Underutilized Potential of Small-Scale Oyster Reef Restoration Units as Habitat for Invertebrates

Jillian Hanley[1,2] and Rachel J. Harris [1,2]
[1] Florida Atlantic University, Wilkes Honors College, Jupiter FL
[2] Loxahatchee River District, WildPine Ecological Laboratory, Jupiter FL
Contact Information: jhanley2015@fau.edu

Introduction

Eastern oysters, *Crassostrea virginica*, improve water quality through filter feeding, stabilizing the shore, and providing a refuge and source of food to various organisms (Wall et al., 2011; Tolley and Volety, 2005; Kesler, 2015). Overharvesting of shellfish, climate change, eutrophication, sedimentation, and habitat degradation all threaten oyster health and abundance (FWC, 2019). Restoration efforts, such as establishing oyster cultch (bagged shells or shell-like material) or deploying vertical hanging shells or shell-like material for juvenile oyster 'spat' recruitment are two potential ways to increase oyster habitat.

Methods

Field Study Design: On an established reef, small-scale oyster cultch units were separated into 2 treatments: cage (i.e. bagged techniques) and string (i.e. vertical oyster gardening techniques) (Fig. 1). 3 replicate treatments were deployed at each site for each treatment (n=12 samples). From August 2018 to August 2019, organisms were collected monthly.

Faunal Sampling and Processing: After sorting and preservation, meiofauna (<1mm) and macrofauna (≥1mm) were identified to the lowest practical taxonomic group and assigned to functional groups based on motility, feeding strategy, and living position (Table 1).

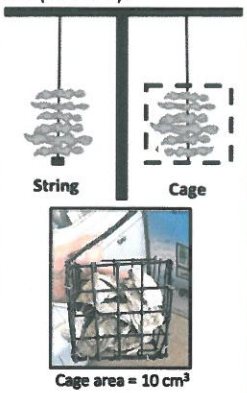


Figure 1. *Study sites in Loxahatchee River. Each x shows a replicate at Sites A and B.*

Dominant species SIMPER results (>3% contribution)	Feeding Strategy	Living Position	Calcium Shell/Tube
Boccardia spp. (5.03%)	DF/SF	FB/TD	
Bopyridae (4.85%)	PC	CR	
Brachidontes exustus (3.68%)	SF	FL	Y
Chondrochelia dubia (5.53%)	DF	TD	
Eurypanopeus depressus (3.88%)	DF/P/SC	FL	
Gammaridae (9.44%)	DF/HG/SC	FB/FL/TD	
Hargeria rapax (4.11%)	DF/SF	TD	
Idunella barnardi (8.17%)	DF	CR/TD	
Odostomia impressa (4.67%)	PC	CR	Y
Onuphidae (6.81%)	DF/HG/SC	SE/TD	
Sinelobus stanfordi (3.38%)	DF/SC	FB/FL/TD	
Stylochus inimicus (4.23%)	PC	CR/FL	
Juvenile Xanthidae (2.98%)	DF/P/SC	FL/FB	

Key
Deposit feeder (DF)
Herbivorous grazer (HG)
Predator (P)
Parasitic carnivore (PC)
Suspension feeder (SF)
Scavenger (SC)
Commensal resident (CR)
Free burrower (FB)
Free living (FL)
Sessile (SE)
Tube dweller (TD)

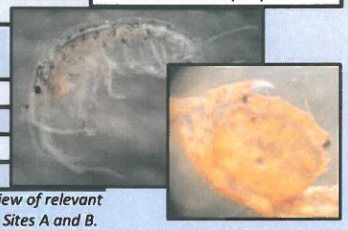
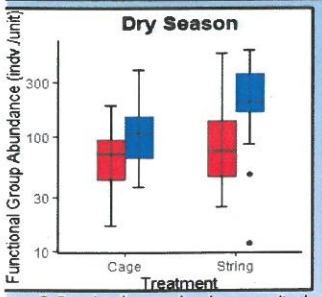
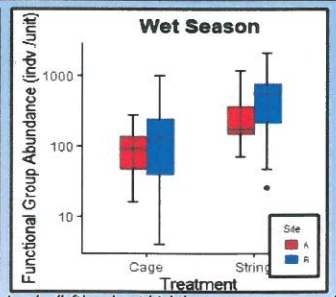


Table 1. *Functional group classifications derived from field observations and a review of relevant literature. Similarity percentages (SIMPER) results of the dominant species at both Sites A and B.*

Results and Discussion

- Oyster spat recruitment was greater during the wet season at both sites (Metz, 2019 report) which is consistent with greater overall functional group abundance (Fig. 2, Table 2) and richness measured during the wet season.
- Functional group abundance was significantly greater in the string treatment (Fig. 2) with no significant difference in richness or diversity by treatment.
- Both forms of small-scale habitat units were utilized by small invertebrates and both offer potential for small-scale oyster restorations.





gure 2. *Functional group abundance per site during dry (left) and wet (right) seasons.*

3-Way ANOVA ('ggpubr' RStudio package)		P-value
Wet Season	Treatment	<0.01*
	Site	0.10
	Site(Replicate)	0.77
	Treatment:Site	0.55
	Treatment:Site (Replicate)	0.79
Dry Season	Treatment	0.02*
	Site	<0.01*
	Site(Replicate)	0.61
	Treatment:Site	0.46
	Treatment:Site (Replicate)	0.87

Table 2. *Functional group abundance results.*

References

Florida Fish and Wildlife Conservation Commission (FWC). (2019) *Florida's Wildlife Legacy Initiative: Florida's State Wildlife Action Plan.* https://myfwc.com/conservation/special-initiatives/fwli/action-plan/

Kassambara, A. (2020). ggpubr: 'ggplot2' Based Publication Ready Plots. [Software Package]. https://rpkgs.datanovia.com/ggpubr.

Kesler, K. E. (2015). *Influences of the biotic and structural components of Crassostrea virginica on the oyster reef community* [Doctoral dissertation]. Department of Biology of University of Maryland.

Tolley, S. G., and Volety, A. K. (2005). The role of oysters in habitat use of oyster reefs by resident fishes and decapod crustaceans. *Journal of Shellfish Research, 24*(4), 1007-1012.

Wall, Charles C., Peterson, Bradley J., and Gobler, Christopher J. (2011), The Growth of Estuarine Resources (*Zostera marina, Mercenaria mercenaria, Crassostrea virginica, Argopecten irradians, Cyprinodon variegatus*) in Response to Nutrient Loading and Enhanced Suspension Feeding by Adult Shellfish. *Estuaries and Coasts 34*. 1262-1277. doi: 10.1007/s12237-011-9377-7.

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