Settlement rates of fishes and crab megalopa within Artificial Seagrass Units (ASU) in Back Sound, NC from June to August 2018

Website: https://www.bco-dmo.org/dataset/891835
Data Type: Other Field Results
Version: 1
Version Date: 2023-03-20

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 assess whether faunal density patterns across landscapes were driven by larval settlement, larval fishes and crab megalopa were sampled seven times from June to August 2018 using Standardized Monitoring Units for the Recruitment of Fishes (SMURFs). To examine how settlement rates across landscapes differed depending upon the amount of immediately surrounding artificial seagrass, each SMURF was positioned at the 'center' of the largest ASU patch (as estimated for each irregular shape) in each landscape. SMURF 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. SMURF samples were processed by Lauren A. Yeager at the Marine Science Institute, of the University of Texas at Austin.

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Coverage

Spatial Extent: **N**:34.707 **E**:-76.589 **S**:34.701 **W**:-76.603
Temporal Extent: 2018-06-07 - 2018-08-17

Acquisition Description

To assess whether faunal density patterns across landscapes were driven by larval settlement, larval fishes and crab megalopa were sampled seven times from June to August 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) using Standardized Monitoring Units for the Recruitment of Fishes (SMURFs; Ammann 2004). This brackets the seasonal timing of settlement by the majority of species that occupy local seagrass as a nursery habitat (Baillie et al., 2015). SMURFs were created from 2.5-centimeter (cm) mesh VEXAR, zip-tied to create a 1-meter long, 0.2-meter diameter cylinder with folded-end closures. To facilitate settlement and accommodate various settler sizes, each cylinder was stuffed with two sizes of plastic mesh: 3 square meters of 5 cm × 7.5 cm and 5 square meters of 1 centimeter × 1-centimeter mesh. SMURFs were secured to each landscape by a 20-centimeter sand screw and a 25-centimeter paracord line attached to the underside of the sampling unit. Floats were attached to cylinder ends for added buoyancy and to suspend the SMURFs above the seafloor.

To examine how settlement rates across landscapes differed depending upon the amount of immediately surrounding artificial seagrass, each SMURF was positioned at the 'center' of the largest ASU patch (as estimated for each irregular shape) in each landscape. SMURFs were deployed for 48 hours to maximize larval collection (Ammann, 2004) while minimizing biofouling (Tavernetti et al., 2009). After the first deployment cycle, it was noted that SMURFs retrieved closer to sunrise had higher settler abundances. Subsequent deployments were therefore timed to coincide with a 4-hour collection window surrounding sunrise. Upon retrieval, 5-gallon buckets of water were poured over each SMURF into a collection bin while the SMURF was shaken and rotated. This process was repeated a minimum of three times or until no additional fauna were observed being washed into the collection bin. Samples were sieved (0.5-millimeter mesh) and collected fauna were frozen for later identification and enumeration in the lab. All SMURFs were rinsed with fresh water and dried by sunlight before redeployment.

Known Issues:
Time_Out data are commonly missing. Length measurements were only taken for larval fish and some crabs.

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

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Data Files

File	
asufrag_smurf_settlement_rate.csv	(Comma Separated Values (.csv), 36.65 KB) MD5:2cbf19fe2625ef4e356bd93a193a70bb
Primary data file for dataset 891835, version 1.	

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Related Publications

Ammann, A. J. (2004). SMURFs: standard monitoring units for the recruitment of temperate reef fishes. Journal of Experimental Marine Biology and Ecology, 299(2), 135–154. doi:10.1016/j.jembe.2003.08.014
Methods

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

Tavernetti, R., Morgan, S., & Yu, Q. (2009). Effect of biological fouling on passive collectors used to estimate fish recruitment. Journal of Fish Biology, 75(3), 699–706. https://doi.org/10.1111/j.1095-8649.2009.02307.x
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 http://lod.bco-dmo.org/id/dataset/891859 [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) **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 http://lod.bco-dmo.org/id/dataset/891794 [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_Out	Date of SMURF retrieval	unitless
Time_Out	Time of SMURF retrieval	unitless
Sci_name	Scientific name of fauna species	unitless
N	Number of fauna species caught	unitless
Length	Total length of fauna	millimeters (mm)
Settler	Is this fauna in the settler/larval stage? (Y/N)	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	bucket
Generic Instrument Description	A bucket used to collect surface sea water samples.

Dataset-specific Instrument Name	
Generic Instrument Name	calipers
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.

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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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