Measurements of above and below ground seagrass biomass around an artificial reef (Fish and biogeochem hot spots project)

Website: https://www.bco-dmo.org/dataset/682593
Data Type: Other Field Results
Version:
Version Date: 2017-02-16

Project
» Fish aggregations and biogeochemical hot spots across regional environmental gradients (Fish and biogeochem hot spots)

Contributors	Affiliation	Role
Layman, Craig	North Carolina State University (NCSU)	Principal Investigator
Copley, Nancy	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Dataset Description

This dataset includes seagrass biomass measurements from collections in The Bahamas in December 2013. Reported are blade area, the number of shoots, grazing scars (bites), bites/unit area, the weight and area of the epiphytes, the dry weight of the blades, roots, rhyzomes, and the below ground biomass.

Related Reference:
Layman, C.A., Allgeier, J.E., and Montaña, C.G. 2016. The attraction-production debate viewed from the bottom-up: mechanistic evidence of increased production thresholds. Ecological Engineering. 95:574-579. http://dx.doi.org/10.1016/j.ecoleng.2016.06.109

Methods & Sampling

All raw values are based on the seagrass measurements collected in a core with a area of 126cm^2.

Methods from Layman et al (2016) Ecol. Engr.:

This case study was based in the Bight of Old Robinson, Abaco, The Bahamas, a semi-enclosed bay that has a complex benthic mosaic comprised predominantly of sand, seagrass (primarily turtle grass Thalassia testudinum), and hard bottom/patch reef habitat. We sampled an artificial reef (N 26 20.549', W77 00.874') that had similar spatial patterns in aboveground seagrass traits as other patch reefs (both natural and artificial) in seagrass beds of this area (Allgeier et al., 2013; Layman et al., 2013). This reef (dimensions ~1.2 m2 at base and ~1.2 m tall) was constructed in March 2009 using 40 cinder blocks arranged in pyramid fashion (Yeager et al., 2011). Samples (December 2013) were taken in spatially-explicit fashion on 3 transects radiating from each reef; transects were oriented ~120 degrees apart in random directions. Cores were taken with a 12.7 cm diameter pvc pipe at set distances (m) from the reef on each transect: 1, 2, 3, 4, 6, 10, 15, 100. The core was driven ~16 cm into the sediment and manually excavated, placing one hand under the bottom of the core as it was pulled out. Visual inspection demonstrated cores successfully remove all seagrass tissues from the

sampled area. Water was drained from the cores and sand was rinsed off with seawater and then they were placed in individual plastic bags and immediately frozen.

In the laboratory, cores of seagrass biomass were thawed and separated into aboveground biomass (all attached green leaves of shoots) and belowground biomass (rhizomes and roots). Shoots were enumerated and morphology of blades (length and width) was measured. As a proxy for grazing intensity, we measured the total number of grazing scars on all blades in the core (Valentine and Duffy, 2006). Blades were gently scraped with a razor blade to remove epiphytes; belowground material was rinsed with deionized water. Tissues were dried for 72 h at a constant temperature of 65C and dry weight (to the nearest 0.01 g) was recorded. Dried samples were ground into a fine powder using a PRECELLYS-24 grinder and subsamples of each were analyzed for percent of carbon (C), nitrogen (N), and phosphorous (P). Percent C and N content were determined using a CHN Carlo-Erba elemental analyzer (Fison NA1500). Percent P was determined by dry oxidation acid hydrolysis extraction followed by colorimetric analysis (Fourqurean and Zieman, 1992).

To explore potential thresholds in allocation of resources between different tissue structures, we first partitioned total plant nutrients into the various tissues from which these measurements were obtained (n = 48 for each tissue type, n = 144 total). Partitions included: % blade nutrients to total (whole-plant) nutrients, % total belowground (root + rhizome) to total, % root to total, % rhizome to total, % roots to total belowground, and % rhizome to total belowground. Generalized additive models (gam) were then used to describe the relationship of these data with respect to distance from the reef. If the relationship was non-linear, a changepoint analysis, using the package "changepoint" in R, was used to determine the distance from the reef at which the threshold was reached. Relationships between belowground and aboveground traits were tested using least squares regression. Data were log transformed and satisfied model assumptions.

Data Processing Description

BCO-DMO Processing:
- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO standard
- reduced number of significant digits of due to sampling precision methods and according to significance arithmetic rules

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Data Files

File	
seagrass_biomass.csv	(Comma Separated Values (.csv), 3.04 KB) MD5:7bf8897933175e626c24a037bc08f668
Primary data file for dataset ID 682593	

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Parameters

Parameter	Description	Units
sample	Sample identifier: the '5' designates that this study was conducted at reef 5 in our array.	unitless
blade_area	The total area of all blades	millimeter^2
num_shoots	Total number of shoots in the core sample	shoots
num_bites	Number of bite marks across all blades	bites
bites_per_area	Number of bite scars divided by the total blade area	bites per millimeter^2
epiphyte_dry_wgt	Mass of epiphytes across all blades in the core	grams
epiphyte_wgt_per_area	Epiphyte mass expressed as a function of blade area	milligrams/millimeter^2
blades_dry_wgt	Dry weight of all blades in the core	grams
roots_dry_wgt	Dry weight of all roots in the core	grams
rhyzomes_dry_wgt	Dry weight of all roots in the core	grams
biomass_below	Sum of root and rhizome mass	grams

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Instruments

Dataset-specific Instrument Name	CHN Carlo-Erba elemental analyzer (Fison NA1500)
Generic Instrument Name	CHN Elemental Analyzer
Generic Instrument Description	A CHN Elemental Analyzer is used for the determination of carbon, hydrogen, and nitrogen content in organic and other types of materials, including solids, liquids, volatile, and viscous samples.

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Deployments

Layman_2014

Website	https://www.bco-dmo.org/deployment/542786
Platform	Caribbean_nearshore
Start Date	2014-01-01
End Date	2014-11-30
Description	Coral reef surveys as part of the project "Fish aggregations and biogeochemical hot spots across regional environmental gradients".

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Project Information

Fish aggregations and biogeochemical hot spots across regional environmental gradients (Fish and biogeochem hot spots)

Coverage: Caribbean

Description from NSF award abstract:
Consumers in marine ecosystems have long been acknowledged for their role in top-down regulation of ecosystems, but their influence through bottom-up pathways such as nutrient supply is often underappreciated and has not been integrated into models of coastal ecosystem dynamics. Yet, nutrient supply from consumers may be a regulating factor when consumers aggregate, such as fishes around structurally complex habitat. Examining this bottom-up mechanistic pathway is essential for a more holistic understanding of seagrass ecosystems, which are important and threatened globally. This study will address the following questions: (1) Does concentrated nutrient supply from consumers result in distinct biogeochemical hot spots in seagrass beds? and (2) How do consumer effects on ecosystem processes vary across regional environmental contexts where nutrient availability and fishing pressure vary? The PIs will conduct experiments at multiple sites within three biogeographic regions in the Caribbean (The Bahamas, Hispaniola, and Grenada/St.Vincent/Grenadines). The experiments will utilize artificial reefs that mimic natural patch reef habitats that concentrate animals at high densities. Response variables reflecting ecosystem processes (e.g., seagrass nutrient content, seagrass biomass, primary producer diversity) will be measured at reef sites and compared with control sites (seagrass sites without reefs). The spatial extent over which ecosystem processes may be affected, i.e., distance from artificial reef, will be quantified and used to detect ecological thresholds in ecosystem responses. Predictor variables, including measures of ambient nutrient availability, fish densities and fish grazing rates, will be used to contextualize the relative importance of consumer-mediated nutrient supply. The hierarchical experimental design and two-pronged analysis will characterize relationships across environmental gradients found among and within the biogeographic regions, facilitating a conceptual framework needed to predict when, where, and why consumer-mediated nutrient supply is an important control of ecosystems processes in seagrass beds.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1405198

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