Percent algal substrate grazed by sea urchins in trophic cascade experiments in Gal?pagos Islands during 2012 (GMR Trophic Cascades project)

Website: https://www.bco-dmo.org/dataset/635717
Data Type: experimental
Version: 1
Version Date: 2016-01-19

Project
» Effects of Predator Diversity on the Strength of Trophic Cascades in an Oceanic Benthic Ecosystem (GMR Trophic Cascades)

Contributors	Affiliation	Role
Witman, Jon D.	Brown University	Principal Investigator, Contact
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Abstract
Percent algal substrate grazed by sea urchins in trophic cascade experiments in Gal?pagos Islands during 2012.

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Coverage

Spatial Extent: **Lat**:-0.411 **Lon**:-90.27525
Temporal Extent: 2012-06 - 2012-07

Methods & Sampling

Data describe the percent algal substrate grazed by sea urchins in trophic cascade experiment. Treatments included full predator exclusion with 4 urchins and predator access (fence with 4 urchins) for two species of urchin (*Eucidaris galapagensis* and *Lytechinus semituberculatus*) conducted on 23 June – 1 July 2012 and 13 – 20 July 2012, respectively. Experimental concrete bases were photographed and digitized for percent cover of grazed substrate. Experiments were conducted at 10 m depth at Baltra Island, Galápagos Islands.

See Witman, J.D., et al (2015) for description of the experimental design.

Data Processing Description

Data are raw, with no processing.

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date, reference information
- renamed parameters to BCO-DMO standard
- replaced blanks with underscores
- reformatted data to a flat file
- added site, lat, lon columns

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Data Files

File
urchin_grazing.csv (Comma Separated Values (.csv), 1.95 KB) MD5:8830a33a44dc8aa870d153fd31e9b0c9 Primary data file for dataset ID 635717

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Related Publications

Witman, J. D., Lamb, R. W., & Byrnes, J. E. K. (2015). Towards an integration of scale and complexity in marine ecology. Ecological Monographs, 85(4), 475–504. doi:10.1890/14-2265.1
Methods

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Parameters

Parameter	Description	Units
species	experimental sea urchin taxonomic name	unitless
site	location of experiment	unitless
lat	latitude; north is positive	decimal degrees
lon	lonitude; east is positive	decimal degrees
days	duration of experiment	days
treatment	description of treatment	unitless
pcent_grazed	percent of area grazed	percent

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Camera
Dataset-specific Description	GoPro digital video camera
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

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Deployments

Witman_2012

Website	https://www.bco-dmo.org/deployment/632747
Platform	Unknown Platform
Start Date	2012-01-01
End Date	2012-12-31
Description	Nearshore biological experiments

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Project Information

Effects of Predator Diversity on the Strength of Trophic Cascades in an Oceanic Benthic Ecosystem (GMR Trophic Cascades)

Website: http://www.witmanlab.com/predator-diversity-and-the-strength-of-trophic-cascades-gmr.html

Coverage: Galapagos Islands, Ecuador 00 33.953 S; 90 08.493 W

Description from NSF award abstract:
Predator diversity has decreased dramatically in the world's oceans due to overfishing, anthropogenic habitat destruction and possibly climate change. Yet, still unknown for most ecosystems is the importance of predator diversity and abundance for ecosystem functioning. One of the most pervasive community-wide consequences of top predators is the Trophic Cascade (TC), where herbivores are suppressed, which releases plants from consumption, thus increasing plant productivity. Recent studies have shown that the diversity of predators may reduce, increase, or have no effect on the strength of trophic cascades. The small number, to date, of experimental tests of predator diversity effects on cascade strength precludes broad generalizations vital to the development of predictive theory. Such research is limited by the lack of experimental realism due to the small number of predator species that can be manipulated in simplified mesocosms. Without more realistic species numbers, it is impossible to extrapolate results to natural ecosystems that experience losses of predator diversity.

To meet these challenges, and to better understand the consequences of present and changing levels of predator diversity in marine ecosystems, a series of experimental manipulations will be conducted on natural levels of predator diversity and their herbivorous sea urchin prey. The hypotheses test the ultimate effects on benthic algae, as a measure of cascade strength in oceanic benthic ecosystems of the Galapagos Marine Reserve (GMR). Because of years of protection from industrial fishing as a UNESCO World Heritage Site, and of local conservation protection as the GMR, there are diverse guilds of higher trophic level predators, such as large fish and sharks. Likewise, there is high diversity of intermediate-level fish and invertebrates that prey on sea urchins, creating an unusual opportunity for testing and developing predator diversity and Biodiversity Ecosystem Functioning theory. The overarching questions addressed in this project are: How do naturally occurring large ranges of oceanic predator diversity influence the strength of trophic cascades? and How does environmental variation and conservation protection influence these processes? The first question will be addressed in experiments manipulating both horizontal (within trophic level; urchin herbivores) and vertical (across trophic level; predators) consumer diversity and in another experiment manipulating the diversity of predatory fish and invertebrates guilds. The experiments employ open fenced treatments containing urchins but allowing access by fish and invertebrate predators of the urchins. To record natural levels of fish and invertebrate predator richness encountering the treatments, consuming the urchins and interacting with each other, the entire experimental layout will be video-recorded for up to several weeks at a time. The time-lapse cameras/lighting system is capable of day and night imaging without affecting predator behavior. A simplified manipulation to measure the influence of predator diversity on cascade strength will be replicated and video-recorded at 16 sites -- representing different levels of upwelling and conservation protection -- to place the

mechanistic understanding gleaned from detailed experiments at local sites into a broader (mesoscale) context.

Relevant References:

Witman, J.D and F. Smith. 2003. Rapid community change at a tropical upwelling site in the Galapagos Marine Reserve. Biodiversity and Conservation 12: 25-45

Witman, J.D., M. Brandt and F. Smith 2010. Coupling between subtidal prey and consumers along a mesoscale upwelling gradient in the Galapagos Islands. Ecological Monographs 80: 153-177.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1061475

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