

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 |
|------------------------------------|---|---------------------------|
| Byers, James E. | University of Georgia (UGA) | Co-Principal Investigator |
| Sotka, Erik | College of Charleston (CofC) | Co-Principal Investigator |
| Kollars, Nicole M. | College of Charleston (CofC) | Student, Contact |
| Copley, Nancy | Woods Hole Oceanographic Institution (WHOI BCO-DMO) | BCO-DMO Data Manager |

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

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