

Results of stable isotope analysis (C, N) of the posteriorly regenerated muscle tissue of *Diopatra* from the Georgia and South Carolina coasts in 2013 (Gracilaria effects project)

Website: <https://www.bco-dmo.org/dataset/641654>

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)

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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.4A - worm growth](#)

[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 spaces with underscores
- replaced special characters

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Data Files

File
Kollars_fig4B.csv (Comma Separated Values (.csv), 1.10 KB) MD5:b44e2b3ef72d370516a5c04c6832b02c Primary data file for dataset ID 641654

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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; pods_field=additional resource samples that were collected from the field	unitless
N_pcent	percent nitrogen content	percent
N15	nitrogen as 15N content	percent
C_pcent	percent carbon content	percent
C13	carbon as 13C content	percent

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Elemental Analyzer
Dataset-specific Description	Thermo Flash EA
Generic Instrument Description	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

Dataset-specific Instrument Name	
Generic Instrument Name	Spectrometer
Dataset-specific Description	Delta V plus spectrometer
Generic Instrument Description	A spectrometer is an optical instrument used to measure properties of light over a specific portion of the electromagnetic spectrum.

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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
NSF Division of Ocean Sciences (NSF OCE)	OCE-1057713

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