Provision of Oyster Reef Habitat in Energetic Systems by the Pervious Oyster Shell Habitat

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INTRODUCTION

- Oyster reefs provide complex habitat for fish and crustaceans
  - Facilitating reproduction, refuge, and feeding
    - Designated as “Essential Fish Habitat” by the 1996 reauthorization of the Magnuson-Stevens Fisheries Conservation and Management Act (1-2)
- Widespread loss of oyster reefs has impacted biodiversity in estuaries [3]
- Restoration methods with increased interstitial space may provide an additional benefit to fish and crustaceans
  - The Pervious Oyster Shell Habitat (POSH) was designed with great structural complexity, and facilitates oyster recruitment [4]
- This study assess the POSH’s ability to provide oyster reef habitat and any additional benefits to increased complexity from Reef Innovations’ “Oyster Ball” model Reef Ball ™

METHODOLOGY

- The study took place from July 2022 to May 2023 along the shorelines at Kingsley Plantation (KP) (Duval County) and Wrights Landing (WL) (St. Johns County)
- Fish and crustaceans were sampled with 2m^2 bottomless lift nets
- Nets were set around reef modules or an oyster reef control at low tide and lifted at high tide, entrapping organisms on the structures
- Water depth, salinity, temperature, dissolved oxygen, and chlorophyll-a concentration were measured to assess abiotic influences on nekton densities
- Fish and crustacean densities (ANOVA), diversity indices (S, J, H’, D), and community similarity (ANOSIM) were assessed through *R*
- Catch efficiency of lift nets was assessed with mark-recapture of *Palaemonetes* dyed with methyl-blue (*see Disc.*)

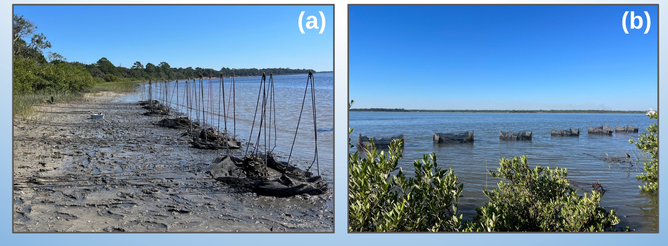
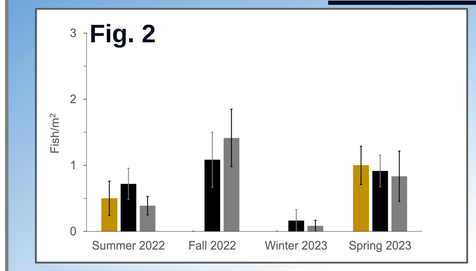
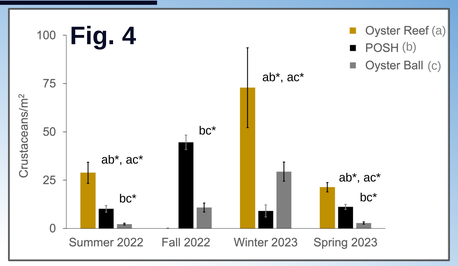
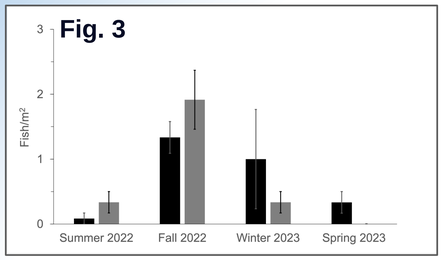


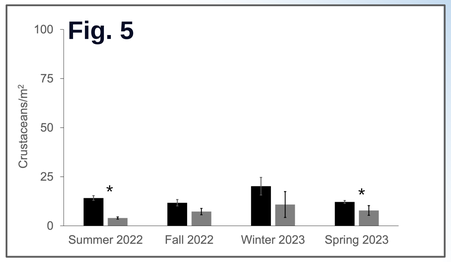
Figure 1: Lift nets set at low tide (a) and lifted at high tide at Wrights Landing, GTMNERR (b)

RESULTS

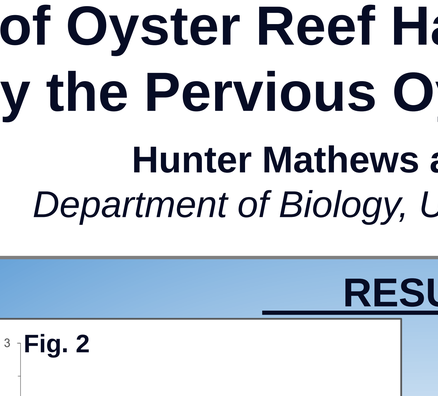


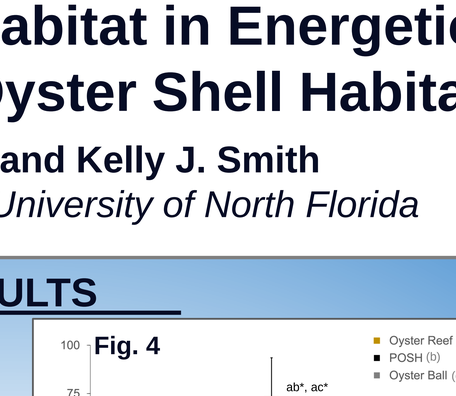






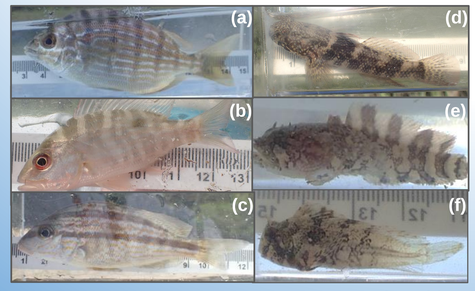
Figures 2-5: Fish densities at KP (2) and WL (3). Crustacean densities at KP (4) and WL (5). Error bars represent ± 1 SE. (*) Denotes a significant difference.





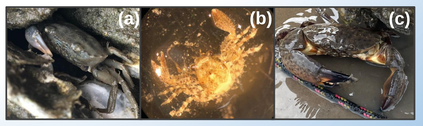
Figures 6-7: Nonmetric-Multidimensional Scaling plots of nekton communities on each treatment at (6) KP and (7) WL, with 95% ellipses.

Commonly Sampled Species



Transients
(a) Pinfish (*Lagodon rhomboides*)
(b) Lane Snapper (*Lutjanus synagris*)
(c) Pigfish (*Orthopristis chrysoptera*)

Reef Residents
(d) Frillfin Goby (*Bathygobius soporator*)
(e) Oyster Toadfish (*Opsanus tau*)
(f) Feather Blenny (*Hypsoblennius hentz*)



Crustaceans
(a) Atlantic Mud Crab (*Panopeus herbstii*), within the interstices of a POSH
(b) Green Porcelain Crab (*Petrolisthes armatus*)
(c) Florida Stone Crab (*Menippe mercenaria*), found on the underside of a POSH

DISCUSSION

- Fish densities were low and similar among treatments
- The POSH had high crustacean densities, significantly greater than the Oyster Ball for 5 out of 8 sampling events
  - The Atlantic Mud Crab (*Panopeus herbstii*) and Green Porcelain Crab (*Petrolisthes armatus*) utilized interstitial spaces
- Diversity metrics and communities were similar among groups
- The POSH provides high-quality habitat for benthic crustaceans (mud crabs, stone crabs, porcelain crabs) (5-6)
  - High prey abundances for many reef predators
- No observable benefit from greater complexity on nekton diversity and fish densities (5-6)
- Bottomless lift nets can be effective at sampling small fish and crustaceans (25-83% *Palaemonetes* recaptured)
  - Lift nets faced difficulties in energetic systems
- Stakeholders wishing to restore oyster reef habitat should consider employing the POSH

ACKNOWLEDGEMENTS

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