Epibenthic faunal densities sampled from within Artificial Seagrass Units (ASU) in Back Sound, NC from June to October 2018

Website: https://www.bco-dmo.org/dataset/891859
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 examine potential differences among faunal responses to habitat configuration within structured habitat (i.e., artificial seagrass) versus matrix habitat (i.e., sand/mudflat) within the borders of the landscape footprint, fish densities (catch per unit effort; CPUE) were sampled with baited minnow traps at three locations within each landscape from June to October 2018. Faunal densities were sampled within the largest ASU patch of each landscape (“largest patch”) and at two locations within the matrix: 1-meter away from the largest patch ("near-patch") and bisecting the largest interpatch distance ("interpatch"). Interpatch samples were not taken in landscapes with 0.59 percolation probability, as they only had one patch. Minnow trap samples were collected 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**:34.701 **W**:-76.603

Temporal Extent: 2018-06-05 - 2018-10-25

Methods & Sampling

From June to October 2018, epibenthic faunae (primarily juvenile) were sampled 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) with baited (approximately 8 pieces of dry dog food, Able et al., 2015) Gee-style minnow traps (41-centimeters long, 22-centimeters wide, 0.3-centimeter galvanized mesh-wire cylinders, with 4-centimeter diameter funneled openings). One trap was deployed within the largest patch of each landscape on nine occasions and at each of two of the matrix locations on four occasions. Each minnow trap deployment lasted 24 hours, at which time all faunae were enumerated, identified to the lowest taxonomical level possible, and released.

Known Issues:
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. Holding the original landscape 234-square meter footprint constant, post-Florence landscape percent cover and percolation probabilities were recalculated both including and excluding ASUs that were fully buried under sediment. Trap samples were taken both before and after Florence. Due to considerable landscape parameter alterations over this timeframe and potentially confounding disturbance influences, caution should be taken in examining post-Florence faunal densities.

Data Processing Description

All data were entered electronically into an Excel spreadsheet.

BCO-DMO Processing Description:
- Adjusted field/parameter names to comply with BCO-DMO naming conventions
- Missing data identifier ‘NA’ replaced with blank (BCO-DMO's default missing data identifier)
- Converted dates to format (YYYY-MM-DD)
- Added "Latitude" and "Longitude" columns and rounded to three decimal places

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Data Files

File	
asufrag_trapfaunalcpue.csv	(Comma Separated Values (.csv), 109.88 KB) MD5:1612ebad8f96834b47df54d20c31f334
Primary data file for dataset 891859.	

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Related Publications

Able, K. W., López-Duarte, P. C., Fodrie, F. J., Jensen, O. P., Martin, C. W., Roberts, B. J., Valenti, J., O’Connor, K., & Halbert, S. C. (2014). Fish Assemblages in Louisiana Salt Marshes: Effects of the Macondo Oil Spill. Estuaries and Coasts, 38(5), 1385–1398. https://doi.org/10.1007/s12237-014-9890-6
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

IsReferencedBy

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]

IsRelatedTo

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., Lopazanski, C., Poray, A. K., Yeager, L. (2023) **Squidpop consumption probability within Artificial Seagrass Units (ASU) in Back Sound, NC from October to November 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-03-15 doi:10.26008/1912/bco-dmo.891794.1 [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_In	Date of minnow trap deployment	unitless
Time_In	Time of minnow trap deployment in format hh:mm (24 hour)	unitless
Date_Out	Date of minnow trap retrieval	unitless
Time_Out	Time of minnow trap retrieval in format hh:mm (24 hour)	unitless
H_tide	Time of high tide proximate to minnow trap deployment in format hh:mm (24 hour)	unitless
L_tide	Time of low tide proximate to minnow trap deployment in format hh:mm (24 hour)	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
Trap_class	Location type of minnow trap deployment within ASU landscape (largest patch, near-patch, inter-patch)	unitless
Cell_coord	Cell coordinates designate a grid position within the ASU landscape. Each landscape was designed as a grid of 15 x 15 cells, each of which may or may not be occupied by an ASU. Landscape cell coordinates are identified by C (column; out of 15) number and R (row; out of 15) number.	unitless
Cell_class	Habitat type of cell within ASU landscape (ASU = artificial seagrass unit; MTRX = mudflat matrix)	unitless
Sp_name	Common name of fauna species	unitless
Sci_name	Scientific name of fauna species	unitless
Length	Total length of fauna	millimeters (mm)

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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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