Bivalves Table 2: Presence and absence of Bivalve species from the North American Basin in the deep-sea East and West Atlantic from 1997-1999 (Deep Sea Benthic Dynamics project)

Website: https://www.bco-dmo.org/dataset/565223
Version: 31 August 2015
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Project
» Reproductive and Geographic Evidence for Source-Sink Dynamics in Deep-Sea Benthic Communities (Deep Sea Benthic Dynamics)

Contributors	Affiliation	Role
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Dataset Description

Bivalves: Table 2. Presence (1) and absence (0) of Bivalves from the North American Basin

Data tables for:
Brault et al. (2012) Contrasting patterns of α- β-diversity in deep-sea bivalves of the eastern and western North Atlantic. Deep-Sea Research II 92, 157-164

Methods & Sampling

Data for Brault et al. (2012) Contrasting patterns of α- β-diversity in deep-sea bivalves of the eastern and western North Atlantic. Deep-Sea Research II 92, 157-164

We base the analysis on the deep-sea bivalve faunas of the western North Atlantic (North American Basin south of New England, Fig. 1), and eastern North Atlantic (Rockall Trough, Porcupine Seabight and Abyssal Plain, Fig. 2). The data include all three subclasses of the Bivalvia, the Protobranchia, Lamellibranchia and Septibranchia (the latter now included in the subclass Anomalodesmata). All material was collected with epibenthic sleds (Hessler and Sanders, 1967), as part of the Woods Hole Oceanographic Institution's Benthic Sampling Program (Sanders, 1977), or the Joint French and British INCAL 1976 Expedition in the Rockall Trough. Complete data, including stations of the Porcupine Seabight, for localities, species identifications, and relative abundances in samples can be found in Allen (2008). We used Baselga's (2010) metrics to distinguish two separate components of β-diversity along depth gradients, species dissimilarity among sites due to spatial replacement (turnover) and species loss leading to nestedness, using R package betapart. We also examined

the rank order of nestedness with depth using Rodríguez-Gironés and Santamaría's (2006) BINMATNEST, with R package bipartite.

Allen, J.A., 2008. Bivalvia of the deep Atlantic. Malacologia 50, 57-173.

Baselga, A., 2010. Partitioning the turnover and nestedness components of beta diversity. Global Ecol. Biogeogr. 19, 134-143.

Rodríguez-Gironés, M.A. and Santamaría, L. (2006). A new algorithm to calculate the nestedness temperature of presence–absence matrices. Journal of Biogeography, 33: 924–935.

Hessler, R.R., Sanders, H.L., 1967. Faunal diversity in the deep-sea. Deep-Sea Res. 14, 65-78.

Sanders, H.L., 1977. Evolutionary ecology and the deep-sea benthos. In: Goulden, C.E. (Ed.), The Changing Scenes in Natural Sciences 1776–1976. Philadelphia Academy of Natural Sciences Special Publication, PH, USA, pp. 223–243.

Data Processing Description

BCO-DMO Processing Notes
- Generated from original file "Data Bivalves Eastern North Atlantic and North American Basin for Brault et al 2013 four tables.xlsx, Sheet 2" contributed by Carol Stuart
- Parameter names edited to conform to BCO-DMO naming convention found at Choosing Parameter Name

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Data Files

File
DSBD_Bivalve_Table2.csv (Comma Separated Values (.csv), 24.21 KB) MD5:e5ee96d190cedada54c91d6a081b4ffc Primary data file for dataset ID 565223

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Parameters

Parameter	Description	Units
Species	Species	text
Min_Depth	Minimum Station Depth	meters
Max_Depth	Maximum Station Depth	meters
Flag	Flag Indicating: Presence (1) and absence (0) of species at Station Id	integer

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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

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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)

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Funding

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

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