Mussels and associated organisms sampling information collected in the Pacific margin of Costa Rica.The collections were made aboard R/V Atlantis in 2017 and 2018 using DSV Alvin. The 2019 collections were made aboard R/V Falkor, using the ROV Subastian

Website: https://www.bco-dmo.org/dataset/805488
Data Type: Cruise Results
Version: 1
Version Date: 2020-03-06

Project
» Collaborative research: Quantifying the biological, chemical, and physical linkages between chemosynthetic communities and the surrounding deep sea (Costa Rica Seeps)

Contributors	Affiliation	Role
Cordes, Erik E.	Temple University (Temple)	Principal Investigator, Contact
Levin, Lisa A.	University of California-San Diego Scripps (UCSD-SIO)	Co-Principal Investigator
Orphan, Victoria J.	California Institute of Technology (Caltech)	Co-Principal Investigator
Roman, Christopher Neil	University of California-San Diego Scripps (UCSD-SIO)	Co-Principal Investigator
Rouse, Gregory	University of California-San Diego Scripps (UCSD-SIO)	Co-Principal Investigator
Soenen, Karen	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Mussels and associated organisms sampling information collected in the Pacific margin of Costa Rica. The collections were made aboard R/V Atlantis during 2017 and 2018 using DSV Alvin. In 2019 the collections were made aboard R/V Falkor, using the ROV Subastian.

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Coverage

Spatial Extent: **N**:9.12153 **E**:-84.3123 **S**:8.9299 **W**:-84.8395
Temporal Extent: 2017-05-22 - 2019-01-10

Dataset Description

Sampling information from mussels and associated organisms collected from different seep sites off the Costa Rica margin. The collections were made aboard R/V Atlantis during 2017 and 2018 using DSV Alvin. In 2019 the

collections were made aboard R/V Falkor, using the ROV Subastian. Sampling information contains length, height, width, Phylum, Class, Order, Family and Genus.

Methods & Sampling

Mussel samples were collected using deep sea vehicle Alvin and ROV Subastian, on R/V Atlantis and R/V Falkor. Methods used for collection involved either grabs, mussel pots, the bushmaster junior, suction apparatus or net scoops:

- Mussel Pot – The mussel pot is a 12-quart aluminium-clad stainless steel pot with a twistable handle connected to a Kevlar bag insert. It is used to sample mussel beds and associated communities. The pot is deployed over the select mussel patch using the submersible or ROV manipulator, then collects the enclosed assemblage by cinching the Kevlar bag closed by turning the handle. This method allows for quantitative analysis of deep-sea mussel bed communities.
- Bushmaster – Original instruments created at Penn State to collect hydrothermal vent and methane seep communities. Hydraulic rods are attached to a very fine mesh that is deployed over the tubeworm patch of interest to collect the tubeworms and associated community. Once the assemblage is enclosed, the net is cinched closed using the submersible or ROV manipulator. Like the mussel pot, this allows for quantitative collections of tubeworm communities.
- Slurp – This is simply the term used for suction sampler that attached to the submersible or ROV and collected organisms by suctioning them into an enclosed container.

Data Processing Description

Samples were processed aboard R/V Atlantis and R/V Falkor and sent back to Temple University, PA, USA for processing

BCO-DMO processing notes:

- Adjusted column names to comply with dataset requirements
- Added ISO_DateTime_UTC column
- Reformated time to HH:MM
- Reformated date to YYYY-MM-DD

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Data Files

File
mussels.csv (Comma Separated Values (.csv), 47.96 KB) MD5:34a885fa0a33050af54f817681ef610e Primary data file for dataset ID 805488

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Parameters

Parameter	Description	Units
Cruise_number	Cruise code #	unitless
Sample_number	Sample number assigned on board	unitless

Associated_sample	Related sample code if collected together	unitless
Dive	Submersible dive #	unitless
Location	Dive location	unitless
Latitude	Latitude of sample - south is negative	decimal degrees
Longitude	Longitude of sample - west is negative	decimal degrees
Depth	Depth sample collected at	meter (m)
Date	Date sample collected on - format YYYY-MM-DD (in UTC)	unitless
Time	Time sample collected at - format HH:SS (in UTC)	unitless
Collected_in	Instrument/box collected in	unitless
Tentative_ID	ID given on board the ship	unitless
Length	Organism length	centimeter (cm)
Height	Organism height	centimeter (cm)
Width	Organism width	centimeter (cm)
Phylum	Phylum	unitless
Class	Class	unitless
Order	Order	unitless
Family	Family	unitless
Genus	Genus	unitless
Species	Species	unitless

ISO_DateTime_UTC	ISO format of Date and Time in UTC (YYYY-MM-DDTHH:MMZ)	yyyy-MM-dd'T'HH:mm'Z'

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Bottom Sediment Grab Samplers
Generic Instrument Description	These samplers are designed to collect an accurate representative sample of the sediment bottom. The bite of the sampler should be deep enough so all depths are sampled equally. The closing mechanism is required to completely close and hold the sample as well as prevent wash-out during retrieval. Likewise, during descent the sampler should be designed to minimize disturbance of the topmost sediment by the pressure wave as it is lowered to the bottom.

Dataset-specific Instrument Name	Bushmaster
Generic Instrument Name	Bushmaster
Dataset-specific Description	Original instruments created at Penn State to collect hydrothermal vent and methane seep communities. Hydraulic rods are attached to a very fine mesh that is deployed over the tubeworm patch of interest to collect the tubeworms and associated community. Once the assemblage is enclosed, the net is cinched closed using the submersible or ROV manipulator. Like the mussel pot, this allows for quantitative collections of tubeworm communities.
Generic Instrument Description	Bushmaster samplers are original instruments created at Penn State to collect hydrothermal vent and methane seep communities. Hydraulic rods are attached to a very fine mesh that is deployed over the tubeworm patch of interest to collect the tubeworms and associated community. Once the assemblage is enclosed, the net is cinched closed using the submersible or ROV manipulator. This allows for quantitative collections of tubeworm communities.

Dataset-specific Instrument Name	Mussel Pot
Generic Instrument Name	Mussel Pot
Dataset-specific Description	The mussel pot is a 12-quart aluminium-clad stainless steel pot with a twistable handle connected to a Kevlar bag insert. It is used to sample mussel beds and associated communities. The pot is deployed over the select mussel patch using the submersible or ROV manipulator, then collects the enclosed assemblage by cinching the Kevlar bag closed by turning the handle. This method allows for quantitative analysis of deep-sea mussel bed communities.
Generic Instrument Description	The mussel pot is a 12-quart aluminium-clad stainless steel pot with a twistable handle connected to a Kevlar bag insert. It is used to sample mussel beds and associated communities. The pot is deployed over the select mussel patch using the submersible or ROV manipulator, then collects the enclosed assemblage by cinching the Kevlar bag closed by turning the handle. This method allows for quantitative analysis of deep-sea mussel bed communities.

Dataset-specific Instrument Name	Slurp
Generic Instrument Name	Sediment suction sampler
Generic Instrument Description	Devices that collect samples from the sediment layer surface using suction. The mechanism of suction can be accomplished by either vacuum, by pressure difference between the air inside the sampler and surrounding water, by pumping water directly into the sampler, or by under pressure air to elevate the sediment inside the sampler. Devices are typically diver- or remotely-operated.

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Deployments

AT37-13

Website	https://www.bco-dmo.org/deployment/714567
Platform	R/V Atlantis
Start Date	2017-05-20
End Date	2017-06-11
Description	More cruise information is available from Rolling Deck to Repository (R2R): * https://www.rvdata.us/search/cruise/AT37-13 * https://doi.org/10.7284/907684

AT42-03

Website	https://www.bco-dmo.org/deployment/777903
Platform	R/V Atlantis
Start Date	2018-10-17
End Date	2018-11-06
Description	More cruise information is available from Rolling Deck to Repository (R2R): * https://www.rvdata.us/search/cruise/AT42-03 * https://doi.org/10.7284/908473

AT37-13_Alvin_Dives

Website	https://www.bco-dmo.org/deployment/715760
Platform	HOV Alvin
Start Date	2017-05-21
End Date	2017-06-08
Description	Collections of seep organisms in sediments and on rocks.

AT42-03_Alvin_Dives

Website	https://www.bco-dmo.org/deployment/777904
Platform	HOV Alvin
Start Date	2018-10-17
End Date	2018-11-04

FK190106

Website	https://www.bco-dmo.org/deployment/806648
Platform	R/V Falkor
Start Date	2019-01-06
End Date	2019-01-27
Description	More cruise information is available from Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/FK190106 (DOI: 10.7284/908271)

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Project Information

Collaborative research: Quantifying the biological, chemical, and physical linkages between chemosynthetic communities and the surrounding deep sea (Costa Rica Seeps)

Coverage: Costa Rica Pacific Margin

NSF abstract:
If life were to disappear from the deep sea, would we notice? We only have a cursory understanding of this vast region and the connectivity among its communities and the rest of the oceans, and yet the ecosystems of the deep sea have been implicated in the larger function of the global marine ecosystems. We now rely on the deep ocean for food, energy, novel drugs and materials, and for its role in the global cycling of carbon, as well as for supporting services such as habitat creation, nutrient replenishment for shallow waters, and the maintenance of biodiversity. Cold seeps, active areas of the seafloor where methane and other chemicals are released, are key features along the continental margins worldwide. To characterize how methane seep communities interact with the surrounding ecosystems and vice versa, we will study methane seeps off the Pacific coast of Costa Rica in 2017 and 2018. It is the sphere of influence around the seep, both along the seafloor and up into the water column, that we seek to better understand. We will map the structure and the chemistry surrounding these habitats using a novel 3-dimensional framework, combining typical transects with vertical characterizations of the water column just above the seafloor. This will include measurements of methane flux into the water column and changes in the overlying carbonate chemistry and oxygen levels that are critical to our understanding of the effect of warming, oxygen loss and ocean acidification in this region. Within this framework, we will collect seep organisms in sediments and on rocks (including all sizes from microbes to large animals), and transplant some of these from within the area of seep influence to the background deep sea, and vice-versa. Together, these studies will help us to measure the size of the seep sphere of influence, and also demonstrate the role of these seeps within the deep sea and the greater, global, marine ecosystem. We will share this information with a group of teachers during a series of workshops in the San Diego area, at an exhibit at the Birch Aquarium, and through the work of an artist who has worked extensively with marine organisms in extreme environments.

Chemosynthetic ecosystems are inextricably linked to the broader world-ocean biome and global biogeochemical cycles in ways that we are just beginning to understand. This research will identify the form, extent, and nature of the physical, chemical, and biological linkages between methane seeps and the surrounding deep-sea ecosystem. The proposed research builds critical understanding of the structural and functional processes that underpin the ecosystem services provided by chemosynthetic ecosystems. We target a critical continental margin, Costa Rica, where methane fates and dynamics loom large and play out in an setting that reflects many oceanographic stressors. We will use quantitative sampling and manipulative

studies within a 3-dimensional oceanographic framework. We will ask what are the shapes of the diversity and density functions for organisms of different size classes and trophic position over the transition from the seep habitat through the ecotone to the background deep sea? Further, we will ask how do depth, dissolved oxygen concentrations, pH and carbonate ion availability, relative rates of fluid flux, and substrate (biogenic, authigenic carbonate, sediments) alter these linkages and interactions with the surrounding deep sea? Evidence for distinct transitional communities and biotic patterns in density and alpha and beta diversity will be quantified and placed in a global biogeographic context. All of these investigations will occur across biological size spectra: for microorganisms (archaea, bacteria, microeukaryotes), the macrofauna, and the megafauna that form biogenic habitats. Our research results will be interpreted in the context of potential effects of global ocean change in the equatorial Pacific to determine how the linkages with the surrounding deep sea will be altered as anthropogenic impacts proceed in the future.

Related publications:

Levin, L.A., V.J. Orphan, G.W. Rouse, W. Ussler, A. E. Rathburn, G. S. Cook, S. Goffredi, E. Perez, A. Waren, B. Grupe, G. Chadwick, B. Strickrott. (2012). A hydrothermal seep on the Costa Rica margin: Middle ground in a continuum of reducing ecosystems. *Proc. Royal Soc. B.* 279: 2580-88 doi: 10.1098/rspb.2012.0205

Sahling, H., Masson, D. G., Ranero, C. R., Hühnerbach, V., Weinrebe, W., Klaucke, I., & Suess, E. (2008). Fluid seepage at the continental margin offshore Costa Rica and southern Nicaragua. *Geochemistry, Geophysics, Geosystems* 9: doi: 10.1029/2008GC001978

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1635219

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