Faunal ID, size and biomass on oyster reefs in Quonochontaug Pond, RI from July-August 2018 and September-October 2018

Website: https://www.bco-dmo.org/dataset/881801
Data Type: Other Field Results
Version: 1
Version Date: 2022-11-02

Project
» CAREER: Linking genetic diversity, population density, and disease prevalence in seagrass and oyster ecosystems (Seagrass and Oyster Ecosystems)

Contributors	Affiliation	Role
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Abstract
This dataset contains results from experiments comparing reef-associated community colonization among oyster reef and sand habitats in Quonochontaug Pond, Rhode Island, USA. Experimental sampling trays were deployed and assigned to four experimental treatments. Trays were deployed by divers on SCUBA on July 10, 2018 (summer) and September 7, 2018 (fall) and were leveled with the surrounding substrate by carefully excavating the surrounding reef material (interior treatment) or sediment (edge, shell, and sand treatments). After 28-29 days, divers collected the trays and associated fauna were measured.

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Coverage

Spatial Extent: **Lat**:41.3 **Lon**:-71.7
Temporal Extent: 2018-07-10 - 2018-10-04

Methods & Sampling

These data were published in Davenport et al., 2022 (Restoration Ecology). All figure numbers mentioned refer to Davenport et al., 2022 (Restoration Ecology).

To compare reef-associated community colonization among oyster reef and sand habitats, we deployed experimental sampling trays assigned to four treatments in Quonochontaug Pond, Rhode Island, USA (41.3 N, 71.7 W). Sampling trays (plastic bakery trays, 0.66 meters L x 0.56 meters W x 0.14 meters H) were lined with fiberglass window screen (1-millimeter mesh opening). For the reef edge, reef interior, and shell treatments, trays were filled with five gallons of clean, articulated oyster shell from a shell recycling program run by The Nature Conservancy. For the sand treatment, the sampling trays were lined as before but filled with ten gallons of locally-sourced sand that was sieved to remove live organisms. Reef edge treatments of a single tray filled with shell were placed abutting each reef at a position randomized by cardinal direction (Fig. S3). Reef interior treatments of a single tray filled with shell were placed at the innermost point on each reef (Fig. S3). Shell and sand treatments of a single tray filled with shell or sand, respectively, were placed in each control plot (Fig. S3). Trays were deployed by divers on SCUBA on July 10, 2018 (summer) and September 7, 2018 (fall) and were leveled with surrounding substrate by carefully excavating the surrounding reef material (interior treatment) or sediment (edge, shell, and sand treatments).

After 28-29 days, divers collected the trays by carefully lifting them off the substrate and noting any organisms that escaped during retrieval. Divers brought the trays to the boat where fish were removed and euthanized in a eugenol/seawater solution before they were bagged and all tray contents placed in coolers. Tray contents were rinsed, sieved and sorted and all individuals were removed and stored in 10% isopropyl alcohol. Individuals were enumerated and identified to the lowest possible taxonomic group, measured, and weighed (wet weight in grams). Trays were rinsed and allowed to dry fully between deployments. Two trays were upturned during the fall deployment (block 1 reef interior; block 3 reef interior), leading to 24 trays sampled in summer and 22 trays in fall.

Measurements are total length to the nearest 1 millimeter (mm) for fishes, carapace width to nearest 0.1 mm for crabs, carapace length to nearest 0.1 mm for shrimps, shell height to nearest 0.1 mm for snails, and shell length to the nearest 0.1 mm for slipper shells. Fish measurements were determined with a metric ruler. All other organisms were measured with Vernier calipers. For species found at high densities, a subset (up to 20 individuals per species per sample) was weighed individually, after which organisms were weighed in bulk by species. Polychaetes were not measured, were weighed in bulk, and were only counted if heads were present.

Tray contents were rinsed with fresh water over a 1-mm sieve and stored in 10% isopropyl alcohol for approximately 1-6 months prior to identification and size and biomass measurements.

Data Processing Description

Data Processing:
All analyses were conducted in R (version 3.6.1; R Core Team 2019). Multivariate analyses were conducted using the vegan package (version 2.5-6; Oksanen et al. 2019). Linear mixed model analysis in R using the lme4 package (Bates et al. 2015).

BCO-DMO Processing:
- Adjusted field/parameter names to comply with BCO-DMO naming conventions
- Missing data identifier 'NA' replaced with 'nd' (BCO-DMO's default missing data identifier)
- Added a conventional header with dataset name, PI names, version date
- Values in column "wet_weight" were rounded to 3 decimal places for all trays except t1
- Values in the column "meas" were rounded to 1 decimal place

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Data Files

File
fauna_habitat.csv (Comma Separated Values (.csv), 241.36 KB) MD5:f847444a0d693b772c3384ee28aeaf35 Primary data file for dataset ID 881801

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Supplemental Files

File
How to Measure Shellfish Recreational Saltwater Fishing Regulations filename: How_to_Measure_Shellfish.pdf (Portable Document Format (.pdf), 207.25 KB) MD5:bc7bf86af68611671584384d9b1bd562 Commonwealth of Massachusetts Dept. of Marine Fisheries document "How to Measure Shellfish Recreational Saltwater Fishing Regulations" describing measurement rules for different shellfish. This measurement protocol was used as part of dataset 881801 ("Fauna on restored oyster reefs").

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Related Publications

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2014). *Fitting Linear Mixed-Effects Models using lme4* (Version 1). arXiv. https://doi.org/10.48550/ARXIV.1406.5823 https://doi.org/10.48550/arXiv.1406.5823
Software

Davenport, T. M. (2022). Reef and landscape characteristics influence nekton recruitment enhancement by restored oyster reefs. https://doi.org/10.17760/D20439250
General

Davenport, T. M., Grabowski, J. H., & Hughes, A. R. (2022). Edge effects influence the composition and density of reef residents on subtidal restored oyster reefs. Restoration Ecology. Portico. https://doi.org/10.1111/rec.13693
Results

Oksanen, J., Kindt, R., Legendre, P., O'Hara, B., Stevens, M. H. H., Oksanen, M. J., & Suggests, M. A. S. S. (2007). The vegan package. Community ecology package, 10(631-637), 719. http://vegan.r-forge.r-project.org/
Software

R Core Team (2019). R: A language and environment for statistical computing. R v3.6.1. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/
Software

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Related Datasets

IsRelatedTo

Hughes, A. R., Davenport, T., Grabowski, J. (2022) **Daily temperature measurements on restored oyster reefs in Quonochontaug Pond, RI from July-August 2018 and September-October 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-11-01 doi:10.26008/1912/bco-dmo.881834.1 [view at BCO-DMO]

Hughes, A. R., Davenport, T., Grabowski, J. (2022) **Oyster density of restored reef edge/interior in Quonochontaug Pond, RI in May 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-11-02 doi:10.26008/1912/bco-dmo.881536.1 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
tray	unique indicator for each experimental sampling tray.	unitless
block	numerical label for experimental block, 1-3; corresponds to Figure 1 in Davenport et al. 2022, Restoration Ecology.	unitless
reef	alphabetical label for the reef on which trays with HOBO loggers were attached; corresponds to Figure 1 in Davenport et al. 2022. Restoration Ecology	unitless
treat	experimental treatment, including I (reef interior), E (reef edge), SHELL (shell control tray). Corresponds to Figure 1 in Davenport et al. 2022, Restoration Ecology.	unitless
species	scientific name including genus and species where known otherwise the lowest taxonomic group is listed with spp. 1 indicating individuals of the same group. A taxon followed by biomass (e.g. "taxon - biomass") indicates the specimen could not be identified to species since it was too damaged but the specimen was added to the biomass for its taxon. Where common name replaces a scientific name (e.g. "Ribbon worm") this individual was not identified to species	unitless
meas_descrip	description of the dimensions measured for each organism. A maximum one-dimensional measurement were chosen for each taxon: For all crabs and horseshoe crabs: carapace width (CW) is reported. For shrimps: carapace length (CL) is reported. For scallops and clams: shell diameter (SD) is reported per Massachusetts Division of Marine Fisheries "How to Measure Shellfish Recreational Saltwater Fishing Regulations" (PDF available under Supplemental Files). For snails: shell height (SH) is reported. For fishes: total length (TL) is reported. For slipper shells: shell length (SL) is reported. Sizes of polychaetes and ribbon worms are excluded as the length of these organisms is challenged by the identification of their posterior.	unitless
meas	measurement of organism size. Organisms for which measurements would be unreliable (e.g. crabs with broken shells) were not measured.	millimeters (mm)
weight_I_group	label indicating whether the organism was weighed individually (I), or as part of a group (G#). New groups were assigned for each species, and where species identifications were not possible, by taxon. Group numbering restarts with each experimental sampling tray.	unitless
wet_weight	wet weight in grams. Organisms were blotted three times with lint-free wipes before weighing.	grams (g)
year	year of tray deployment in format: YYYY	unitless
season	season of tray deployment (summer or fall)	unitless

Instruments

Dataset-specific Instrument Name	Vernier calipers
Generic Instrument Name	calipers
Dataset-specific Description	Vernier calipers were used for measuring organism sizes to the nearest 0.1mm (e.g. https://www.fishersci.com/shop/products/plastic-vernier-calipers/nc9280794).
Generic Instrument Description	A caliper (or "pair of calipers") is a device used to measure the distance between two opposite sides of an object. Many types of calipers permit reading out a measurement on a ruled scale, a dial, or a digital display.

Dataset-specific Instrument Name	metric ruler
Generic Instrument Name	ruler
Dataset-specific Description	A metric ruler was used for measuring organism size for fishes (to the nearest 1mm).
Generic Instrument Description	A device used for measuring or for drawing straight lines, consisting of an elongated piece of rigid or semi-rigid material marked with units for measurement. Device that allows one or more physical dimensions of a sample or specimen to be determined by visible comparison against marked graduations in units of measurement of dimension length.

Dataset-specific Instrument Name	microbalance
Generic Instrument Name	scale
Dataset-specific Description	A microbalance was used for weighing organism biomass (e.g. https://www.richmondscientific.com/product/ohaus-explorer-precision-bala...).
Generic Instrument Description	An instrument used to measure weight or mass.

Dataset-specific Instrument Name	SCUBA
Generic Instrument Name	Self-Contained Underwater Breathing Apparatus
Generic Instrument Description	The self-contained underwater breathing apparatus or scuba diving system is the result of technological developments and innovations that began almost 300 years ago. Scuba diving is the most extensively used system for breathing underwater by recreational divers throughout the world and in various forms is also widely used to perform underwater work for military, scientific, and commercial purposes. Reference: https://oceanexplorer.noaa.gov/technology/technical/technical.html

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Project Information

CAREER: Linking genetic diversity, population density, and disease prevalence in seagrass and oyster ecosystems (Seagrass and Oyster Ecosystems)

Coverage: Coastal New England

NSF Award Abstract:
Disease outbreaks in the ocean are increasing, causing losses of ecologically important marine species, but the factors contributing to these outbreaks are not well understood. This 5-year CAREER project will study disease prevalence and intensity in two marine foundation species - the seagrass Zostera marina and the Eastern oyster Crassostrea virginica. More specifically, host-disease relationships will be explored to understand how genetic diversity and population density of the host species impacts disease transmission and risk. This work will pair large-scale experimental restorations and smaller-scale field experiments to examine disease-host relationships across multiple spatial scales. Comparisons of patterns and mechanisms across the two coastal systems will provide an important first step towards identifying generalities in the diversity-density-disease relationship. To enhance the broader impacts and utility of this work, the experiments will be conducted in collaboration with restoration practitioners and guided by knowledge ascertained from key stakeholder groups. The project will support the development of an early career female researcher and multiple graduate and undergraduate students. Students will be trained in state-of-the-art molecular techniques to quantify oyster and seagrass parasites. Key findings from the surveys and experimental work will be incorporated into undergraduate courses focused on Conservation Biology, Marine Biology, and Disease Ecology. Finally, students in these courses will help develop social-ecological surveys and mutual learning games to stimulate knowledge transfer with stakeholders through a series of workshops.

The relationship between host genetic diversity and disease dynamics is complex. In some cases, known as a dilution effect, diversity reduces disease transmission and risk. However, the opposite relationship, known as the amplification effect, can also occur when diversity increases the risk of infection. Even if diversity directly reduces disease risk, simultaneous positive effects of diversity on host density could lead to amplification by increasing disease transmission between infected and uninfected individuals. Large-scale field restorations of seagrasses (Zostera marina) and oysters (Crassostrea virginica) will be utilized to test the effects of host genetic diversity on host population density and disease prevalence/intensity. Additional field experiments independently manipulating host genetic diversity and density will examine the mechanisms leading to dilution or amplification. Conducting similar manipulations in two marine foundation species - one a clonal plant and the other a non-clonal animal - will help identify commonalities in the diversity-density-disease relationship. Further, collaborations among project scientists, students, and stakeholders will enhance interdisciplinary training and help facilitate the exchange of information to improve management and restoration efforts. As part of these efforts, targeted surveys will be used to document the perceptions and attitudes of managers and restoration practitioners regarding genetic diversity and its role in ecological resilience and restoration.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1652320

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