Fauna species count data from minnow trap sampling within seagrass in Summer 2017 in Back Sound, North Carolina

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Project
» Collaborative Research: Habitat fragmentation effects on fish diversity at landscape scales: experimental tests of multiple mechanisms (Habitat Fragmentation)

Contributors	Affiliation	Role
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Abstract
Fauna species count data from minnow trap sampling within seagrass in Summer 2017 in Back Sound, North Carolina.

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Coverage

Spatial Extent: **N**:34.703251 **E**:-76.526267 **S**:34.651056 **W**:-76.587826
Temporal Extent: 2017-06-10 - 2017-08-21

Dataset Description

Fauna species count data from minnow trap sampling within seagrass in Summer 2017 in Back Sound, North Carolina.

Methods & Sampling

For Table and Figure references below, see the document "MinnowTrap_statistical_analysis.pdf" in the Supplemental Files section.

Study Site Selection

We conducted our study across eight discrete seagrass meadows (hereafter referred to as landscapes) located in Back Sound, North Carolina (NC), USA (3442′ N to 3439′ N, 7637′ W to 7631′ W) (Fig. S1). All of our sampled landscapes were composed of a mixture of Back Sound's dominant seagrasses: eelgrass and shoal

grass, Halodule wrightii (Ascherson 1868) (Yeager et al. 2016). Landscapes were chosen based upon available aerial imagery in Google Earth Pro as of February 19, 2017, and ground-truthed for changes in seasonal seagrass growth/senescence using summer, 2017, drone photography and ImageJ 1.x (Schneider et al. 2012). No discernable differences in landscape fragmentation states (e.g. total area, number of patches) were found between the two aerial imagery sources. All landscapes were relatively shallow (1-1.5 m depth at high tide), reasonably isolated from other seagrass beds (distance to nearest seagrass meadow = 112 17 m [mean standard error]) and were appropriately sized to encompass short-term (e.g., daily, monthly) movements of common seagrass-associated fauna in this system (Yeager et al. 2016). We identified similarly sized landscapes (25882 6592 m2) available in Back Sound by defining the minimum convex polygon surrounding the seagrass meadow, regardless of the total seagrass cover within the polygon. Among eight candidate landscapes of similar size, we defined four continuous landscapes and four fragmented landscapes based on the number of patches, the perimeter-to-area ratio, and the largest patch's percent cover of the total seagrass area (Table 1). Seagrass fragmentation is often naturally coupled with habitat loss (Wilcove et al. 1986), resulting in the mean seagrass area of our fragmented landscapes being nearly half that of our continuous landscapes (Table 1). Thus, our experiment was designed to examine the effects of fragmentation (i.e., the breaking apart of habitat concomitant with habitat loss) rather than fragmentation per se (i.e., the breaking apart of habitat without habitat loss; sensu Fahrig 2003).

Seagrass-associated Fauna Sampling

Seagrass-associated fauna were sampled to explore relationships between our observed predation/depredation rates and seasonal faunal densities within each fragmentation state. We sampled seagrass-associated fauna during each crab tethering cycle with four baited (with ~ 8 pieces of dried dog food; Mahoney et al. 2018) Gee-style minnow traps (41-cm long, 22-cm wide, 0.3-cm galvanized mesh-wire cylinders, with 4-cm diameter funneled openings) haphazardly deployed in each landscape. We acknowledge that baiting traps increases catch rates in our system and could bias the captured community toward predators and scavengers (our target community), yet this increase in catch rate seems to be uniform across seagrass habitat structure variables (Mahoney et al. 2018). At 24 h, faunae were enumerated, identified to the lowest taxonomical level possible, and released.
Point measurements of water temperature (C) were taken in each landscape at the location and time of all faunal sampling using hand-held thermometers (Table S1). We chose temperature as our seasonality proxy (Fig. S2) because several other seasonally affected factors including faunal densities correlate with water temperature variability. Additionally, the measurement of temperature is easy, cheap, reliable, and comparable to previous studies.

Equipment:
* Generic brand dog food
* Memphis and twine Gee-style minnow traps (41-cm long, 22-cm wide, 0.3-cm galvanized mesh-wire cylinders, with 4-cm diameter funneled openings)

Data Processing Description

Data processing: All data were entered electronically into an Excel spreadsheet.

BCO-DMO Data Manager Processing Notes:
* exported submitted excel file to csv format
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions
* date format converted to ISO 8601 standard format yyyy-mm-dd
* No-data values in this dataset are displayed as the missing data identifier "nd" for "no data" in the BCO-DMO system.
* Taxonomic names checked with the World Register of Marine Species taxon matching tool on 2019-10-28. All names matched exactly to accepted names.

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Data Files

File
MinnowTrap_Data.csv(Comma Separated Values (.csv), 26.32 KB) MD5:88b86f34fdbc445ed158f0730c38deb6 Primary data file for dataset ID 780027

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Supplemental Files

File
MinnowTrap_statistical_analysis.pdf(Portable Document Format (.pdf), 182.88 KB) MD5:ebd625037fc55250db8c24fe2bda8230 MinnowTrap statistical analysis, tables and figures

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Related Publications

Fahrig, L. (2003). Effects of Habitat Fragmentation on Biodiversity. Annual Review of Ecology, Evolution, and Systematics, 34(1), 487–515. doi:10.1146/annurev.ecolsys.34.011802.132419
Methods

Mahoney, R. D., Kenworthy, M. D., Geyer, J. K., Hovel, K. A., & Joel Fodrie, F. (2018). Distribution and relative predation risk of nekton reveal complex edge effects within temperate seagrass habitat. Journal of Experimental Marine Biology and Ecology, 503, 52–59. doi:10.1016/j.jembe.2018.02.004
Methods

R Core Team (2016) R: A language and environment for statistical computing. R Foundation for Statistical Computing. Vienna, Austria. https://www.r-project.org
Software

Schneider, C. A., Rasband, W. S., & Eliceiri, K. W. (2012). NIH Image to ImageJ: 25 years of image analysis. Nature Methods, 9(7), 671–675. https://doi.org/10.1038/nmeth.2089
Software

Wilcove DS, McLellan CH, Dobson AP (1986) Habitat fragmentation in the temperate zone. In: Soule ME (ed) Conservation Biology, Sinauer, Sunderland, MA pp 237–256.
https://www.fws.gov/southwest/es/documents/r2es/litcited/lpc_2012/wilcove_et_al_1986.pdf
Methods

Yeager, L. A., Keller, D. A., Burns, T. R., Pool, A. S., & Fodrie, F. J. (2016). Threshold effects of habitat fragmentation on fish diversity at landscapes scales. Ecology, 97(8), 2157–2166. doi:10.1002/ecy.1449
Methods

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Parameters

Parameter	Description	Units
Date	Date minnow trap deployed (ISO 8601 format yyyy-mm-dd)	unitless
SiteID	Name of seagrass bed in which trap was deployed	unitless
C_F	Fragmentation state of seagrass bed: C = Continuous, F = Fragmented	unitless
lat	Latitude	decimal degrees
lon	Longitude	decimal degrees
MinnowTrap_Num	Replicate number of minnow trap	unitless
Species	Common name of species caught	unitless
Scientific_name	Scientific name of species caught	unitless
Species_Num	Count number of individuals of a species caught in a minnow trap	per individual

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	minnow trap
Dataset-specific Description	Memphis and twine Gee-style minnow traps (41-cm long, 22-cm wide, 0.3-cm galvanized mesh-wire cylinders, with 4-cm diameter funneled openings)
Generic Instrument Description	shore fishing gear

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Project Information

Collaborative Research: Habitat fragmentation effects on fish diversity at landscape scales: experimental tests of multiple mechanisms (Habitat Fragmentation)

Coverage: North Carolina

Amount and quality of habitat is thought to be of fundamental importance to maintaining coastal marine ecosystems. This research will use large-scale field experiments to help understand how and why fish

populations respond to fragmentation of seagrass habitats. The question is complex because increased fragmentation in seagrass beds decreases the amount and also the configuration of the habitat (one patch splits into many, patches become further apart, the amount of edge increases, etc). Previous work by the investigators in natural seagrass meadows provided evidence that fragmentation interacts with amount of habitat to influence the community dynamics of fishes in coastal marine landscapes. Specifically, fragmentation had no effect when the habitat was large, but had a negative effect when habitat was smaller. In this study, the investigators will build artificial seagrass habitat to use in a series of manipulative field experiments at an ambitious scale. The results will provide new, more specific information about how coastal fish community dynamics are affected by changes in overall amount and fragmentation of seagrass habitat, in concert with factors such as disturbance, larval dispersal, and wave energy. The project will support two early-career investigators, inform habitat conservation strategies for coastal management, and provide training opportunities for graduate and undergraduate students. The investigators plan to target students from underrepresented groups for the research opportunities.

Building on previous research in seagrass environments, this research will conduct a series of field experiments approach at novel, yet relevant scales, to test how habitat area and fragmentation affect fish diversity and productivity. Specifically, 15 by 15-m seagrass beds will be created using artificial seagrass units (ASUs) that control for within-patch-level (~1-10 m2) factors such as shoot density and length. The investigators will employ ASUs to manipulate total habitat area and the degree of fragmentation within seagrass beds in a temperate estuary in North Carolina. In year one, response of the fishes that colonize these landscapes will be measured as abundance, biomass, community structure, as well as taxonomic and functional diversity. Targeted ASU removals will then follow to determine species-specific responses to habitat disturbance. In year two, the landscape array and sampling regime will be doubled, and half of the landscapes will be seeded with post-larval fish of low dispersal ability to test whether pre- or post-recruitment processes drive landscape-scale patterns. In year three, the role of wave exposure (a natural driver of seagrass fragmentation) in mediating fish community response to landscape configuration will be tested by deploying ASU meadows across low and high energy environments.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1635950

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