# Collections of fish and invertebrates settled in artificial seagrass landscapes

**Website**: https://www.bco-dmo.org/dataset/784927
**Data Type**: Other Field Results
**Version**: 1
**Version Date**: 2019-12-23

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

| Contributors | Affiliation | Role |
|---|---|---|
| Yeager, Lauren A. | University of Texas - Marine Science Institute (UTMSI) | Principal Investigator |
| Fodrie, F. Joel | University of North Carolina at Chapel Hill (UNC-Chapel Hill-IMS) | Co-Principal Investigator |
| Soenen, Karen | Woods Hole Oceanographic Institution (WHOI BCO-DMO) | BCO-DMO Data Manager |

**Abstract**
Collections of fish and invertebrates settles in artificial seagrass landscapes collected between June and August 2018

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## Coverage

**Spatial Extent**: **N**:34.7067 **E**:-76.588016 **S**:34.70033333 **W**:-76.602848

**Temporal Extent**: 2018-06-07 - 2018-08-17

## Dataset Description

Collections of fish and invertebrates settles in artificial seagrass landscapes collected between June and August 2018.

### Acquisition Description

We measured recruitment of fishes and crabs to artificial and natural seagrass beds in Back Sound, North Carolina from June to August 2018. We sampled 26 artificial seagrass landscapes defined by 18m x 13m landscape extents (234 m2). Within each landscape, we varied habitat amount and fragmentation independently in a crossed design. We created a custom algorithm to generate random landscapes using the randomHabitat function in the secr package in R (Efford 2018, R Core Team 2018). Landscapes were generated along two orthogonal axes of habitat cover (10-60%) and fragmentation using a random modified clusters method (percolation probability = 0.10-0.59 which determines patch number; higher percolation coefficients correspond to less patchiness)(Saura and Martinez-Millan 2000). Landscapes were constrained to fall within 2% of the area input parameter, while holding patch number similar within fragmentation levels (1, 2-3, 4-5, 6-7, or 8-10 patches for each level). Using this approach, we constructed landscapes in which seagrass area and number of patches were uncorrelated (R = -0.02), allowing us to independently assess the effects of seagrass area and habitat configuration on fish communities across experimental study sites. Artificial seagrass units (ASUs) were used to create artificial seagrass landscapes. ASUs were made by tying green plastic ribbon to polyethylene mesh cut into 1.2m x 0.86m rectangles, with ~450, 15 cm tall shoots (with 2 blades each) attached each unit. ASUs were deployed by affixing ASUs in designated configurations to bare sediment using metal lawn staples. These artificial landscapes were deployed between May 23 to May 31, 2018. We compared the artificial seagrass landscapes to natural landscapes in the same area. We sampled 18 haphazardly selected natural seagrass patches that were at least 100 m away from the artificial seagrass landscapes.

We used Standardized Monitoring Units for Reef Fishes (SMURFs, Ammann 2004) to measure recruitment of fishes and invertebrates into each landscape. SMURFs used in this study were 60 x 15 x 20 cm in size with an outer shell made from 5 cm x 7.6 cm polyethylene mesh. Each SMURF was filled with crumpled 2.5 x 2.5 cm polyethylene mesh and plastic mesh produce bags (https://www.amazon.com/dp/B01LWL1YFT/ref=cm_sw_r_cp_api_i_J9TzCbZZ5GKR6). For deployment, SMURFs were deployed attached to the bottom at one end, but floated vertically in the water column. SMURFs were deployed for ~24hrs, including overnight, and

collected before noon on the following day (pick-up times are included in the data). Upon retrieval, the SMURF was enclosed in a custom made BINKE net (Anderson and Carr 1998) made out of 1.5 mm square nylon netting. The SMURF was brought to the boat within the enclosed BINKE net and placed into a large plastic tub. It was shaken vigorously while being rinsed with buckets of seawater and then the rinse water in the tub was visually inspected for organisms which we collected, placed in a resealable plastic bag, and quickly froze in an ice and seawater slurry. This process was repeated until three successive rinses yielded no new organisms. The water in the tub was passed through a 1 mm mesh sieve to ensure no organisms remained in the tub. All organisms were returned to the lab for processing. Each landscape was sampled on 9 different dates between June and August, representing the major recruitment period for most fishes in this system.

**Processing Description**

Samples were processed in the lab to identify and measure all organisms collected. Each sample was examined with the aid of a dissecting microscope and organisms were identified to the lowest reasonable taxonomic levels and the size each fish and crab was measured to the nearest mm. The purpose of these collections was to sample fish recruitment, but the SMURFs also attracted other post-settlement organisms including many shrimps and some larger juvenile fishes and crabs. We identified all organisms collected, including shrimp to higher level taxonomic groupings (family or infraorder), even if they were not recently recruited from the plankton. We then indicated whether organisms were likely larvae/new recruits vs. other post-settlement organisms (via the “Larvae.settler” column in the dataset). We considered fish <20 mm SL as new recruits and larval crabs in Megalopa stage or newly metamorphosed (<3 mm carapace width) as larvae/settlers.

BCO-DMO processing notes:

- Adjusted titles to comply with database set-up
- Replaced comma by semicolon in "Notes" column
- Added PickUp_DateTime_UTC_ISO column

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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 [details]

Anderson, T. W., & Carr, M. H. (1998). Environmental Biology of Fishes, 51(1), 111–115. doi:10.1023/a:1007355408723 https://doi.org/https://doi.org/10.1023/A:1007355408723 [details]

Efford, M. G. (2018). secr: Spatially explicit capture-recapture models. R package version 3.1.6 https://cran.r-project.org/web/packages/secr/index.html [details]

R Core Team (2018) R: A language and environment for statistical computing (R Foundation for Statistical Computing, Vienna, Austria). https://www.R-project.org [details]

Saura, S., & Martínez-Millán, J. (2000). Landscape Ecology, 15(7), 661–678. doi:10.1023/a:1008107902848 https://doi.org/https://doi.org/10.1023/A:1008107902848 [details]

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## Parameters

| Parameter | Description | Units |
|---|---|---|
| Sample_ID | Unique sample identifier: site + date | unitless |
| Landscape_type | Was the SMURF placed in a natural seagrass bed (natural) or one made of artifical seagrass units (ASU) | unitless |
| Percent_cover_treatment | Percent cover treatment- area of the landscape covered in artificial seagrass | percentage (%) |
| Fragmentation_treatment | Fragmentation treatment - percolation coefficient from random landscape generation" | unitless |
| Site | Site name | unitless |
| Pick_up_date | Date retrieved | unitless |
| Pick_up_time | Time retrieved on 24-hour clock in local time (EST) | unitless |
| Gear | Collection gear | unitless |
| Latitude | Latitude (South is negative) | decimal degrees |
| Longitude | Longitude (West is negative) | decimal degrees |
| Processed_by | Intials of person who processed the sample | unitless |
| Taxa | Taxa name | unitless |
| Size | Standard length (fish), carapace length (shrimp), or carapace width (crabs) | millimeter (mm) |
| Larvae_settler | Was the organism in the larval stage or recently settled? Y = yes, N = no | unitless |
| N | Count, number of individuals | unitless |
| Notes | Notes | unitless |
| PickUp_DateTime_UTC_ISO | Pick up date and time in UTC and ISO formatted. The column shows up as nd when there was no local time defined for that specific row. | unitless |

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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 |
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1661683 |


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