreak
- SAV cover – aerial imagery



Results: Wave Height

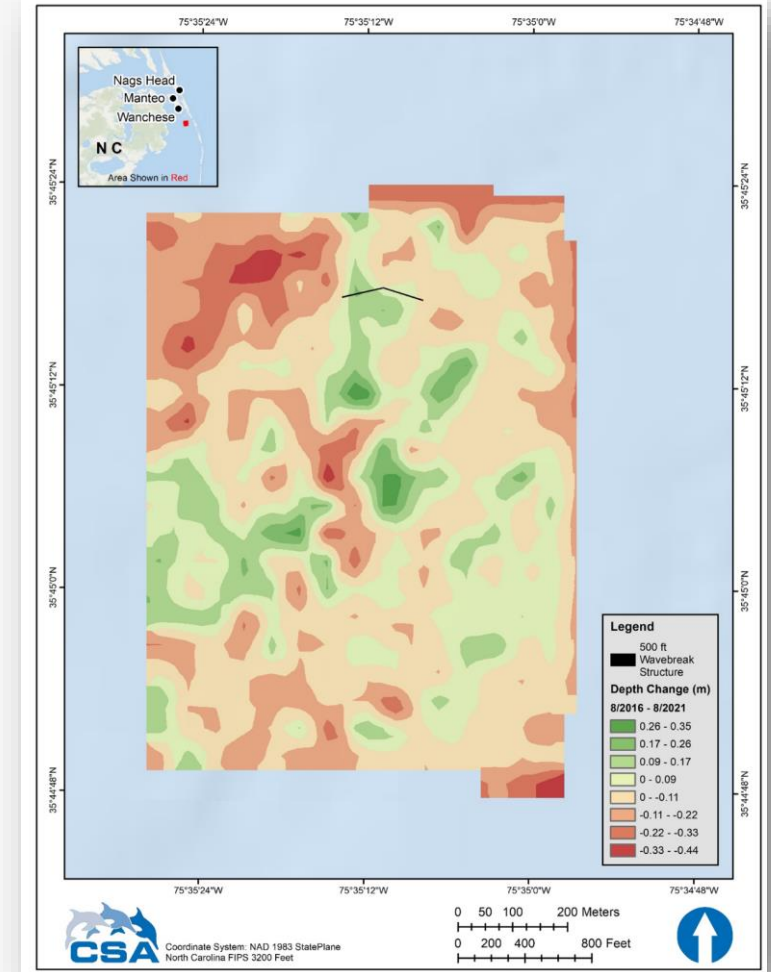
- Strongest wind events; thus, wave energy predicted from the north
- Daily wave height data – alternation of higher waves on north and south sides
- Top 5% of wave heights occurred 5 times more frequently on the north side
- “Extreme event” results supported forecasted wind energy reduction zones



Results: Sediment Elevation



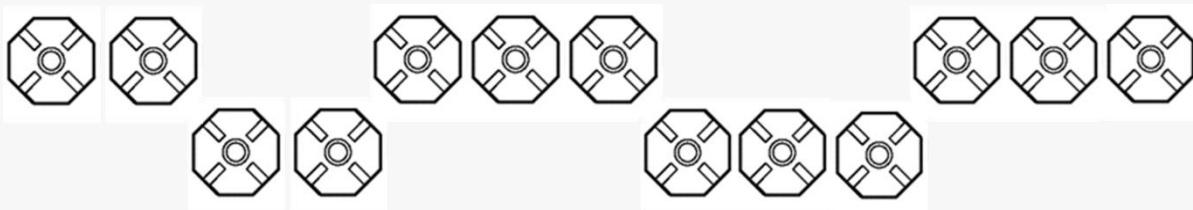
- Near-Field: Sediment elevation along transects within 150 ft of wavebreak
- Far-Field: Digital Elevation Model (DEM) within ~118-acre area surrounding wavebreak



Results: Sediment Elevation

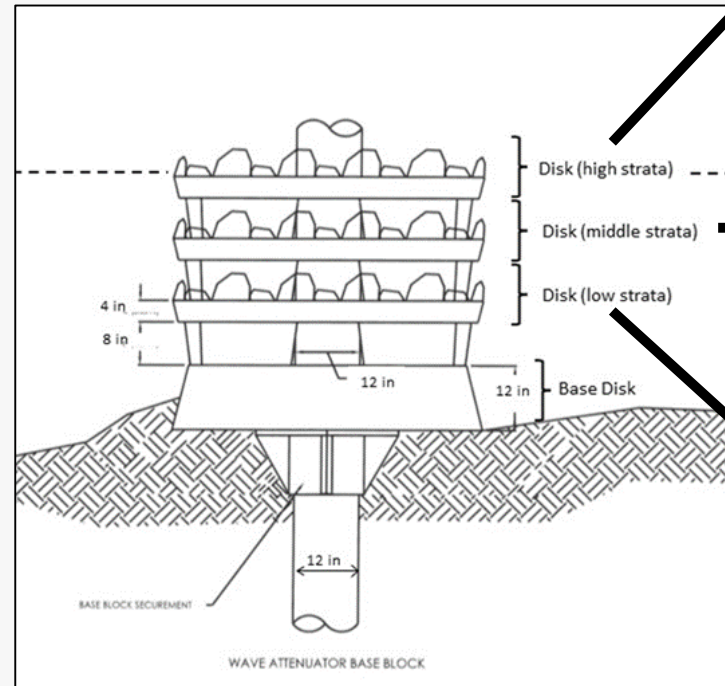
Sediment Scouring

- Scour pits developed under wavebreak
- Creation of “sand apron”
- Delayed colonization of transplanted SAV
- Octagonal Reefmaker shape and alternative orientation in testing to alleviate scouring



Results: Epibiota Monitoring

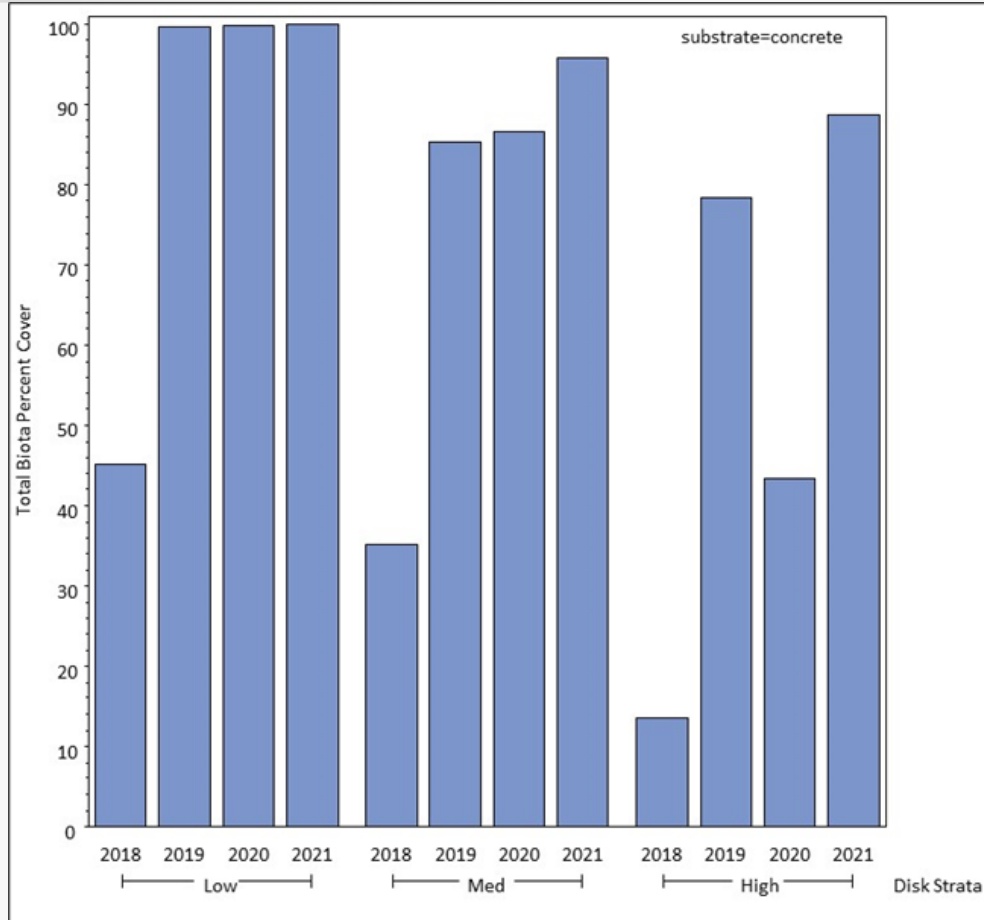
- Substrates - Rock vs. Concrete
- Elevation - Low vs. Middle vs. High
- Colonization - macroalgae, hydroids, barnacles, oysters, cyanobacteria
- Concrete primarily colonized by macro & barnacles
- Rock colonization = macro/barnacles → macro → macro/oysters
- 2-year lag for oysters, 8-12x higher cover on rock vs. concrete



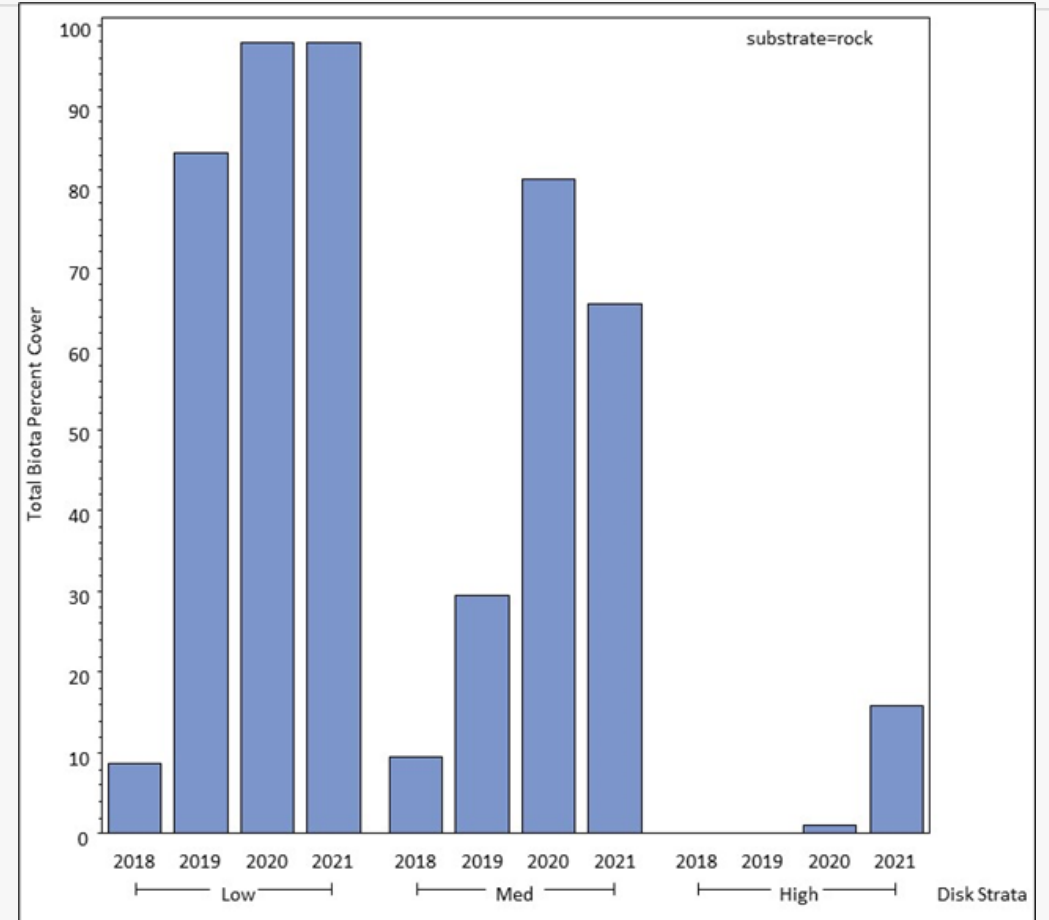


Epibiota Monitoring Results

Percent Cover Total Biota



Concrete

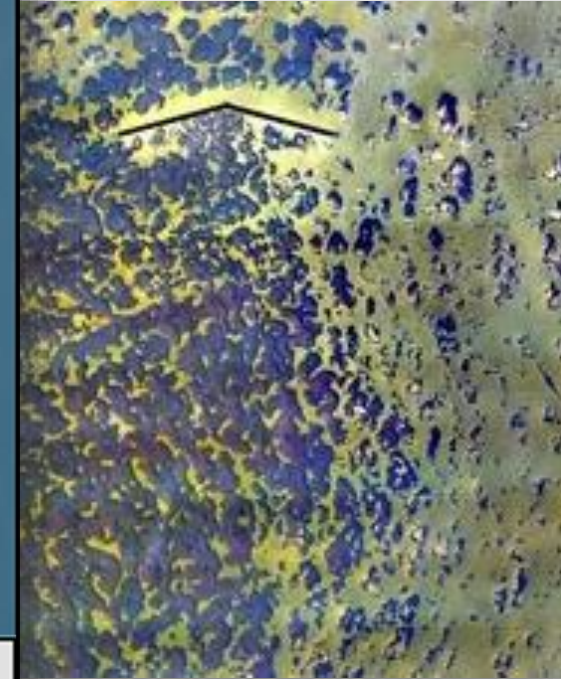
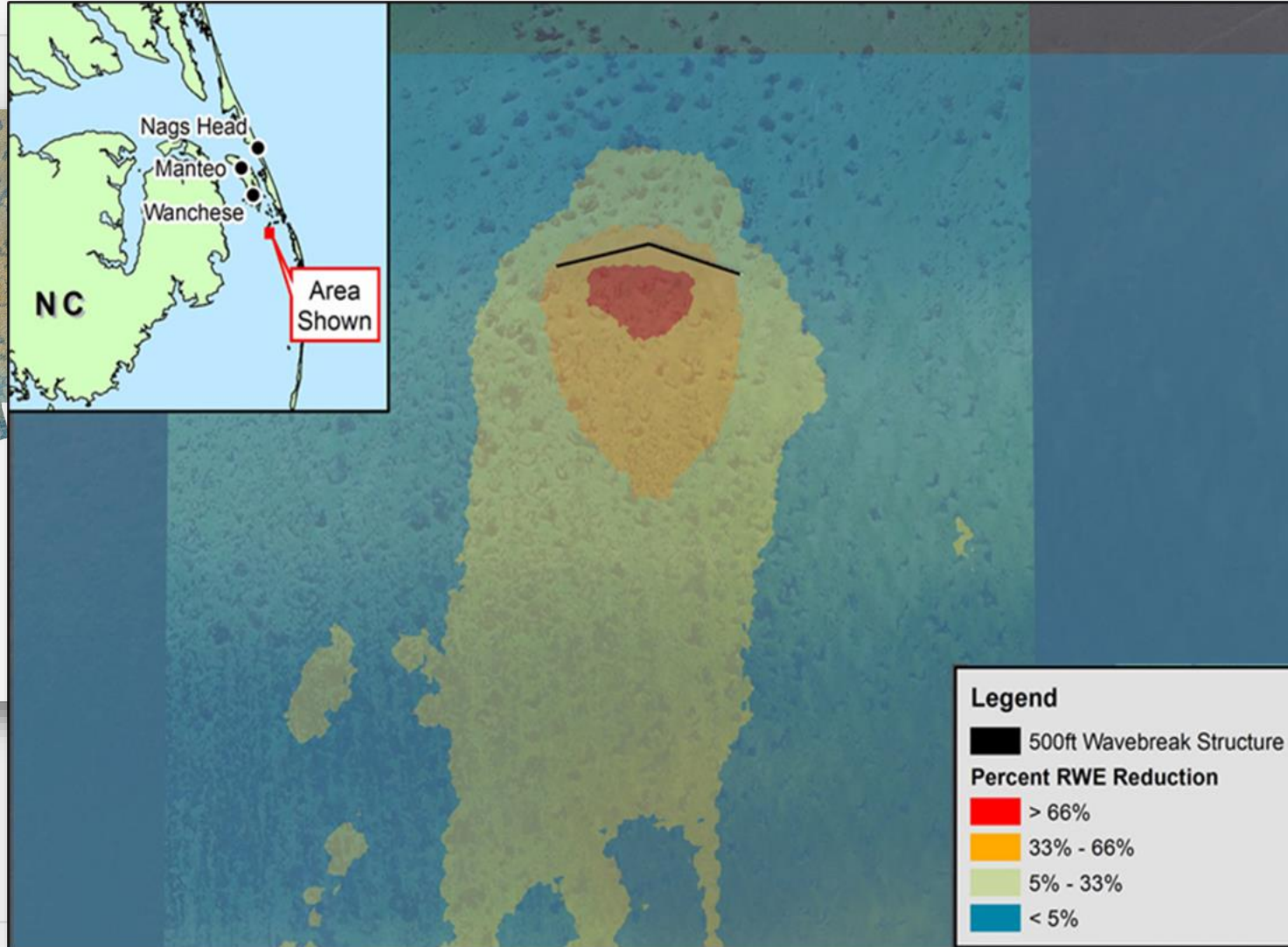


Rock

Results: SAV Mapping



AUG 2018

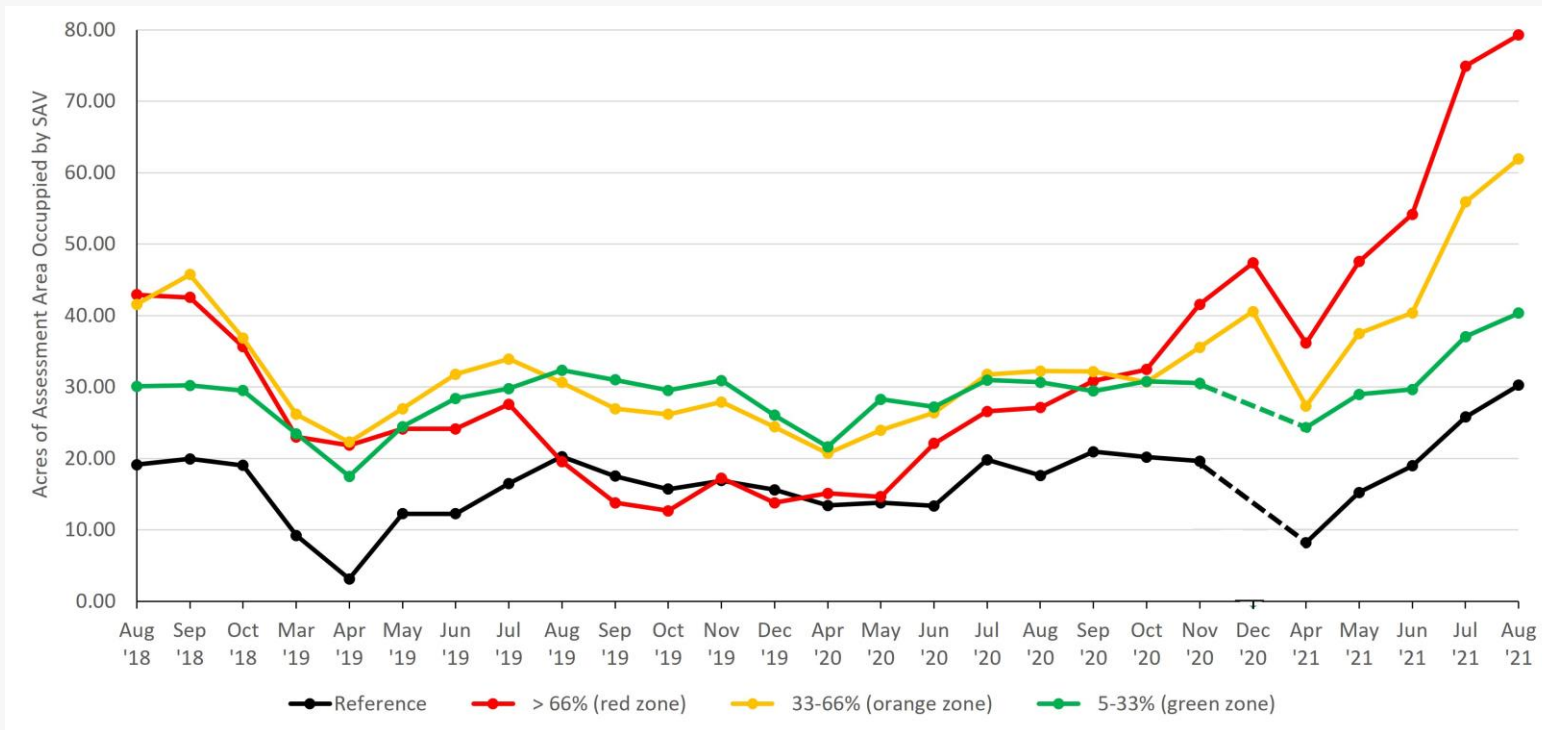


AUG 2021

Results: SAV Mapping

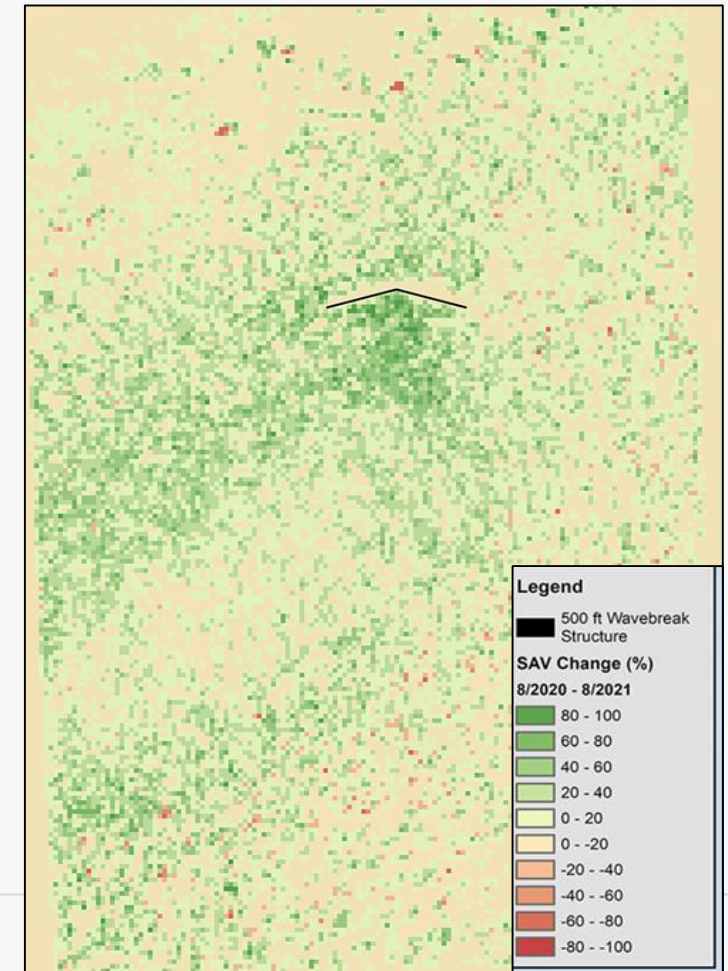


Total Acres SAV by Zone: Aug 2018 to Aug 2021



High (red) + Med (yellow) = + 1.77 acres (Aug 2020 to Aug 2021)
 High (red) + Med (yellow) = + 1.15 acres (Aug 2018 to Aug 2021)

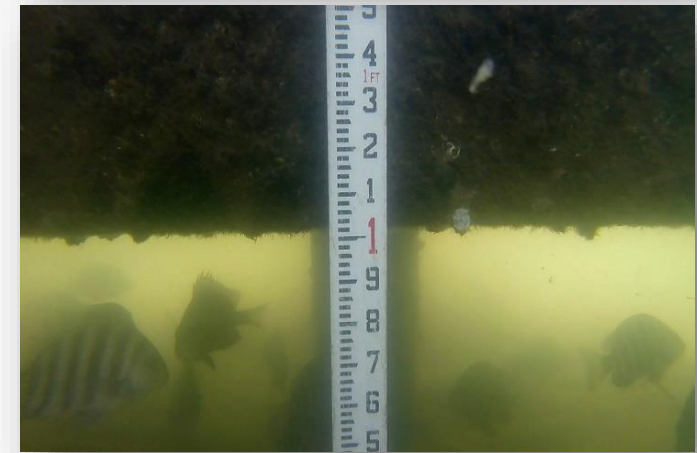
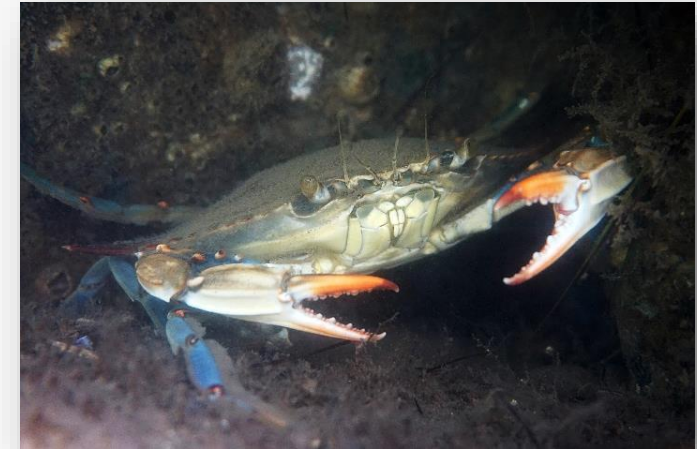
Change in Cover of SAV: Aug 2020 vs. Aug 2021



Take-Aways



- Ecological services were enhanced: SAV, seabirds, essential fish habitat (EFH)
- Net gain in SAV cover
- Alternative Reefmaker unit shape and configuration may alleviate scouring
- Durable engineering solution to reduce wave energy (wind, boat wakes)
- Viable mitigation strategy, employed principles of “green engineering”





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