Rock wall manipulation experiment conducted in Bodega Bay, CA from 2010-2011

Website: https://www.bco-dmo.org/dataset/641692
Data Type: Other Field Results
Version: 01 April 2016
Version Date: 2016-04-01

Project
» Long-term and interactive effects of seaweed diversity and herbivory on intertidal community structure and functioning (Intertidal Diversity)

Contributors	Affiliation	Role
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Coverage

Spatial Extent: **Lat**:38.3244 **Lon**:-123.0386
Temporal Extent: 2010-09-22 - 2011-08-16

Dataset Description

These data summarize results from a field experiment testing effects of gastropod grazer diversity and substrate heterogeneity generated by barnacles on intertidal algal succession. The manipulation experiment was conducted in Bodega Bay, CA from 2010-2011.

Methods & Sampling

The experiment was conducted on a vertical rock wall in the mid-high intertidal zone of Bodega Marine Reserve, Bodega Bay, CA, USA. Grazer diversity and substrate heterogeneity were factorially manipulated in 20cm x 20cm plots. Grazers were manipulated via direct removals from plots in order to generate monocultures of each of three gastropod taxa, the limpets, *Lottia digitalis* and *Lottia scabra*, and the snails *Littorina* spp. (*L. plena* and *L. scutulata*), along with an unmanipulated polyculture with all three gastropod grazers. Substrate heterogeneity was manipulated by scraping barnacle covered areas from the rock surface. Three barnacle treatments were used: two homogeneous treatments (full = no barnacle removal, none = all barnacles removed) and one heterogeneous treatment (half = barnacles removed from one half of plot but left intact on the other half). Grazer and substrate treatments were maintained over time by counting and removing unwanted grazers from plots and by removing new barnacle recruits from previously cleared areas. On each survey date, grazer abundance and visually-assessed percent cover of algal taxa were recorded.

Reference:
Matthew A. Whalen, Kristin M. Aquilino, John J. Stachowicz. 2016. Grazer diversity interacts with biogenic

habitat heterogeneity to accelerate intertidal algal succession. Ecology. in press.

Data Processing Description

BCO-DMO Processing:
- added location, lat, and lon columns (taken from metadata);
- added month, day, and year columns;
- changed date format to YYYYmmdd;
- modified parameter names to conform with BCO-DMO naming conventions.

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Data Files

File
rockwallexp.csv(Comma Separated Values (.csv), 1.02 MB)   MD5:31da8abc3b8b56b970fa0a81ae6cefcc   Primary data file for dataset ID 641692

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Parameters

Parameter	Description	Units
location	Site name.	dimensionless
lat	Latitude of site.	decimal degrees
lon	Longitude of site. Negative = West.	decimal degrees
survey	Algal/animal surveys listed numerically in chronological order.	dimensionless
date	The date a particular plot was sampled. format: YYYYmmdd	unitless
month	2-digit month of sampling.	mm (01 to 12)
day	2-digit day of month of sampling.	dd (01 to 31)
year	4-digit year of sampling. in YYYY format	unitless
plot	The unit of replication; each plot consisted of a 20cm x 20cm square surrounded by marine epoxy (Z-spar A-788 Splash-Zone).	dimensionless
block	Each of two spatial blocks (1 and 2) that are on opposite sides of a channel that feeds an elogate pool at the base of the rock wall.	dimensionless
herb_trtmt	Herbivore (Grazer) treatment: A=all three species; L=Littorina only (limpets removed); D=Lottia digitalis only; S=Lottia scabra only.	dimensionless
barnacle_trtmt	Barnacle treatment: full (no barnacles removed); none (all barnacles removed); half (barnacles removed from one half of plot).	dimensionless
barn_trtmt	Barnacle subtreatment: Y (plot/side with barnacles); N (plot/side without barnacles); H (plot with half barnacle cover).	dimensionless
area	Area occupied by reference plot or side of plot in cm^2; separates full plots from sides within plots in the half barnacle treatment.	square centimeters (cm^2)
taxon	Taxon/group measured: new_barn = new barnacles; diatoms = microalgae; ulva = Ulva spp.; endo = Endocladia muricata; masto = Mastocarpus papillatus; hilden = Hildenbrandia sp.; petro = Mastocarpus papillatus tetrasporophyte (aka Petrocelis phase); porphy = Pyropia perforata (formerly Porphyra); pelv = Pelvetiopsis limitata; clad = Cladopohora sp.; enc_coral = encrusting coralline red algae; cumagloia = Cumagloia andersonii; littorina = Littorina sp.; L_scabra = Lottia scabra; L_digitalis = Lottia digitalis.	dimensionless
abundance	new_barn = Number of newly settled barnacles counted and subsequently removed from cleared areas (half and no barnacle treatments). diatoms, ulva, endo, masto, hilden, petro, porphy, pelv, clad, enc_coral, cumagloia = Visual percent cover estimate of the taxon/group in plot/side of plot. littorina = Number of Littorina sp. counted in plot and subsequently removed from herbivore treatments D and S. L_scabra = Number of Lottia scabra counted in plot and subsequently removed from herbivore treatments D and L. L_digitalis = Number of Lottia digitalis counted in plot and subsequently removed from herbivore treatments S and L.	varies by taxon/group (see description)

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Deployments

BodegaBay_Stachowicz

Website	https://www.bco-dmo.org/deployment/521213
Platform	Bodega Marine Reserve
Start Date	2004-07-19
End Date	2013-07-10
Description	rocky intertidal

Project Information

Long-term and interactive effects of seaweed diversity and herbivory on intertidal community structure and functioning (Intertidal Diversity)

Coverage: Bodega Bay, CA (38.3244 N, 123.0386 W); Temperate rocky intertidal zone

Description from NSF award abstract:
Stimulated in part by rapid changes in the biological composition and richness of most of Earth's ecosystems, considerable theoretical and empirical research has focused on understanding the effects of species richness on communities and ecosystems. This research has resulted in major advances and has shown that diversity can affect ecosystem processes. However, we are currently limited in our ability to draw generalities regarding these effects that transcend ecosystems and to apply this knowledge to conservation and management efforts because: (1) most experiments are of short duration and relatively few are conducted under field conditions on natural substratum; and (2) most experiments manipulate only diversity and so cannot assess the strength of diversity relative to other known drivers of ecosystem functioning. Previous NSF-funded work found that species diversity of seaweeds does increase the accumulation of producer biomass and the diversity and richness of mobile invertebrates associated with those seaweeds. **In this project, the investigator will examine the interactive effects of plant and grazer richness on seaweed productivity and assemblage recovery from disturbance by (a) continuing our ongoing diversity manipulations (b) nesting additional experiments manipulating grazers within these plots, and (c) performing new experiments to examine effects of grazer richness on algal assemblages.** The main experiment consists of 72 1.5 m diameter plots in the rocky intertidal at Bodega Bay, California, split into 6 different treatments: a monoculture of each of the 4 algal species that comprise >85% of the algal cover in our system; a 4-species polyculture, and an unmanipulated control plot. The PI created these "diversity" plots by weeding under the auspices of a previous NSF grant.

Objectives of this project are:
(1) To nest within the diversity plots smaller cleared areas that either allow or prohibit access by grazers in order to test the interactive effects of algal diversity and herbivory on recovery of the algal assemblage from disturbance (or resilience).
(2) To conduct a separate combined additive and replacement series experiment to examine the effects of herbivore identity and richness on algal recruitment and succession.
(3) While the nested grazer-exclusion experiment is in progress, to continue weeding and collecting data in the uncleared portion of these plots as a continued test of the univariate effect of algal richness on the cover of algae and sessile invertebrates, and on mobile invertebrate abundance, richness, and diversity. Together with previous results, this will produce a 7 year record of the effects of seaweed richness on rocky intertidal communities, which will then be correlated with archived environmental data.
(4) After the nested grazer exclusion experiment is complete, to cease weeding plots and track their reinvasion by weeded species in order to evaluate the mechanisms maintaining diversity of perennial algae.

Understanding the consequences of simultaneous changes in grazer abundance or diversity and algal diversity as well as the long-term effects of both on the resilience of algal communities in the face of disturbance will provide a better understanding of both the consequences of human encroachment into these habitats and the appropriate management efforts needed to minimize impacts and maintain ecosystem functioning. This is especially critical given that harvesting and trampling by humans are altering the diversity and composition of herbivores and algae in the California rocky intertidal zone.

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0850707