Distribution of benthic invertebrates along the East Coast, USA, ranging from latitudes 38.61283 to 29.753272.

Website: https://www.bco-dmo.org/dataset/719556
Data Type: experimental
Version: 1
Version Date: 2017-11-17

Project
» Biogeography of a marine defensive microbial symbiont: relative importance of host defense vs. abiotic factors (BiogeogDefensiveSymb)

Contributors	Affiliation	Role
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Abstract
This dataset includes the distribution of benthic invertebrates along the East Coast, USA, ranging from latitudes 38.61283 to 29.753272.

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Coverage

Spatial Extent: **N**:38.61283 **E**:-75.072524 **S**:29.753272 **W**:-81.421
Temporal Extent: 2015-03-16 - 2016-06-21

Dataset Description

Distribution of benthic invertebrates along the East Coast, USA from latitudes 38.61283 to 29.753272.

Methods & Sampling

Samples were collected by hand using a 15x15 cm grid placed randomly on submerged area of floating dock, and identified by eye. For some colonial organisms (sponges, hydroids, tunicates, bryozoans), enumeration was challenging. Zeros indicate no animals in that group were found in that sample.

Temperature was measured with a digital thermometer, and salinity with a refractometer at the time of collection.

Data Processing Description

We have analyzed the proportions at differing latitudes and performed regression analysis with various factors (latitude, longitude, temperature, salinity) using SPSS Statistics 24.

BCO-DMO Processing:
- copied date, location name, location code, lat, lon, temp, and sal to each relevant row (was only included the first row for each sample set);
- created location_descrip column for more detailed location place name;
- modified parameter names;
- moved "Total" to the "Grid" column;
- removed commas and apostrophes from place names; replaced spaces with underscores;
- replaced blanks with "nd" (no data).

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Data Files

File
invert_dist.csv (Comma Separated Values (.csv), 64.17 KB) MD5:13066356a8522518992f187ccf5fb2f7 Primary data file for dataset ID 719556

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Parameters

Parameter	Description	Units
date	Date of collection, formatted as mm/dd/yyyy	unitless
location	Location samples collected	unitless
location_descrip	Specific area within location where samples were collected	unitless
location_code	Location code	unitless
Latitude	Latitude of location	decimal degrees
Longitude	Longitude of location	decimal degrees
temp	Water temperature	degrees Celsius
salinity	Water salinity	parts per thousand
grid_num	Sampling effort replicate	unitless
sponge_random	Random sponge count	unitless
sponge_orange	Orange sponge count	unitless
sponge_yellow	Yellow sponge count	unitless
sponge_purp_gray	Purple/gray sponge count	unitless
sponge_pink	Pink sponge count	unitless
sponge_green	Green sponge count	unitless
spong_orange_encr	Orange encr. sponge count	unitless
Anemone	Anemone count	unitless
hydroid	Hydroid count	unitless
hydroid_tubularia	Hydroid (tubularia) count	unitless
crab	Crab count	unitless

barnacle	Barnacle count	unitless
oyster	Oyster count	unitless
mussel	Mussel count	unitless
snail	Snail count	unitless
nudibranch	Nudibranch count	unitless
limpet	Limpet count	unitless
worm_red	Red worm count	unitless
worm_green	Green worm count	unitless
tubeworm	Tubeworm count	unitless
ragworm	Ragworm count	unitless
tunicate_orange	Orange tunicate count	unitless
tunicate_black	Black tunicate count	unitless
molgula	Molgula count	unitless
styela	Styela count	unitless
ecteinascidia_like_tunicate	Ecteinascidia-like tunicate count	unitless
white_tunicate_clavelina	White tunicate/clavelina count	unitless
clear_tunicate	Clear tunicate count	unitless
stalked_tunicate	Stalked tunicate count	unitless
encrusting_bryozoan	Encrusting bryozoan count	unitless
bugula_sp	Bugula sp. count	unitless
B_neritina	B. neritina count	unitless
total_count	Total count	unitless
sponge_tot	Total sponge count (counts summed by taxonomic grouping)	unitless
anemone_tot	Total anemone count (counts summed by taxonomic grouping)	unitless
hydroid_tot	Total hydroid count (counts summed by taxonomic grouping)	unitless
barnacle_tot	Total barnacle count (counts summed by taxonomic grouping)	unitless
oyster_tot	Total oyster count (counts summed by taxonomic grouping)	unitless
mussel_tot	Total mussel count (counts summed by taxonomic grouping)	unitless
other_mollusk_tot	Total other mollusk count (counts summed by taxonomic grouping)	unitless
worm_tot	Total worm count (counts summed by taxonomic grouping)	unitless
colonial_tun_tot	Total colonial tunicate count (counts summed by taxonomic grouping)	unitless
solitary_tun_tot	Total solitary tunicate count (counts summed by taxonomic grouping)	unitless
encr_bry_tot	Total encrusting bryozoan count (counts summed by taxonomic grouping)	unitless
B_stolon_tot	Total B. stolon count (counts summed by taxonomic grouping)	unitless
B_neritina_tot	Total B. neritina count (counts summed by taxonomic grouping)	unitless
total	Total of counts summed by taxonomic grouping	unitless
total_minus_bry	Total of counts summed by taxonomic grouping minus the bryozoans	unitless

sponge_prop	sponge_tot as a proportion	unitless
anemone_prop	anemone_tot as a proportion	unitless
hydroid_prop	hydroid_tot as a proportion	unitless
barnacle_prop	barnacle_tot as a proportion	unitless
oyster_prop	oyster_tot as a proportion	unitless
mussel_prop	mussel_tot as a proportion	unitless
other_mollusk_prop	other_mullusk_tot as a proportion	unitless
worm_prop	worm_tot as a proportion	unitless
colonial_tun_prop	colonial_tun_tot as a proportion	unitless
solitary_tun_prop	solitary_tun_tot as a proportion	unitless
encr_bry_prop	encr_bry_tot as a proportion	unitless
B_stolon_prop	B_stolon_tot as a proportion	unitless
B_neritina_prop	B_neritina_tot as a proportion	unitless
total_prop	Total of proportions	unitless
sponge_minus_bry_prop	Sponge proportion after removing bryozoan counts	unitless
anemone_minus_bry_prop	Anemone proportion after removing bryozoan counts	unitless
hydroid_minus_bry_prop	Hydroid proportion after removing bryozoan counts	unitless
barnacle_minus_bry_prop	Barnacle proportion after removing bryozoan counts	unitless
mollusks_minus_bry_prop	Mollusks proportion after removing bryozoan counts	unitless
worm_minus_bry_prop	Worm proportion after removing bryozoan counts	unitless
tunicates_minus_bry_prop	Tunicates proportion after removing bryozoan counts	unitless
total_minus_bry_prop	Total of proportions after removing bryozoan counts	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	digital thermometer
Generic Instrument Description	An instrument that measures temperature digitally.

Dataset-specific Instrument Name	
Generic Instrument Name	Refractometer
Generic Instrument Description	A refractometer is a laboratory or field device for the measurement of an index of refraction (refractometry). The index of refraction is calculated from Snell's law and can be calculated from the composition of the material using the Gladstone-Dale relation. In optics the refractive index (or index of refraction) n of a substance (optical medium) is a dimensionless number that describes how light, or any other radiation, propagates through that medium.

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Project Information

Biogeography of a marine defensive microbial symbiont: relative importance of host defense vs. abiotic factors (BiogeogDefensiveSymb)

Coverage: Western Atlantic coast, ranging from latitudes 38.61283 to 29.753272

Recent research has shown that microorganisms can be very important to their eukaryotic hosts, by providing nutrition or contributing to host defense against enemies, such as pathogens or predators. In many cases, however, hosting a bacterial symbiont imposes a physiological cost on the host organism, resulting in reduced growth or reproduction in the presence of the symbiont. Further, these costs may be more pronounced in some habitats than others, causing natural selection to act in eliminating symbiont-containing hosts from the population. In this project, the investigators are studying the relationship between the marine bryozoan invertebrate, Bugula neritina, and its uncultured symbiont. The symbiont produces natural products with activity against cancer, Alzheimer's disease, and HIV. Interestingly, these compounds also are distasteful and protect larvae from predators, indicating that this symbiotic relationship is defensive in nature. Along the East Coast of the US, the investigators have found a much higher proportion of individuals that have the defensive symbiont at lower latitudes, while the symbiont is absent in individuals collected at higher latitudes. This pattern is consistent with the theory that higher predation pressure exists at lower latitudes. Other environmental factors, such as temperature, can also vary over a wide geographical area, and may also play a role in influencing the relationship. In this project, the investigators will evaluate the ecological and environmental parameters that influence the distribution of a defensive symbiont, including predation pressure and temperature. Defensive symbionts represent another level of ecological complexity, and likely play an important role in structuring marine communities. This study will provide insight into how environmental factors can influence host-symbiont interactions and drive partner co-evolution. Furthermore, the bioactive products have pharmaceutical potential, and understanding how environmental factors influence the relationship between B. neritina and its symbiont may improve bioprospecting for novel compounds that could be developed into drugs.

In this research, the investigators will determine the ecological and environmental parameters that influence the distribution of a defensive symbiont in the marine bryozoan, Bugula neritina. The goal of this research is to determine the mechanism that results in the defensive endosymbiont being restricted to hosts that inhabit lower latitudes. This pattern of symbiont distribution could be the result of differing levels of costs and benefits at different latitudes: where predation pressure is low, the costs of hosting the symbiont outweigh the benefits, and aposymbiotic individuals outcompete their symbiotic conspecifics. In areas of higher predation, the defensive benefit outweighs the cost, and symbiotic individuals have higher survival rates than their undefended, aposymbiotic conspecifics. An alternative, but not mutually exclusive hypothesis, is that symbiont growth is inhibited at higher latitudes, where it is not as beneficial, and growth is induced in areas of higher predation. Specific goals are to determine if (1) a biogeographical cline in predation pressure corresponds to a gradient of symbiont frequency associating with the host, (2) symbiotic hosts have a higher fitness at low latitudes, and aposymbiotic hosts have a higher fitness at high latitudes, and (3) symbiont growth is promoted at low latitudes and inhibited at high latitudes. A combination of field and laboratory-based experiments will be conducted using ecological and molecular biology techniques. Bioactive compounds produced by symbionts of marine invertebrates can mediate multi-trophic interactions and potentially influence benthic community structure. There has been almost no research, however, on how ecological and environmental parameters influence the distribution of marine defensive endosymbionts.

Related Reference:

Linneman J, Paulus D, Lim-Fong G, Lopanik NB (2014) Latitudinal Variation of a Defensive Symbiosis in the Bugula neritina (Bryozoa) Sibling Species Complex. PLoS ONE 9(10): e108783. doi:10.1371/journal.pone.0108783

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Funding

Funding Source	Award
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