Squidpop consumption probability within Artificial Seagrass Units (ASU) in Back Sound, NC from October to November 2018

Website: https://www.bco-dmo.org/dataset/891794
Data Type: Other Field Results
Version: 1
Version Date: 2023-03-15

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
To parse the ecological effects of habitat area and patchiness on faunal community structure and dynamics of estuarine nekton, we employed artificial seagrass unit (ASU) landscapes at a scale relevant to habitat fidelity of common fish and macroinvertebrates in our temperate study system, Back Sound, NC. These ASU landscapes were designed along orthogonal axes of artificial seagrass area (i.e., percent cover of each landscape = 10-60 percent) and fragmentation per se (i.e., percolation probability; 0.1-0.59) to delineate their independent and interactive effects on seagrass fish and macroinvertebrate communities. To measure generalist consumption probabilities across landscapes, we conducted two squidpop consumption assays on 19-Oct and 1-Nov 2018. Consumption assays were conducted after landscapes were disturbed by Hurricane Florence, but prior to the seasonal egress of nekton from local seagrass meadows. On each assay date, up to 10 squidpops were deployed within ASUs in each landscape, 1 meter apart and less than 0.5 meters from the ASU-matrix interface (the edge of ASU patches), to control for potentially different consumption probabilities between seagrass patch edges and interiors. Squidpop presence/absence was checked after 1 hours, 2 hours, and 3 hours to retrospectively assess the timeframe in which overall consumption probabilities allowed for resolution of differences in consumption among sites (i.e., between one- and two-thirds of all bait consumed). All absent squidpops were presumed eaten based on previous efforts that have demonstrated negligible spurious bait loss. Consumption assays were conducted by Drs. F. Joel Fodrie and Amy H. Yarnall for the Estuarine Ecology Laboratory of the University of North Carolina at Chapel Hill's Institute of Marine Sciences.

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Coverage

Spatial Extent: **N**:34.707 **E**:-76.589 **S**:34.702 **W**:-76.603
Temporal Extent: 2018-10-19 - 2018-11-01

Methods & Sampling

To measure generalist consumption probabilities across landscapes, we conducted two squidpop consumption assays on 19-Oct and 1-Nov 2018 on Oscar Shoal and an adjacent unnamed shoal in Back Sound, NC, USA (34°42′20" N to 34°41′60" N, 76°36′ 15" W to 76°35′17" W). Consumption assays were conducted after Hurricane Florence disturbed our landscapes (see below), prior to the seasonal egress of nekton from local seagrass meadows (Baillie et al., 2015). Squidpops are 1-centimeter × 1-centimeter squares of dried squid mantle tied to 1-centimeter segments of monofilament (Duffy et al., 2015). Squidpops were secured to 60-centimeter long, 0.5-centimeter diameter, fiberglass stakes with attached floats for relocation. On each assay date, up to 10 squidpops were deployed within ASUs in each landscape, 1 meter apart and less than 0.5 meters from the ASU-matrix interface (the edge of ASU patches), to control for potentially different consumption probabilities between seagrass patch edges and interiors (Mahoney et al., 2018). The number of squidpops deployed in each landscape [mean of 9.2 ± 1.8 SD] depended upon the length of the available edge. Squidpop presence/absence was checked after 1 hour, 2 hours, and 3 hours to retrospectively assess the timeframe in which overall consumption probabilities allowed for the resolution of differences in consumption among sites (i.e., between one- and two-thirds of all bait consumed). This threshold was met after 1 hour, therefore we focus our results on these data. All absent squidpops were presumed eaten based on previous efforts that have demonstrated negligible spurious bait loss (Lefcheck et al., 2021).

The study area and artificial landscapes were directly impacted by Hurricane Florence during 13-16 Sept 2018. Despite ASU re-enforcements made prior to Florence's landfall (i.e., additional lawn staples and cable ties), our landscapes experienced substantial disturbance akin to natural seagrasses in the vicinity, in many cases completely removing or burying ASUs which altered the landscape percent cover and fragmentation per se parameters. We recalculated landscape parameters based on ASU-by-ASU checks made after Hurricane Florence. Holding the original landscape 234-square meter footprint constant, the percent cover and percolation probability of each landscape was recalculated from the remaining number of ASUs (excluding buried ASUs).

Known Issues:
Artificial seagrass landscapes were substantially altered by Hurricane Florence; therefore, landscape parameters were recalculated based on ASU-to-ASU checks. For the purposes of squidpop consumption analysis, buried ASUs were excluded from parameter calculations (as buried ASUs were not expected to influence above-ground fauna).

Data Processing Description

All data were entered electronically into an Excel spreadsheet.

BCO-DMO Processing Description:
- Missing data identifier ‘NA’ replaced with blank (BCO-DMO's default missing data identifier)
- Added "Latitude" and "Longitude" columns and rounded to three decimal places
- Removed "%" symbol from data cells

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Data Files

File
asufrag_squidpopconsumptionprob.csv (Comma Separated Values (.csv), 9.69 KB) MD5:94dde592af493580cfe47d736a7014de Primary data file for dataset 891794.

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Related Publications

Baillie, C. J., Fear, J. M., & Fodrie, F. J. (2014). Ecotone Effects on Seagrass and Saltmarsh Habitat Use by Juvenile Nekton in a Temperate Estuary. Estuaries and Coasts, 38(5), 1414–1430. https://doi.org/10.1007/s12237-014-9898-y
Methods

Duffy, J. E., Ziegler, S. L., Campbell, J. E., Bippus, P. M., & Lefcheck, J. S. (2015). Squidpops: A Simple Tool to Crowdsource a Global Map of Marine Predation Intensity. PLOS ONE, 10(11), e0142994. doi:10.1371/journal.pone.0142994
Methods

Lefcheck, J. S., Pfirrmann, B. W., Fodrie, F. J., Grabowski, J. H., Hughes, A. R., & Smyth, A. R. (2021). Consumption rates vary based on the presence and type of oyster structure: A seasonal and latitudinal comparison. Journal of Experimental Marine Biology and Ecology, 536, 151501. https://doi.org/10.1016/j.jembe.2020.151501
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

Yarnall, A. H., Yeager, L. A., Lopazanski, C., Poray, A. K., Morley, J. M., Hurlbert, A., and Fodrie, F.J. Habitat area more consistently affects seagrass faunal communities than fragmentation per se.
Results

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Related Datasets

IsRelatedTo

Yarnall, A., Fodrie, F. J., Lopazanski, C., Poray, A. K., Yeager, L. (2023) **Epibenthic faunal densities sampled from within Artificial Seagrass Units (ASU) in Back Sound, NC from June to October 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-03-15 doi:10.26008/1912/bco-dmo.891859.1 [view at BCO-DMO]

Yarnall, A., Fodrie, F. J., Lopazanski, C., Poray, A. K., Yeager, L. (2023) **Landscape fine-scale complexity of seagrass, fish and macroinvertebrate communities within Artificial Seagrass Units (ASU) in Back Sound, NC from July to September 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-03-17 doi:10.26008/1912/bco-dmo.891652.1 [view at BCO-DMO]

Yarnall, A., Fodrie, F. J., Lopazanski, C., Poray, A. K., Yeager, L. (2023) **Landscape parameters of seagrass, fish and macroinvertebrate communities within Artificial Seagrass Units (ASU) in Back Sound, NC from July to September 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-03-27 doi:10.26008/1912/bco-dmo.891670.1 [view at BCO-DMO]

Yarnall, A., Fodrie, F. J., Lopazanski, C., Poray, A. K., Yeager, L. (2023) **Settlement rates of fishes and crab megalopa within Artificial Seagrass Units (ASU) in Back Sound, NC from June to August 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-03-20 doi:10.26008/1912/bco-dmo.891835.1 [view at BCO-DMO]

Yarnall, A., Fodrie, F. J., Morley, J., Yeager, L. (2023) **Fish densities sampled by Dual Frequency Identification Sonar (DIDSON) within Artificial Seagrass Units (ASU) in Back Sound, NC from June**

to October 2018. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-03-13 doi:10.26008/1912/bco-dmo.891779.1 [view at BCO-DMO]

Yarnall, A., Fodrie, F. J., Morley, J., Yeager, L. (2023) **Fish measurements sampled by Dual Frequency Identification Sonar (DIDSON) within Artificial Seagrass Units (ASU) in Back Sound, NC from July to September 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-03-10 doi:10.26008/1912/bco-dmo.891686.1 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
Site_ID	Artificial seagrass unit (ASU) landscape name (Percent cover value-Percolation probability value)	unitless
Latitude	Latitude North (South is negative) of sampling site	decimal degrees
Longitude	Longitude East (West is negative) of sampling site	decimal degrees
Per_cov	Percent cover of ASUs in a 234 square meter landscape footprint (10, 22.5, 35, 47.5, 60)	percent (%)
Frag	ASU landscape fragmentation per se indexed by percolation probability (0.1, 0.225, 0.35, 0.475, 0.59)	unitless
Date	Date of squidpop assay	unitless
Time_In	Time of squidpop assay deployment	unitless
Time_Check	Time of squidpop assay check	unitless
PostFlo_Per_Cov	ASU landscape percent cover after Hurricane Florence - including ASUs that are buried under sediment	percent (%)
PostFlo_Frag	ASU landscape percolation probability after Hurricane Florence - including ASUs that are buried under sediment	unitless
N	Number of squidpops deployed	unitless
N_eaten	Number of squidpops eaten at time of check	unitless
WaterTemp_C	Surface water temperature at time of minnow trap deployment	degrees C
Sal_PSU	Surface salinity at time of minnow trap deployment	PSU

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Instruments

Dataset-specific Instrument Name	ExTech 39240
Generic Instrument Name	digital thermometer
Generic Instrument Description	An instrument that measures temperature digitally.

Dataset-specific Instrument Name	
Generic Instrument Name	minnow trap
Generic Instrument Description	shore fishing gear

Dataset-specific Instrument Name	VeeGee STX-3
Generic Instrument Name	Refractometer
Generic Instrument Description	A refractometer is a laboratory or field device for the measurement of an index of refraction (refractometry). The index of refraction is calculated from Snell's law and can be calculated from the composition of the material using the Gladstone-Dale relation. In optics the refractive index (or index of refraction) n of a substance (optical medium) is a dimensionless number that describes how light, or any other radiation, propagates through that medium.

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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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