Megafaunal presence recorded from AUV Sentry phototransects conducted at sites across the Costa Rica margin from R/V Atlantis cruises AT37-13, AT42-03 in 2017 and 2018

Website: https://www.bco-dmo.org/dataset/847032
Data Type: Cruise Results
Version: 1
Version Date: 2021-05-03

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

Contributors	Affiliation	Role
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Abstract
Megafaunal presence recorded from AUV Sentry phototransects conducted at sites across the Costa Rica margin from R/V Atlantis cruises AT37-13, AT42-03 in 2017 and 2018.

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Coverage

Spatial Extent: **N**:9.12506 **E**:-84.2085 **S**:8.78231 **W**:-85.1879
Temporal Extent: 2017-05-24 - 2018-11-04

Methods & Sampling

Location: Pacific coast of Costa Rica

Sampling and analytical procedures:

AUV *Sentry* was deployed on two R/V *Atlantis* cruises in May-June 2017 and October-November 2018 off the

Pacific coast of Costa Rica to capture seafloor images of predetermined transects along with their associated coordinates and environmental conditions. Visual assessment of each photo was undertaken, and biogenic habitat forming species presence was recorded, as well as carbonate rock presence for sessile species attachment.

Photos were processed visually at Temple University, PA, USA. The "proc" format of the photos were analyzed "color corrected and smoothed color TIFF photos" (see https://ndsf.whoi.edu/sentry/using-sentry/data-products/).

Instruments:
The AUV houses several sensors, including a Seapoint optical backscatter sensor for turbidity, an Anderaa optode 4330 dissolved oxygen sensor, and a Seabird SBE49 CTD probe for salinity, temperature and depth monitoring. Finally, a NOAA PMEL oxidation-reduction potential (ORP) probe was attached to the AUV as a proxy measure for methane seepage

Data Processing Description

BCO-DMO Data Manager Processing Notes:
* All sheets from "Excel file BCO-DMO data submission- Sentry presence absence.xlsx" imported into the BCO-DMO data system and combined into one table. Each sheet was one dive of data.
* Date column had variable format so made all ISO8601 format yyyy-mm-dd
* ISO_DateTime_UTC and dive_image_number columns added from information in the sentry image name.
* Column names renamed to match BCO-DMO naming conventions (spaces and slashes changed to underscores, units removed from column name). Unit information is available in the parameter section of the metadata.
* Issue in sheet 432 of the original excel file starting at row 9861 to the end of the sheet. The issue seems to be the "f" of the filename (the .tif part) seems to be missing and it instead is in the Depth (m) column so the values for depth look like "f 990.56222744119". The imagenames were corrected to end in .tif instead of .ti and removed the "f " preceding the depths.
* In sheet 502 row 7789 of the original excel file, (row for image sentry.20181021.104425422155.7861.tif) there was an issue where the latitude value was "7 8.9307818665541". The "7 " was removed in this dataset.
* Depth and Altitude columns rounded to two decimal places.
* Latitude and longitude rounded to 5 decimal places.

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Related Publications

Data Products – Sentry. National Deep Submergence Facility. (n.d.). https://ndsf.whoi.edu/sentry/using-sentry/data-products/. Accessed May 3rd, 2021.
Methods

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Related Datasets

References

Woods Hole Oceanographic Institution National Deep Submergence Facility. (2017). *Sentry Underway Data for Cruise AT37-13, Sentry Dives 429-441* [Data set]. Woods Hole Oceanographic Institution. https://doi.org/10.26025/1912/27017

Woods Hole Oceanographic Institution National Deep Submergence Facility. (2018). *Sentry Underway Data for Cruise AT42-03, Sentry Dives 500-509* [Data set]. Woods Hole Oceanographic Institution. https://doi.org/10.26025/1912/27016

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Parameters

Parameter	Description	Units
Photo_Filename	Identifying # of photo	unitless
Cruise	Cruise code #	unitless
Year	Year of cruise	unitless
Date	Date of cruise in ISO 8601 format yyyy-mm-dd.	unitless
ISO_DateTime_UTC	Timestamp when the image was taken down to the microsecond in ISO8601 format yyyy-mm-ddTHH:MM:SS.ffffff.	unitless
Dive	AUV Sentry dive code #	unitless
dive_image_number	Sequential image number from the start of the dive starting with image 0.	unitless
Site	AUV Sentry dive site	unitless
Depth	Water depth of AUV	meters
Altitude	Distance of AUV above sediment	meters
Oxygen_Concentration	Oxygen concentration of water	micromoles/kg
dORP_to_dt	Oxidative-reductive potential (change in millivolts per second).	dimensionless
Latitude	Latitude of sample	decimal degrees
Longitude	Longitude of sample	decimal degrees
Salinity	Salinity of water column	Practical Salinity Units (PSU)
Temperature	Temperature of water column	degrees Celsius
Carbonate_Rock	Presence of carbonate rock in photos. present (1), absent (0).	unitless
Tubeworm	Presence of tubeworms in photos. present (1), absent (0).	unitless
Mussel	Presence of mussels in photos. present (1), absent (0).	unitless
Serpulid	Presence of serpulids in photos. present (1), absent (0).	unitless
Clam	Presence of clams in photos. present (1), absent (0).	unitless
Bacterial_Mat	Presence of bacterial mats in photos. present (1), absent (0).	unitless
Coral	Presence of corals in photos. present (1), absent (0).	unitless
Kiwa_puravida	Presence of Kiwa puravida in photos. present (1), absent (0).	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	AUV Sentry
Generic Instrument Description	The autonomous underwater vehicle (AUV) Sentry is a fully autonomous underwater vehicle capable of exploring the ocean down to 6,000 meters (19,685 feet) depth. Sentry builds on the success of its predecessor the ABE, with improved speed, range, and maneuverability. Sentry's hydrodynamic shape also allows faster ascents and descents. Sentry carries a superior science sensor suite and an increased science payload enabling it to be used for both mid-water and near-seabed oceanographic investigations. Sentry produces bathymetric, sidescan, subbottom, and magnetic maps of the seafloor and is capable of taking digital bottom photographs in a variety of deep-sea terrains such as mid-ocean ridges, deep-sea vents, and cold seeps at ocean margins. Sentry is uniquely able to operate in extreme terrain, including volcano caldera and scarps. Sentry's navigation system uses a doppler velocity log and inertial navigation system, aided by acoustic navigation systems (USBL or LBL). The USBL system also provides acoustic communications, which can be used to obtain the vehicle state and sensor status as well as to retask the vehicle while on the bottom. In addition its standard sensors, Sentry has carried a variety of science-supplied sensors, including the Nakamura redox potential probe, ACFR 3-D imaging system, and the Tethys in-situ mass spectrometer. Sentry can be used to locate and quantify hydrothermal fluxes. Sentry is also capable of a much wider range of oceanographic applications due to its superior sensing suite, increased speed and endurance, improved navigation, and acoustic communications. Sentry can be used as a stand alone vehicle or in tandem with Alvin or an ROV to increase the efficiency of deep-submergence investigations. More information is available from the operator site at URL: http://www.whoi.edu/main/sentry

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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

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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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