Abundance of Gracilaria and Diopatra along a tidal mudflat in Charleston Harbor, South Carolina in 2013 (Gracilaria effects project)

Website: https://www.bco-dmo.org/dataset/641577
Data Type: Other Field Results
Version:
Version Date: 2016-04-07

Project
» Cascading effects of an invasive seaweed on estuarine food webs of the southeastern US (Gracilaria effects)

Contributors	Affiliation	Role
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Coverage

Spatial Extent: **Lat**:32.751305 **Lon**:-79.90142
Temporal Extent: 2012-06-01 - 2012-06-30

Methods & Sampling

Study sites
We conducted field surveys and experiments near Charleston, South Carolina (SC) (Fort Johnson: 32.751305°N, 79.90142°W; Stono River: 32.75253°N, 80.0076° W) and Savannah, Georgia (GA) (Priest's Landing: 31.96012° N, 81.01223°W; Bull's River: 31.97458°N, 80.92287°W) in the USA. The hydro- dynamic forces in southeastern estuaries generate high turbidity and fluid soft sediments which reduce light attenuation and thus create a habitat that is largely inhospitable to macrophyte attachment and persistence (Byers et al. 2012 and references therein). Gracilaria invaded SC and GA estuaries in the early 2000s (E. E. Sotka unpubl. data), and on intertidal mudflats where Diopatra worms are common, Gracilaria presently represents 90-99% of the total macroalgal biomass (Byers et al. 2012). The green alga Ulva sp. can be found in colder months and attached to oyster shells, wooden debris, the hard calcareous tubes of the soda-straw worm and only rarely on Diopatra tubes (Berke 2012; N. M. Kollars, E. E. Sotka & C. Plante pers. obs.). Other macroalgae present in the system include red algae that are epiphytic on Gracilaria (of the genera Polysiphonia and Ceramium; Berke 2012, C. E. Gerstenmaier and E. E. Sotka pers. obs.) and rarely, Gracilaria tikvahiae (Berke 2012, N. M. Kollars & E. E. Sotka pers. obs.). The non-native Gracilaria and native Diopatra are both rare within the salt marshes and oyster beds that fringe the upper-intertidal edge of these mudflats. We performed all laboratory experiments within the Grice Marine Laboratory (College of Charleston, SC, USA). See related reference for citations.

Tidal distribution
In late August 2013, we surveyed the abundance of Diopatra and Gracilaria on the Fort Johnson mudflat, Charleston, SC at 5 tidal heights (~ +0.61, +0.09, 0.0, -0.09, and -0.91 m mean lower low water [MLLW]) that span the upper and lower tidal distributions of both species. At each tidal height, we sampled 5 replicate 3.05 × 0.5 m (~1.52 m2; long end parallel to the shore) quadrats separated by ~1.5 m. We specifically used a large sample frame in order to capture the patchy densities of Diopatra (and therefore Gracilaria) that are particularly common in the lower intertidal. Within each quadrat, we counted the number of Diopatra tube caps (the presence of a tube cap is an excellent proxy for a live worm; Peckol & Baxter 1986) and collected all Gracilaria. We removed macroscopic epifauna and epiphytes present on Gracilaria and dried Gracilaria tissue at 60°C until no change in mass occurred.

Related Reference:
Kollars, N.M., J.E. Byers and E.E. Sotka (2016) Invasive decor: an association between a native decorator worm and a non-native seaweed can be mutualistic. Marine Ecology Progress Series (DOI: 10.3354/meps11602)

Related Datasets:
MEPS_2016: Fig.2B - Gracilaria growth rate
MEPS_2016: Fig.3 - growth rate and depth
MEPS_2016: Fig.4A - worm growth
MEPS_2016: Fig.4B - stable isotopes
MEPS_2016: Fig.5A - field expt 2012
MEPS_2016: Fig.5B - field expt 2013

Data Processing Description

BCO-DMO Processing:
- added conventional header with dataset name, PI name, version date, reference information
- renamed parameters to BCO-DMO standard
- reduced excess number of digits after decimal
- added lat and lon

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Data Files

File
Kollars_fig2A.csv (Comma Separated Values (.csv), 1.72 KB) MD5:beea91037c424b6870ddd5133cfeabdb Primary data file for dataset ID 641577

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Parameters

Parameter	Description	Units
site	position in Charleston Harbor SC: FJ= Fort Johnson	unitless
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees
plot	unique plot identification number	unitless
height_ft	tidal height in feet	feet
height_m	tidal height in meters	meters
num_worms	number of Diopatra worms present in the plot	worms
worms_m2	density of Diopatra worms in the plot	worms/m^2
tot_wet	total wet mass of Gracilaria collected from the plot	grams
wet_m2	wet mass density of Gracilaria in the plot	grams/m^2
tot_dry	total dry mass of Gracilaria collected from the plot	grams
dry_m2	total dry mass per unit area of Gracilaria collected from the plot	grams/m^2

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Deployments

Sotka_2013

Website	https://www.bco-dmo.org/deployment/641612
Platform	Coll_Charleston
Start Date	2012-01-01
End Date	2013-12-31
Description	Benthic interactions of polychaetes and macroalgae

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Project Information

Cascading effects of an invasive seaweed on estuarine food webs of the southeastern US (Gracilaria effects)

Coverage: Georgia and South Carolina coasts

Description from NSF award abstract:
During the last decade, the Asian seaweed, *Gracilaria vermiculophylla*, has proliferated along high-salinity mudflats in several Georgia and South Carolina estuaries. The invasion is noteworthy because the mudflats in these estuaries were historically devoid of macrophyte-based primary production and structure. *Gracilaria* has few native analogues in these mudflat environments, and thus represents an opportunity to examine the ecosystem consequences of an invasion within an historically-unexploited niche. In theory, *Gracilaria* affects populations of species that are directly dependent on the invader for structure and food, as well as altering community- and ecosystem-level processes such as detrital production and food web structure. Through a combination of manipulative field experiments, laboratory assays and stable isotope analysis, the investigators will test three mechanisms by which *Gracilaria* influences native community structure. The novel structure and primary production generated by *Gracilaria vermiculophylla* may be 1) increasing rates of secondary production, 2) increasing levels of mudflat microbial production through leeching of dissolved nutrients, and 3) increasing detrital input to microbial and macrobial food webs.

This project will provide a mechanistic understanding of the multiple cascading impacts of an invasive species within the estuarine community. Species invasions that alter ecosystem functions are usually the most profound. These alterations are often generated by a small number of invaders that create physical structure, including important biogenic habitat, de novo. By altering physical structure, these non-native ecosystem engineers alter local abiotic conditions, interactions between species, and species composition. Highly influential invaders may also change food web structure and trophic flow of energy and materials. Such substantive food web changes can occur when an influential invader provides nutrients or resources that are different in quality, quantity or both. An invasive species that both provisions new physical structure and fundamentally alters food web structure could exert an overwhelming influence on native communities when these mechanisms act in synergy.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1057707
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