Marsh consumer diversity effects on multifunctionality from experiments conducted by manipulating the presence of crabs, snails, and fungus in Spartina plots on Sapelo Island, Georgia

Website: https://www.bco-dmo.org/dataset/717035
Data Type: experimental
Version: 1
Version Date: 2017-10-17

Project
» Small Grazers, Multiple Stressors and the Proliferation of Fungal Disease in Marine Plant Ecosystems (small grazers facilitating fungal disease)

Contributors	Affiliation	Role
Hensel, Marc	University of Florida (UF)	Principal Investigator
Silliman, Brian	Duke University	Co-Principal Investigator
Switzer, Megan	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
The effect of consumer diversity on the ecosystem functioning of salt marshes on Sapelo Island, Georgia.

Table of Contents

Dataset Description

The effect of consumer diversity on the ecosystem functioning of salt marshes on Sapelo Island, Georgia.

Methods & Sampling

We manipulated the presence and absence of all three species in a factorial design that yielded eight treatments and comprised four levels of diversity: three consumers (crabs + snails + fungus), two consumers (crabs + snails, crabs + fungus, snails + fungus), one consumer (crabs or snails or fungus), and no consumers. Sixty-four plots were selected (mean Spartina density: 120.8 ± 6.2 stems per m2).

Ecosystem Function 1: NPP. To determine the effect of experimental consumer variety on NPP, net Spartina production was estimated by measuring change in live aboveground plant mass from the beginning to end of the experiment.

Ecosystem Function 2: Decomposition Rate. We quantified the effect of consumer variety on marsh decomposition rate by deploying a plug consisting of three dead Spartina stems zip tied to a plastic flag post.

Ecosystem Function 3: Infiltration Rate Measurement. We quantified the effect of consumer variety on marsh infiltration at the conclusion of the experiment by using a double-ring infiltrometer.

Assessing Multifunctionality. To assess whether snail, crab, and fungi consumers differed in their ability to perform all measured functions simultaneously, we calculated an average multifunctionality index for each

treatment. This method is a simple technique involving averaging standardized values of multiple functions into a single index. For each of the three functions, we used a “standardization by maximum observed value” approach where we defined maximum functioning as the mean of the highest three values from all 64 plots in the experiment for each function, giving us one maximum for each function regardless of treatment. Using this maximum, plot data were recorded as the percent of that maximum for each function, creating a scaled “percent functioning” value for each individual plot.

See Hensel and Silliman 2013 for detailed methods descriptions.

Hensel, M. J. S. & Silliman, B. R. Consumer diversity across kingdoms supports multiple functions in a coastal ecosystem. Proc Natl Acad Sci USA 110, 20621–20626 (2013).
DOI: 10.1073/pnas.1312317110

Data Processing Description

Data were analyzed with JMP 9.0 (SAS Institute 2010) and in R (R Core Team 2013).

[table of contents | back to top]

Data Files

File
multifunc.csv (Comma Separated Values (.csv), 2.29 KB) MD5:f5cf91e351a310e651bdcacc24d1e4a5 Primary data file for dataset ID 717035

[table of contents | back to top]

Related Publications

Hensel, M. J. S., & Silliman, B. R. (2013). Consumer diversity across kingdoms supports multiple functions in a coastal ecosystem. Proceedings of the National Academy of Sciences, 110(51), 20621–20626. doi:10.1073/pnas.1312317110
Results

[table of contents | back to top]

Parameters

Parameter	Description	Units
treat	consumers present/absent	S = snails present,C = crabs present,F = fungus present, NS = no snails,etc
rep	repetition number	1-8, number of repetition
live	live biomass at exp end	g of Spartina/ sq meter
dead	dead biomass at exp end	g of Spartina/ sq meter
g_lost	grams decomposed per month	g of Spartina decomposed over 1 month
perco	percolation rate in each plot	Liters of water absorbed per hour
multi	average multifunctionality (%)	mean % functioning of all ecosystem functions per plot
no_cons	number of consumers per treatment	no between 1 and 3

[table of contents | back to top]

Project Information

Small Grazers, Multiple Stressors and the Proliferation of Fungal Disease in Marine Plant Ecosystems (small grazers facilitating fungal disease)

Coverage: Coastal Plant Ecosystems in North and South America.

In terrestrial communities, grazer-facilitation of fungal disease in plants has been studied for over a century. Despite the prevalence of this interaction in terrestrial systems, it was not considered relevant to the structure of marine plant communities until the investigator's recent work in salt marshes. By manipulating both grazer and fungal presence, he demonstrated that snail grazing and subsequent fungal infection in live grass led to drastic reductions in plant growth and, at high grazer densities, destruction of canopy. If grazer promotion of fungal disease in marine plants is not limited to marshes (as suggested by preliminary data from a world-wide survey of 4 marine plant ecosystems) then small grazers that take small bites out of plants could be exerting similarly strong, but undetected control over marine plants globally. In addition, since physical stress commonly reduces plant immune responses, intensifying multiple stressors associated with marine global change could intensify and destabilize these unstudied grazer-disease-plant interactions. To test the global generality of this potentially keystone ecological interaction, this project will answer the following questions with a combination of multi-site surveys and manipulations across 4 ecosystems spanning 2 continents: 1) Is grazer facilitation of fungal disease in marine plants a common but overlooked interaction? 2) What is the resultant impact of grazer-facilitated fungal infection on marine plant growth? 3) How do multiple stressors impact the strength of grazer facilitation of fungal disease in marine plants? The work represents a transformative step forward in our understanding of plant-grazer interactions in marine ecosystems as it fills a > 100-year intellectual gap in our understanding of top-down control in marine plant ecosystems: Do small grazers commonly facilitate fungal disease in marine plants and does this interaction suppress plant growth? Evidence for this cryptic, yet powerful mechanism of grazer regulation of marine plants will compel marine ecologists to reevaluate our understanding of top-down control and lead to widespread integration of disease dynamics in marine food web ecology.

The consequences of marine plant ecosystem health are far-reaching for humans, since these communities provide many essential services. Results from this study will allow managers to better predict effects of disease and global change on marine plant systems and formulate effective strategies for conservation. To help integrate plant disease dynamics into marine ecology and conservation, the investigator will: (1) produce an edited volume on Food Webs and Disease in Marine Ecosystems and (2) work closely with The Nature Conservancy to incorporate findings into their global marine learning exchanges. In addition, an integrated educational plan will increase student: (1) understanding of disease and food web dynamics in marine ecosystems and (2) consideration of marine science careers.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1056980

[table of contents | back to top]