Experimental results describing the thickness of byssal threads produced by mussels of a given planform area analyzed at Hopkins Marine Station during 2014 (Experiments in a Model Ecosystem project)

Website: https://www.bco-dmo.org/dataset/632629
Data Type: experimental
Version: 2016-01-13

Project
» Environmental Variability, Functional Redundancy, and the Maintenance of Ecological Processes: Experiments in a Model Ecosystem (Experiments in a Model Ecosystem)

Contributors	Affiliation	Role
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Dataset Description

This dataset includes the number and attachment sites of byssal threads produced by individual mussels.

Related Reference:

Cole, A. and Denny MW. (2014) United we fail: group versus individual strength in the ribbed mussel *Mytilus californianus*. *Biol. Bull.* 227: 61-67.

These data are also available at the Stanford Digital Repository: http://purl.stanford.edu/ph942zz5524

Related Datasets:

mussel size vs. byssal count
mussel byssus tenacity
mussel dislodgement data

Methods & Sampling

Field measurements were performed in three separate beds of the California sea mussel, Mytilus californianus, in the rocky intertidal zone adjacent to Hopkins Marine Station, Pacific Grove, California. The beds comprised two layers of mussels: a basal layer attached to the rock and a surface layer attached to the basal layer. Measurements were conducted in summer and early autumn of 2008.

Byssal thread allocation:

We examined byssal thread allocation (interlaminar vs. intralaminar) in the same beds used for tenacity measurements. Because mussels were tightly packed, it was necessary to dissect both the surface and basal layers to accurately ascertain the per capita number of intra- and interlaminar threads anchoring surface-layer mussels. In the surface layer, we counted for each individual the total number of byssal threads produced (n_{tot}) and the number of threads that were attached to other surface-layer mussels (n_s). The difference between the average of n_{tot} and the average of n_s is an estimate of the average number of interlaminar threads produced by each surface-layer mussel. To obtain a second estimate of the average number of interlaminar threads produced by surface-layer mussels, we examined the basal layer. For each individual we counted the number of intralaminar threads extended to neighboring shells (n_b) and the total number of byssal threads attached to each mussel's shell (n_{sh}). The difference between the average of n_b and the average of n_{sh} is a second estimate of the average number of interlaminar threads extending downward from each surface-layer mussel. We then averaged the two estimates of interlaminar thread number per surface-layer individual for comparison to the average number of intralaminar threads per surfacelayer individual. The planform area of each individual mussel was calculated from the width and height of its shell.

Data Processing Description

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO standard

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Data Files

File
mussel_size_v_thickns.csv (Comma Separated Values (.csv), 274 bytes) MD5:bedddde4945b348bb0c74384dfb55c1e Primary data file for dataset ID 632629

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Parameters

Parameter	Description	Units
byssus_width_mm	width of individual byssal thread	millimeter
shell_area_plan_mm2	planform area of mussel shell	mm^2

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Deployments

Denny_2014

Website	https://www.bco-dmo.org/deployment/630162
Platform	Hopkins Marine Station
Start Date	2014-01-01
End Date	2014-12-31
Description	mussel studies

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Project Information

Environmental Variability, Functional Redundancy, and the Maintenance of Ecological Processes: Experiments in a Model Ecosystem (Experiments in a Model Ecosystem)

Coverage: Rocky intertidal zone; Hopkins Marine Station, Pacific Grove, CA USA

From NSF award abstract:
Functional traits of species are those that determine either species-specific responses to environmental conditions or their influence on ecological processes. Current theory suggests that communities with many species that perform a given function in a similar way but have different sensitivities to environmental conditions will exhibit greater temporal stability of ecosystem properties. So-called functional redundancy should lead to compensation among species, as some will do better when others do worse in response to environmental variability. Anthropogenic global warming is a major driver of current and anticipated changes in population dynamics, species interactions, and community structure from local to global scales. Resulting changes in biodiversity therefore have the potential to significantly alter important ecosystem properties such as productivity, nutrient cycling, and resistance to disturbance or invasion. Although ecologists have typically emphasized the response of populations and communities to changing climatic averages (e.g., increasing temperature and rainfall), global circulation models also predict significant increases in the intensity, frequency and duration of extreme weather and climate events in many parts of the world; that is, increases in the variability of the physical environment. Unfortunately, our current knowledge about the effects of increasing climatic variation on natural ecosystems is generally quite poor. Predicting how communities will likely respond to changing environmental variability has therefore been recognized as a critical research priority.

This project will advance our understanding of how projected changes in temperature variability will affect the behavior, demography, and interactions of key taxa on rocky shores, a model system for testing theoretical ecological predictions with field experiments. Environmental temperatures strongly influence the physiology, behavior, and demography of most organisms, and changes in average temperature have already been implicated in geographic range shifts of many species. A novel manipulative technique will be used to test the effects of changes in thermal variability on performance by a guild of congeneric grazing limpets, the productivity of their benthic microalgal food, and the resulting interaction strengths between the two taxa. Energy transfer among trophic levels is a key ecosystem process linked to local food-web support and rates of nutrient cycling. This research will evaluate not only species-specific effects of thermal variability on limpet survival, growth, and grazing activity, but also the potential for functional redundancy among limpet species to maintain that ecosystem function over time as environmental variability increases. Data generated from this study will provide a framework for future investigations of the consequences of climate change in this diverse and productive habitat.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1131038
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