Asteroids and Holothurians: Table 2: Holothurian species - Number of individuals by station in the deep-sea East and West Atlantic from 1977-1985 (Deep Sea Benthic Dynamics project)

Website: https://www.bco-dmo.org/dataset/565136
Version: 31 August 2015
Version Date: 2015-08-31

Project
» Reproductive and Geographic Evidence for Source-Sink Dynamics in Deep-Sea Benthic Communities (Deep Sea Benthic Dynamics)

Contributors	Affiliation	Role
Rex, Michael	University of Massachusetts Boston (UMass Boston)	Lead Principal Investigator, Contact
Brault, Solange	University of Massachusetts Boston (UMass Boston)	Co-Principal Investigator
Stuart, Carol	University of Massachusetts Boston (UMass Boston)	Co-Principal Investigator
Gegg, Stephen R.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Table of Contents

- Dataset Description
  - Methods & Sampling
  - Data Processing Description
- Data Files
- Parameters
- Instruments
- Deployments
- Project Information
- Funding

Dataset Description

Holothurians: Table 2. Holothurian species, number of individuals by station

Data tables for:
Wagstaff, M., Howell, K.L., Bett, B. J., Billett, D. S. M., Brault, S., Stuart, C. T. & Rex, M. (2014) β-diversity of deep-sea holothurians and asteroids along a bathymetric gradient (NE Atlantic). Marine Ecology Progress Series, 508,177–185.

Taxonomic Note
Zoroaster longicauda = Zoroaster fulgens (long armed morph) of Howell et al 2004**
Zoroaster fulgens (robust morph) = Zoroaster fulgens (robust morph) of Howell et al 2004**
Zoroaster fulgens (slender morph) = Zoroaster fulgens (slender morph) of Howell et al 2004**

**Howell, K.L., Rogers, A., Tyler, P.A. and Billett, D.S.M. (2004). Reproductive isolation among morphotypes of the cosmopolitan species Zoroaster fulgens (Asteroidea:Echinodermata).

Methods & Sampling

We compare depth distributions, and β-diversity of holothurians and asteroids collected from the Porcupine Seabight (PSB) and Porcupine Abyssal Plain (PAP) in the eastern North Atlantic. The data represent 160 and 209 epibenthic sledge and semi-balloon otter trawl samples for holothurians and asteroids respectively taken from 1977 to 1998 as part of the Institute of Oceanographic Sciences Biology Programme in the PSB (Rice et al. 1991) and the BENGAL Program in the PAP (Billett & Rice 2001). The samples include 43 species of holothurians (Billett 1991) and 43 species of asteroids (Howell et al. 2002).

We performed analyses of nested order by applying BINMATNEST (Rodríguez-Gironés & Santamaría 2006. Baselga (2010, 2012) showed that β-diversity, can be decomposed into 2 terms: dissimilarity resulting from turnover (spatial replacement) and dissimilarity attributed to nestedness. We used these measures to examine the differences in composition between 2 sites (pair-wise dissimilarity). To determine the general trend in species composition over all depths, we performed non-metric multi-dimensional scaling (NMDS) on species presence absence matrices (Bray-Curtis dissimilarity index scaling) using the metaMDS function in R.

Baselga A (2010) Partitioning the turnover and nestedness components of β diversity. Glob Ecol Biogeogr 19: 134−143

Baselga A (2012) The relationship between species replacement, dissimilarity derived from nestedness, and nestedness. Glob Ecol Biogeogr 21: 1223−1232

Billett DSM (1991) Deep-sea holothurians. Oceanogr Mar Biol Annu Rev 29: 259−317

Billett DSM, Rice AL (2001) The BENGAL programme: introduction and overview. Prog Oceanogr 50: 13−25

Howell KL, Billett DS, Tyler PA (2002) Depth-related distribution and abundance of seastars (Echinodermata: Asteroidea) in the Porcupine Seabight and Porcupine Abyssal Plain, NE Atlantic. Deep-Sea Res I 49: 1901−1920

Rice AL, Billett DSM, Thurston MH, Lampitt RS (1991) The Institute of Oceanographic Sciences biology programme in the Porcupine Seabight: background and general introduction. J Mar Biol Assoc UK 71: 281−310

Rodríguez-Gironés MA, Santamaría L (2006) A new algorithm to calculate the nestedness temperature of presence-absence matrices. J Biogeogr 33: 924−935

Wagstaff, M., Howell, K.L., Bett, B. J., Billett, D. S. M., Brault, S., Stuart, C. T. & Rex, M. (2014) β-diversity of deep-sea holothurians and asteroids along a bathymetric gradient (NE Atlantic). Marine Ecology Progress Series, 508,177–185.

Gear code Gear type
BN1.5/3F Epibenthic sled
BN1.5/3M Epibenthic sled
BN1.5/C Epibenthic sled
BN1.5/P Epibenthic sled
BNC Epibenthic sled
BNF Epibenthic sled
GT Otter trawl
OT Otter trawl
OTSB14 Otter trawl
OTSB14D Otter trawl
ST Otter trawl

Data Processing Description

BCO-DMO Processing Notes
- Generated from original file "Data Asteroid Holothurian for Wagstaff et al paper 2014.xlsx, Sheet 2" contributed by Carol Stuart
- Parameter names edited to conform to BCO-DMO naming convention found at Choosing Parameter Name
- Date reformatted to YYYYMMDD
- Misc dates corrected (mis-entered originally)

[table of contents | back to top]

Data Files

File
DSBD_AsterHolo_Table2.csv (Comma Separated Values (.csv), 33.22 KB) MD5:98f2390f42b14ff504310c70360062c9 Primary data file for dataset ID 565136

[table of contents | back to top]

Parameters

Parameter	Description	Units
Station	Station Id - IOS station number	text
Gear	Type of gear used for samplingGear code Gear type BN1.5/3F Epibenthic sled BN1.5/3M Epibenthic sled BN1.5/C Epibenthic sled BN1.5/P Epibenthic sled BNC Epibenthic sled BNF Epibenthic sled GT Otter trawl OT Otter trawl OTSB14 Otter trawl OTSB14D Otter trawl ST Otter trawl	text
Date	Date of sampling	YYYYMMDD
Latitude	Latitude position of sample (South is negative)	dec degs
Longitude	Longitude position of sample (West is negative)	dec degs
Mid_Depth	Estimated mid-(mean) depth of sample	meters
Temperature_Range	Temperature range From collection of CTD cast datasets obtained during sampling period with the Porcupine Seabight	degs Celsius
Salinity_Range	Salinity range From collection of CTD cast datasets obtained during sampling period with the Porcupine Seabight	psu
Count_Species	Number of specimens within a species for the sample	integer

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	CTD Profiler
Generic Instrument Name	CTD - profiler
Dataset-specific Description	Temperature and Salinity ranges from collection of CTD cast datasets obtained during sampling period with the Porcupine Seabight and highlights intrusion of Mediterranean Outflow Water
Generic Instrument Description	The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column. It permits scientists to observe the physical properties in real-time via a conducting cable, which is typically connected to a CTD to a deck unit and computer on a ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This term applies to profiling CTDs. For fixed CTDs, see https://www.bco-dmo.org/instrument/869934.

Dataset-specific Instrument Name	Epibenthic Sled
Generic Instrument Name	Epibenthic Sled
Dataset-specific Description	Gear code Gear type BN1.5/3F Epibenthic sled BN1.5/3M Epibenthic sled BN1.5/C Epibenthic sled BN1.5/P Epibenthic sled BNC Epibenthic sled BNF Epibenthic sled GT Otter trawl OT Otter trawl OTSB14 Otter trawl OTSB14D Otter trawl ST Otter trawl
Generic Instrument Description	An epibenthic sled is a semi-quantitative bottom-sampling device designed to trawl just above the bottom at the sediment water interface (the epibenthic zone). The sled consists of a rectangular steel frame with a mesh net (often more than one) attached to it. Towed along the ocean floor, its weight scrapes into the benthos, collecting any organisms on the surface or in the first few centimeters of sediment. It also collects the organisms in the water column just above the benthos. Descriptions from WHOI and Census of Marine Life.

Dataset-specific Instrument Name	Otter Trawl
Generic Instrument Name	Otter Trawl
Dataset-specific Description	Gear code Gear type BN1.5/3F Epibenthic sled BN1.5/3M Epibenthic sled BN1.5/C Epibenthic sled BN1.5/P Epibenthic sled BNC Epibenthic sled BNF Epibenthic sled GT Otter trawl OT Otter trawl OTSB14 Otter trawl OTSB14D Otter trawl ST Otter trawl
Generic Instrument Description	Otter trawls have large rectangular otter boards which are used to keep the mouth of the trawl net open. Otter boards are made of timber or steel and are positioned in such a way that the hydrodynamic forces, acting on them when the net is towed along the seabed, pushes them outwards and prevents the mouth of the net from closing. The speed that the trawl is towed at depends on the swimming speed of the species which is being targeted and the exact gear that is being used, but for most demersal species, a speed of around 4 knots (7 km/h) is appropriate. More: http://en.wikipedia.org/wiki/Bottom_trawling

[table of contents | back to top]

Deployments

DSBD_NAtl

Website	https://www.bco-dmo.org/deployment/565075
Platform	lab Deep Sea Benthic Dynamics
Start Date	1997-11-01
End Date	1999-05-15
Description	Synthesis of measurements from multiple cruises

[table of contents | back to top]

Project Information

Reproductive and Geographic Evidence for Source-Sink Dynamics in Deep-Sea Benthic Communities (Deep Sea Benthic Dynamics)

Coverage: Deep-Sea East and West Atlantic and Gulf of Mexico

Description from NSF award abstract:
Many hypotheses have been proposed to explain deep-sea species diversity including competition, predation, physical disturbance, patch mosaics, coarse-grained environmental heterogeneity, metapopulation dynamics mediated by dispersal, and a host of abiotic factors. Evidence supporting these ideas comes largely from spatio-temporal patterns of alpha- (local) diversity. This investigator and collaborators proposed an alternative explanation based on species depth ranges. Abyssal populations of mollusks do not comprise a unique assemblage, but are mainly deeper attenuated range extensions of bathyal populations. Densities of many abyssal populations are so extraordinarily low, especially for minute organisms with low mobility and separate sexes, that it is implausible they could be reproductively viable. Most have larval dispersal ability. This suggested that many abyssal populations are maintained by source-sink dynamics. They suffer chronic local extinction from vulnerabilities to Allee effects, and persist through continued immigration from more abundant bathyal source populations. Source-sink dynamics provides a broad synthetic framework within which other potential causes of diversity (above) can act. It also resolves the long-standing paradox of how abyssal diversity could be shaped by interactions when density is so low. The theory does not require that abyssal communities be ecologically structured. They may be mostly a passive consequence of dispersal.

This project will apply two tests for source-sink dynamics: 1. The investigators will perform a direct test by examining reproductive patterns in molluscan species whose bathymetric ranges span the lower bathyal zone and the abyss. Since rare abyssal populations are predicted not to be reproductively viable, they should show diminished gamete production, and no evidence of mating. 2. They will conduct an extensive new synthesis of geographic evidence for source-sink dynamics. Geographic patterns, are currently the primary evidence available on very large spatial scales, and are invaluable for identifying taxonomic and geographical scenarios for future reproductive studies. Recent advances in nested analysis allow us to determine statistically whether abyssal communities are nested subsets of bathyal communities as predicted by source-sink theory. Newly available large datasets include Pan Atlantic distributions of gastropods, bivalves, and cumaceans from the Woods Hole Oceanographic Institution's Benthic Sampling Program; mollusks, asteroids and holothurians from Southampton Oceanography Centre's sampling program in the Porcupine Seabight and Abyssal Plains, and macrofaunal taxa from Texas A&M's Deep Gulf of Mexico Benthic Program. The investigator makes specific predictions about which groups should show geographic evidence of source-sink dynamics based on their natural history and the productivity regime. This synthesis will also contribute significantly to documenting and understanding beta diversity, the most important remaining challenge in deep-sea community ecology.

The source-sink hypothesis has the potential to unify and synthesize the large number of disparate theories of community structure in the deep-sea benthos. The research will also dramatically increase the number of computerized datasets on biogeographic distributions. The single greatest obstacle to expanding our understanding of macroecology in the deep sea is the near absence of data on species ranges. This also has vital implications for conservation and sustainable development of the deep-sea ecosystem. Without much more information on geographic ranges, it is currently impossible to gauge the extinction potential of deep-sea species.

References for the Data Analyses:
Brault, S., Stuart, C.T., Wagstaff, M.C. & Rex, M.A. (2012) Geographic evidence for source-sink dynamics in deep-sea neogastropods of the eastern North Atlantic: an approach using nested analysis. *Global Ecology and Biogeography*, 22,433−439. doi:10.1111/geb.12005

Brault, S., Stuart, C.T., Wagstaff, M.C., McClain, C.R., Allen, J.A. & Rex, M.A. (2013) Contrasting patterns of α- and β-diversity in deep-sea bivalves of the eastern and western North Atlantic. *Deep-Sea Research II*, 92,157−164. doi:10.1016/j.dsr2.2013.01.018

Wagstaff, M., Howell, K.L., Bett, B. J., Billett, D. S. M., Brault, S., Stuart, C. T. & Rex, M. (2014) β-diversity of deep-sea holothurians and asteroids along a bathymetric gradient (NE Atlantic). *Marine Ecology Progress Series*, 508,177–185. doi:10.3354/meps10877

Stuart, C.T., Brault, S., Rowe, G.T., Wei, C-L., Wagstaff, M., McClain, C.R., & Rex, M.A. Nestedness and species replacement along bathymetric gradients in the deep sea reflect productivity: a test with polychaete assemblages in the oligotrophic NW Gulf of Mexico. *Journal of Biogeography* (to be submitted)

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1129612

[table of contents | back to top]