Understanding the Role of Substrate Complexity on Epifaunal Community Composition Using Custom Settlement Tiles

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Introduction

- Habitat complexity in marine environments impacts the diversity and community composition of epifaunal organisms (1).
- Anthropogenic surfaces that are flat and smooth support low diversity and favor invasive species (2).

Goal and Hypotheses

The goal of this study is to assess the impact of surface complexity (measured as diversity of niches) on epifaunal sessile suspension feeders and motile organisms. We will test the following hypotheses:

1) epifaunal community composition will vary across treatments, 2) high complexity treatments will have the highest species richness, diversity, and percent cover of sessile organisms, and 3) high complexity treatments will have the highest species richness and diversity of associated motile fauna.

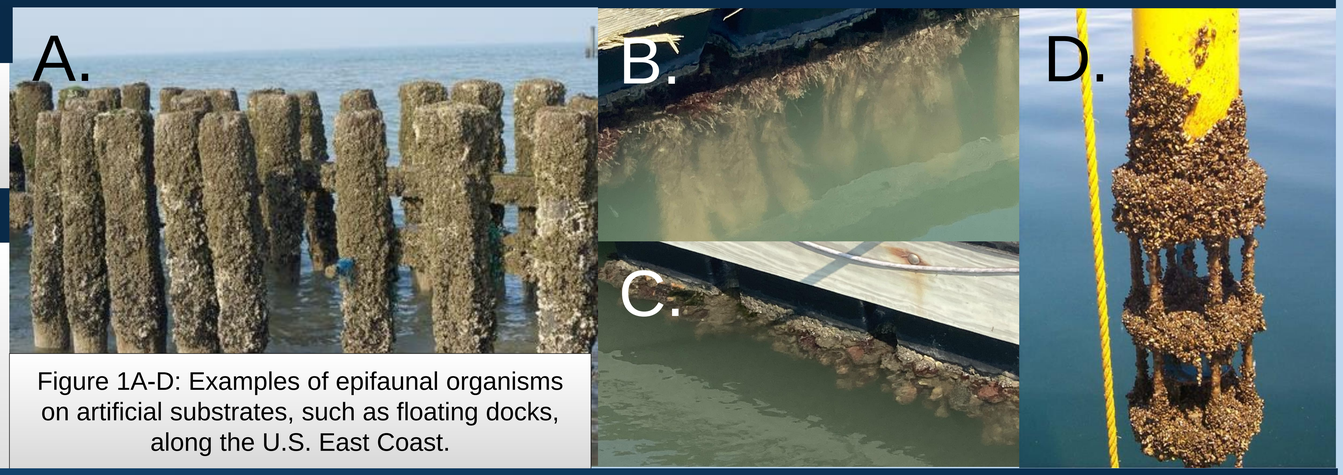
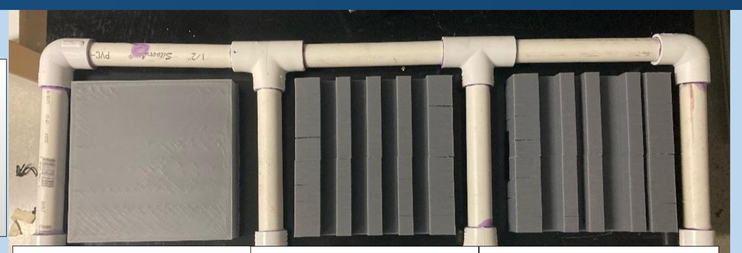


Figure 1A-D: Examples of epifaunal organisms on artificial substrates, such as floating docks, along the U.S. East Coast.

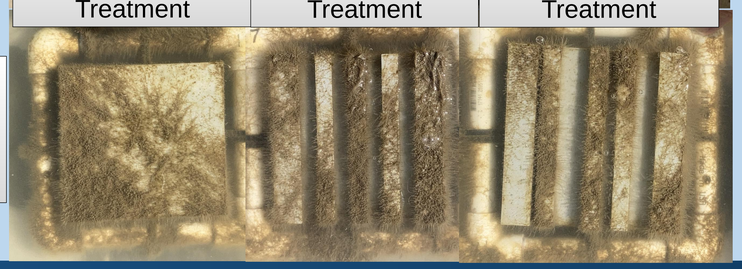
Design and Deployment

One "Unit", an un-deployed prototype.



Low Complexity Treatment | Intermediate Complexity Treatment | High Complexity Treatment

Deployed "Unit", from 10/1/23



Straight-walled canyons were used to provide additional niche space and complexity for organisms, with three levels:

- Low Complexity, with no modifications made to the surface.
- Intermediate Complexity, with four canyons of equal widths.
- High Complexity, with four canyons of variable widths.

Panels were 3D-printed using gray PETG filament.
For deployment, panels were arranged in within one PVC frame, constituting one 'unit'.

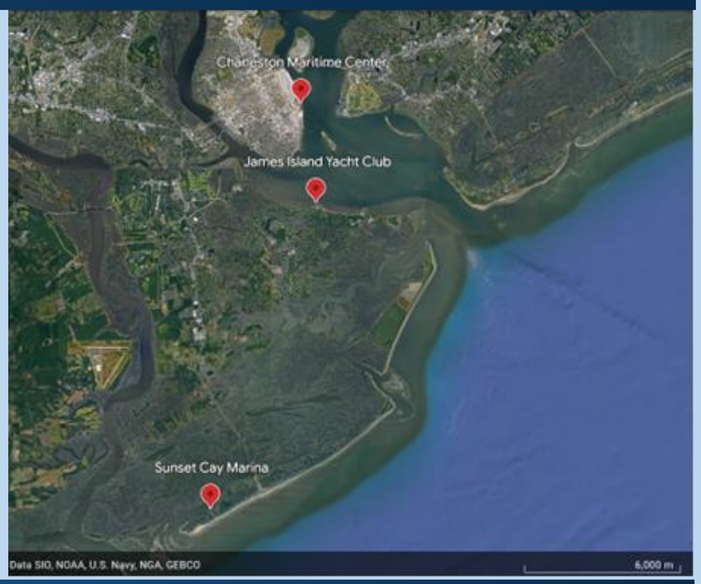
Three sites were chosen for deployment of six units each:

- Charleston Maritime Center.
- James Island Yacht Club.
- Sunset Cay Marina.

Sites had unique epifaunal communities and were chosen to account for spatial variation.
In addition, temporal variation will be assessed with two deployment periods:

- Sep. 2023-Jan. 2024.
- Mar. 2024-Jul. 2024.

Seasonal change in Charleston produces different 'booms' of recruitment, one in fall and one in spring (3).



Data Collection

Six units were deployed at each site on Sep. 14th, 2023, with biweekly sampling checks until the end of deployment 1 on January 15th, 2024.
At each check:

- Units will be pulled out, submerged in a clear bin, and panels will be individually photographed from above.
- Water will be sampled *in situ* via YSI probe, collecting temperature, salinity, and DO concentrations.
- Water samples will be taken to determine chlorophyll and Nitrogen/Phosphorus contents in lab.

In addition to discrete measurements, HOBO loggers were attached to two units at each site, providing continuous measurement of irradiance and temperature. Clod cards will be attached bimonthly and retrieved from units to determine current speed.

- Coral Point Count will be used to determine percent cover of organisms from photographs and determine richness, abundance, and diversity of sessile epifaunal organisms.

On the last sampling date, panels will be collected for final counts and to report and identify associated motile fauna.

Literature Cited

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2. Caine, E. A. (1987). Potential effect of floating dock communities on a South Carolina estuary. Journal of experimental marine Biology and Ecology, 108(1), 83-91.
3. Crickenberger, S., & Sotka, E. (2009). Temporal Shifts of Fouling Communities in Charleston Harbor with a Report of Perna viridis (Mytilidae). Journal of the North Carolina Academy of Science, 78-84.

Acknowledgements

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