Video Documentation of the Marine Community Using an Oyster Farm As Habitat

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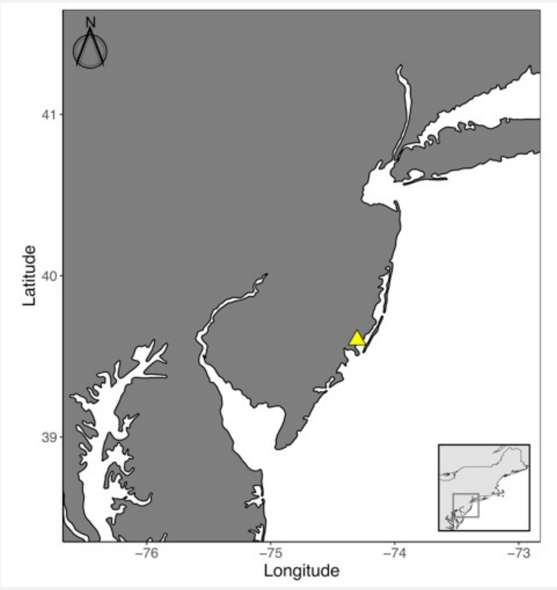
Introduction

Off-bottom oyster cages are an increasingly common method for culturing large numbers of oysters on a small footprint. These cages create 3-D structure that may provide habitat for fish and invertebrates; potentially providing the only complex habitat on otherwise relatively featureless, bay-bottom areas. Shellfish growers routinely observe fish and invertebrates at a variety of life stages interacting with aquaculture gear. Regional data documenting fish habitat provisioning will be of value to regulators and fishery managers who make decisions about siting shellfish farms and protecting habitat for recreationally and commercially important fish species.

(Left) Floating oyster bags anchored to bottom. (Right) Oyster cages with bags inside at low tide, sitting on bottom.

Methods

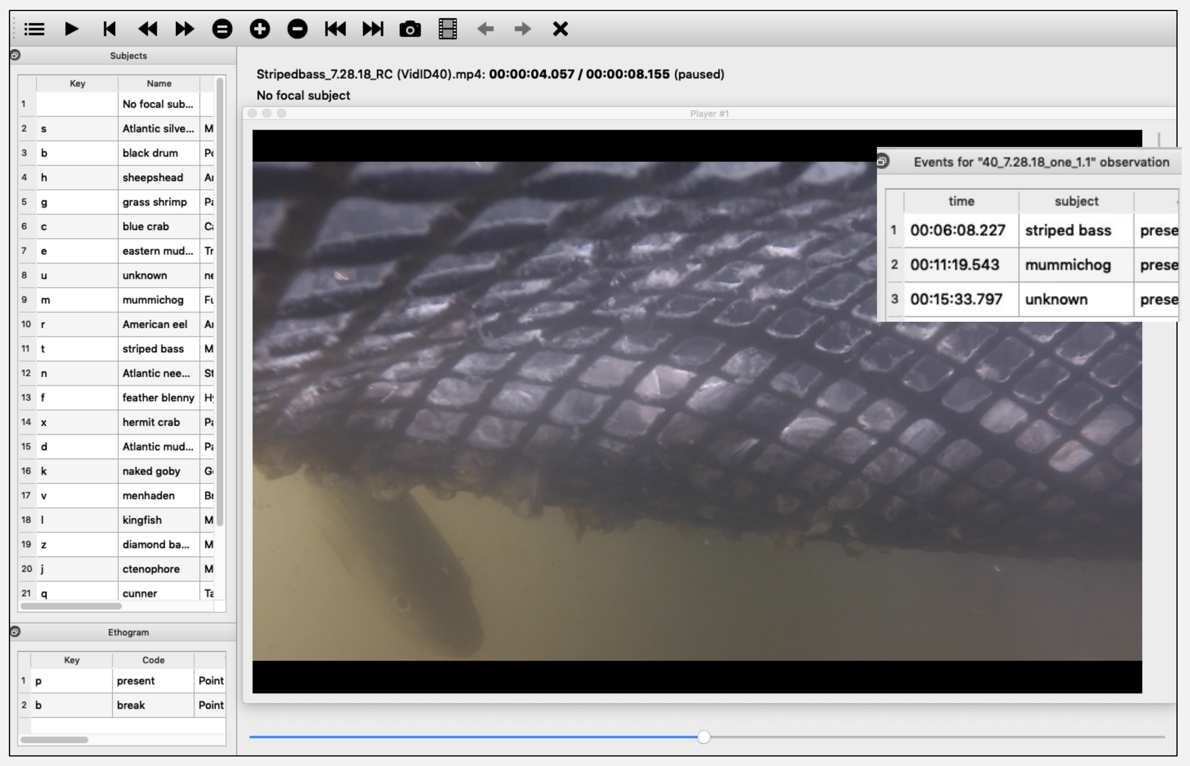
To quantitatively assess observed interactions, point-of-view (GoPro) cameras were used to document fish activity in and around on an oyster farm and naturally structured habitat in the Little Egg Harbor region of Barnegat Bay, New Jersey. Opportunistic camera deployments collected continuous footage across tidal cycles during farm operations from July-September 2018 and 2019. Videos were analyzed using BORIS, *Behavioral Observation Research Interactive Software*, a free and open-source event logging software[1]. Animals observed in the footage were identified to the closest possible taxon and coded in BORIS. Nekton abundance was determined using MaxN[2], defined as maximum number of individuals of a given species present in a single frame within each 1-minute segment of video. Qualitative behavioral observations were also recorded.



The location of the oyster farm used for this study is denoted by the yellow triangle. Image credit: Sarah Borsetti

Sampled habitats:
- Floating oyster bags
- Bottom cages
- Bottom clam screens
- Natural, marsh edge
- Bare, sandy bottom

GoPro camera affixed to the bottom of a floating bag.



View of BORIS during video analysis.

Results

Results shown are for the 2018 data. Twenty-one species from four phyla were observed across all days and sites; 8,937 observations in total. The farm was actively being worked during sampling events.

Common name	Species	Residency	Cage	Floating bag	Marsh
Atlantic silverside	***Menidia menidia***	Transient	310.67	3.14	23.55
Mummichog	***Fundulus heteroclitus***	Transient	1.91	11.66	2.32
Feather blenny	*Hypsoblennius hentz*	Obligate	0.99	2.75	0.87
Blue crab	***Callinectes sapidus***	Facultative	0.53	1.24	1.64
Atlantic needlefish	*Strongylura marina*	Transient	2.70	0	0
Grass shrimp	*Palaemonetes* spp.	Transient	0.13	1.44	0.29
Naked goby	*Gobiosoma bosci*	Obligate	0.26	0.85	0.39
Sheepshead	***Archosargus probatocephalus***	Facultative	1.25	0.20	0
Silver perch	*Bairdiella chrysoura*	Transient	1.25	0	0
Permit	*Trachinotus falcatus*	Transient	0	0	1.06
Striped bass	***Morone saxatilis***	Transient	0	0.98	0
Hermit crab	*Pagurus* spp.	Transient	0.07	0.59	0
Cunner	*Tautogolabrus adspersus*	Transient	0.40	0	0
Atlantic mud crab	*Panopeus herbstii*	Obligate	0.07	0.07	0.10
Atlantic menhaden	***Brevoortia tyrannus***	Transient	0	0	0.19
Summer flounder	***Paralichthys dentatus***	Transient	0.07	0.07	0
Northern kingfish	*Menticirrhus saxatilis*	Transient	0	0	0.10
Diamondback terrapin	*Malaclemys terrapin*	Transient	0.07	0	0
American eel	***Anguilla rostrata***	Transient	0	0.07	0

Table: The number of raw observations per hour of viewable footage collected across sampling dates is shown. Species listed in **bold** are part of a commercial or recreational fishery in New Jersey. Classification of species by residency type is sourced from Breitburg (1998)[3] and Coen et al. (1999)[4]

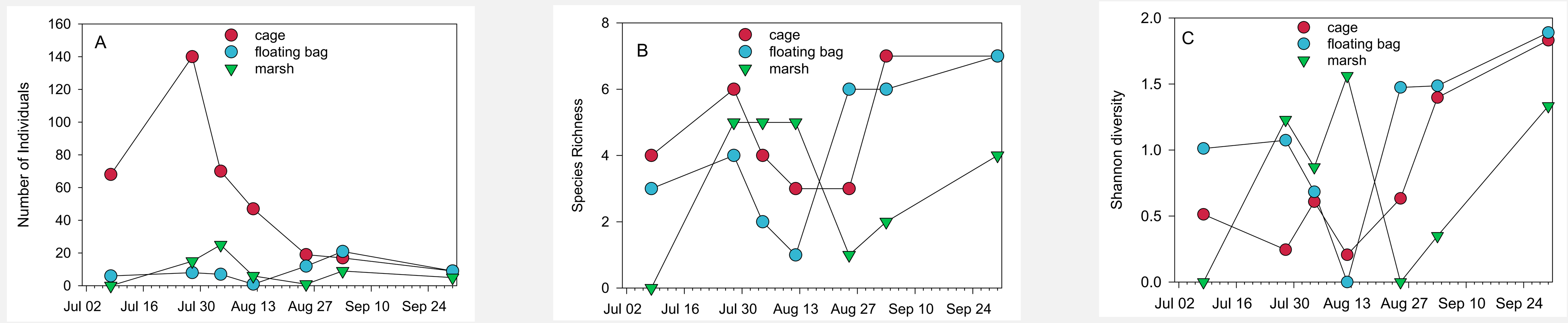


Figure 1: (A) Total number of individuals (sum of MaxN across all species, where MaxN is defined as the maximum number of individuals of a given species present within each 80 min segment of video). (B) Species richness (total number of species observed). (C) Shannon diversity index for the 3 habitat types over the 7 dates during which video was collected (n = 21)

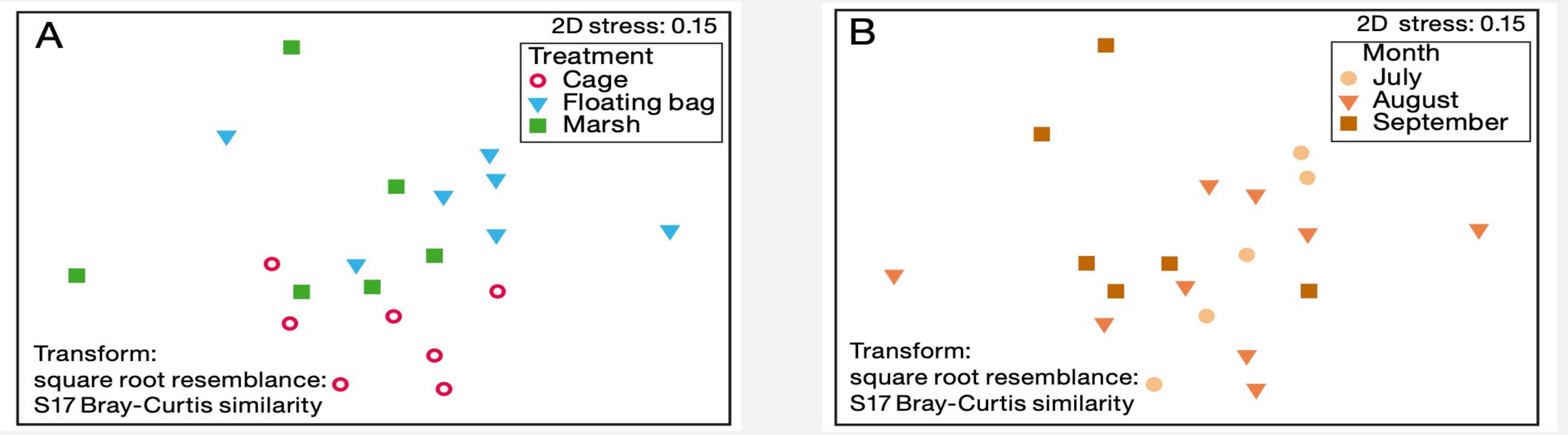


Figure 2: Non-metric multidimensional scaling plots of nekton community based on MaxN calculated from each 80 min video for each species (n = 21), with overlays of (A) habitat treatment type and (B) sampling month

View some of the footage collected during the study

Conclusions

Species that are of ecological and economical importance used the farm gear in some compacity. This supports the ideal that oyster farms may provide a similar habitat to the diminished natural structured habitats. Most frequently, juveniles of a given species were observed, suggesting that the oyster farm enhances the nursery function of an estuary. The readily accessible methods employed here provide a relatively inexpensive way to document faunal utilization of various habitats that could be replicated in other locations with different gear. The number of oyster farms globally has increased5 and understanding the ecological role that they play in different habitats is important. Data from this project has spearhead the first steps towards a comprehensive regional network characterizing and evaluating fish habitat provisioning on off-bottom oyster farms with our collaborators at the NOAA Northeast Fisheries Science Center Milford Laboratory.

Resources

[1]Friard, O. *et al.* (2016). Methods in Ecology and Evolution. 7:11. 1325-1330
[2]Ellis, D. *et al.* (1995). Fishery Bulletin. 93. 67-77.
[3]Breitburg, D.L. (1998) *In* M. Luckenbach, R. Mann and J. A. Wesson, editors. Oyster reef habitat restoration: a synopsis and synthesis of approaches. VIMS Press, Gloucester Point, VA. Pgs. 239-250
[4]Coen, L.D. *et al.* (1999), *In* Fish Habitat: Essential Fish Habitat and Rehabilitation, Benka LR (ed.) American Fisheries Society, Bethesda, MD
[5] Wijsman JWM, Troost K, Fang J, Roncarati A (2019) Global production of marine bivalves. Trends and challenges. In: Smaal A, Ferreira J, Grant J, Petersen J, Strand Ø (eds) Goods and services of marine bivalves. Springer, Cham, p 7–26

A diamond back terrapin (*Malaclemys terrapin)* cruises over a bottom cage on 8/4/18 in Rose Cove, Barnegat Bay.

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Northeastern Regional Aquaculture Center

USDA United States Department of Agriculture National Institute of Food and Agriculture

NOAA FISHERIES Northeast Fisheries Science Center