Experimental results on the response of Diopatra size to Gracilaria-mediated resource items in 2013 (Gracilaria effects project)

Website: https://www.bco-dmo.org/dataset/641641
Data Type: experimental
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**:32.75196 **Lon**:-79.89816

Methods & Sampling

Lab Experiments: Using laboratory and field-based experiments, we tested whether Gracilaria increased the survivorship and growth of Diopatra through direct or indirect provisioning of food, or through refuge from predation. Diopatra tubes extend up to 1 m below the benthos and it is difficult to collect Diopatra bodies without incidentally severing the worm. Severing, however, does not cause mortality because these animals are capable of both anterior and posterior regeneration (Berke et al. 2009). To standardize the initial size of the worm and create a point of posterior regeneration, we cut the field-collected worms to ~3 cm in length. We buried the worm in field-collected sediment contained in a 15 cm long × 3 cm diameter plastic tube in the laboratory. Tubes were held in racks in a recirculating seawater table at 22°C and a salinity of 30 ppt to allow the worms to regenerate their sediment-based tubes before experimentation, which usually happened within 24 h (Berke et al. 2009, N. M. Kollars pers. obs.).

In the laboratory, we offered Gracilaria-associated diet items to Diopatra and measured survivorship and growth after 6 wk. Diopatra were collected from the Fort Johnson mudflat in January 2013, and placed into plastic tubes that were encircled with window screen to create feeding chambers that still allowed water flow. Diopatra were randomly offered one of 4 diets: sediment-only control, Gracilaria, amphipods, or Gracilaria and amphipods (n = 24 per treatment). Gracilaria was offered ad libitum and replaced weekly. Three frozen, field-collected amphipods were offered daily (primarily Gammarus mucronatus, the most abundant amphipod species on Gracilaria; Wright et al. 2014). Though we offered Diopatra dead amphipods due to logistical

constraints, we do have video evidence that shows that, in the laboratory, Diopatra are capable of pursuing and catching amphipods (see video Supplement 2 at www. int-res. com/ articles/ suppl/ m545 p135_ supp/). After 6 wk, we removed Diopatra from their sediment tubes and dried them at 60°C until no change in mass occurred and measured the final body mass. To examine the effects of diet treatment on Diopatra final dry weight, we used a 1-way ANOVA followed by a post-hoc Tukey's test.

To assess the incorporation of the supplied food source into the new worm tissue, we quantified the carbon and nitrogen stable isotopic signatures in the posteriorly regenerated tissue of 5 worms from each diet treatment. We randomly selected 5 individuals from each diet treatment and sampled the dried posteriorly regenerated tissue (targeting muscle tissue and avoiding the digestive tract or fecal pellets). For comparison, we also analyzed 3 samples of each resource (collected from the field in April 2013): Gracilaria and amphipods. We generated the isotopic signature data using a Delta V plus spectrometer (ThermoFinnigan), with a Thermo Flash EA as the interface at the Skidaway Institute Scientific Stable Isotope Laboratory (Savannah, GA, USA).

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.2A - survey
MEPS_2016: Fig.2B - Gracilaria growth rate
MEPS_2016: Fig.3 - growth rate and depth
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
- replaced special characters

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Data Files

File
Kollars_fig4A.csv (Comma Separated Values (.csv), 1.53 KB) MD5:ae6806f72638cffebda5d9e048bf4e9a Primary data file for dataset ID 641641

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Parameters

Parameter	Description	Units
sample	unique identification number for each sampled Diopatra worm	unitless
treatment	treatment assignment: mud=sediment-only control; grac=Gracilaria provided ad libitum; pods=provided 3 freshly-killed and frozen amphipods [primarily Gammarus mucranatus] daily; grac_and_pods=Gracilaria provided ad libitum and provided with 3 freshly killed and frozen amphipods	unitless
final_size	mass of dried worm	grams

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	scale
Generic Instrument Description	An instrument used to measure weight or mass.

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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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