Capture records of abyssal megafauna captured using submersibles and ROVs at Station ALOHA off Hawaii and Station M off California from 2019 to 2020

Website: https://www.bco-dmo.org/dataset/922718
Data Type: Cruise Results
Version: 1
Version Date: 2024-04-29

Project

» Collaborative Research: Assessing the relative importance of small vs large particles as sources of nutrition to abyssal communities (Abyssal food web)

Contributors	Affiliation	Role
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Abstract

This dataset includes the capture records for the abyssal megafauna captured as part of this food web project. Megafauna were captured using submersibles and ROVs at Station ALOHA off Hawaii and Station M off California from 2019 to 2020. These animals were captured as representatives of their abyssal food webs for an isotopic investigation of their original particulate nutritional sources (different sized particles). Each organism was identified, measured, most weighed using a motion compensated scale, and frozen for later drying and isotope analysis. For larger organisms such as holothurians or fishes, samples of tissues were taken and often the whole animal was preserved for later confirmation of taxonomic identification.

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Coverage

Location: Eastern North Pacific (Station M) and North Pacific Subtropical Gyre (Station ALOHA)
Spatial Extent: **N**:34.5 **E**:-123.06 **S**:22.75 **W**:-158
Temporal Extent: 2019-04-30 - 2020-08-02

Methods & Sampling

Megafauna were collected in May and October 2019 using the HOV Alvin and the ROV Doc Ricketts, respectively, at Station M; and in July 2019, January 2020, and July 2020 using ROV Lu'ukai at Station Aloha. Megafauna were collected using the submersible vehicle's manipulator arm and/or slurp gun. Upon retrieval to the surface, samples were placed in a cool room (5 degrees Celsius (ºC)) for further processing. Specimens of megafauna were weighed and measured, then they were dissected using a scalpel. All tissue samples were placed in cryovials and frozen in liquid nitrogen, and subsequently stored at -80ºC. Samples of megafauna body tissues or macrofauna were freeze dried and ground to a homogenous powder using mortar and pestle.

BCO-DMO Processing Description

- Imported original file "Abyssal animal collection information.xlsx" (with dates) into the BCO-DMO system.
- Marked "n/a" as a missing data value. Missing data values are emtpy/blank in the final CSV file.
- Renamed fields/columns to comply with BCO-DMO naming conventions.
- Converted "local_date" column to YYYY-MM-DD format.
- Added "Station_Latitude" and "Station_Longitude" columns and populated with lat/lon for each station.
- Replaced the degrees symbol (unallowed character) with the word "degrees" in "comment" column of row 162.
- PI provided updated copy of file named as "922718_v1_abyssal_megafauna_capture_recordsV2.csv".
- Imported the new file, "922718_v1_abyssal_megafauna_capture_recordsV2.csv", into the BCO-DMO system and saved the final file as "922718_v1_abyssal_megafauna_capture_records.csv".

[ ]

Data Files

File
922718_v1_abyssal_megafauna_capture_records.csv(Comma Separated Values (.csv), 61.25 KB) MD5:0ff5569fab4abe26ef3d7cdc874cea22
Primary data file for dataset ID 922718, version 1

[ ]

Parameters

Parameter	Description	Units
Cruise_number	Cruise ID number: R/V Atlantis cruise AT4210; R/V Western Flyer cruise Pulse 72; R/V Kilo Moana cruises KM1914, KM2002, KM2008	unitless
sample_code	A combination of the cruise number, station number (e.g. ROV dive number), and sequential animal number	unitless
Sample	The sequential animal number for a given cruise number	unitless
Station	Either Station Aloha or Station M	unitless
Station_Latitude	Station latitude; positive values = North	decimal degrees
Station_Longitude	Station longitude; negative values = West	decimal degrees
local_date	Date of collection (local time zone)	unitless
Type_of_organism	A broad category of animal or sample type (e.g. gut contents)	unitless
species	Species	unitless
number	Number of individuals	unitless
Total_Length_cm	Total length	centimeters (cm)
Standard_Length_cm	Standard length	centimeters (cm)
PreAnal_Fin_Length_cm	Preanal fin length	centimeters (cm)
Carapace_Length_mm	Carapace length	millimeters (mm)
Mass_g	Mass	grams (g)
sex	Sex (M or F)	unitless
Tissue_fin_clip	Portion of an animal taken for isotope analysis if it was large (Y or N)	unitless
Tissue_whole_body	Portion of an animal taken for isotope analysis if it was large (Y or N)	unitless
Tissue_white_muscle	Portion of an animal taken for isotope analysis if it was large (Y or N)	unitless
Tissue_gut_removed	Portion of an animal taken for isotope analysis if it was large (Y or N)	unitless
Tissue_body_wall	Portion of an animal taken for isotope analysis if it was large (Y or N)	unitless
Tissue_liver	Portion of an animal taken for isotope analysis if it was large (Y or N)	unitless
Tissue_pereiopod	Portion of an animal taken for isotope analysis if it was large (Y or N)	unitless
Tissue_pleopod	Portion of an animal taken for isotope analysis if it was large (Y or N)	unitless
number_cryovials	The number of individual cryovials of a particular tissue or animal that were used for freezing it	unitless
pics	Whether or not a photograph of the animal was take prior to dissection and/or freezing (Y or N)	unitless
whole_body_fate	Either frozen, preserved in formalin, or preserved in ethanol	unitless
container_size	Refers to the size of the cryovial that the tissue or whole animal was frozen in	unitless
comments	Notes/comments	unitless

Instruments

Dataset-specific Instrument Name	mortar and pestle
Generic Instrument Name	Homogenizer
Generic Instrument Description	A homogenizer is a piece of laboratory equipment used for the homogenization of various types of material, such as tissue, plant, food, soil, and many others.

Dataset-specific Instrument Name	HOV Alvin
Generic Instrument Name	HOV Alvin
Generic Instrument Description	Human Occupied Vehicle (HOV) Alvin is part of the National Deep Submergence Facility (NDSF). Alvin enables in-situ data collection and observation by two scientists to depths reaching 6,500 meters, during dives lasting up to ten hours. Commissioned in 1964 as one of the world's first deep-ocean submersibles, Alvin has remained state-of-the-art as a result of numerous overhauls and upgrades made over its lifetime. The most recent upgrades, begun in 2011 and completed in 2021, saw the installation of a new, larger personnel sphere with a more ergonomic interior; improved visibility and overlapping fields of view; longer bottoms times; new lighting and high-definition imaging systems; improved sensors, data acquisition and download speed. It also doubled the science basket payload, and improved the command-and-control system allowing greater speed, range and maneuverability. With seven reversible thrusters, it can hover in the water, maneuver over rugged topography, or rest on the sea floor. It can collect data throughout the water column, produce a variety of maps and perform photographic surveys. Alvin also has two robotic arms that can manipulate instruments, obtain samples, and its basket can be reconfigured daily based on the needs of the upcoming dive. Alvin's depth rating of 6,500m gives researchers in-person access to 99% of the ocean floor. Alvin is a proven and reliable platform capable of diving for up to 30 days in a row before requiring a single scheduled maintenance day. Recent collaborations with autonomous vehicles such as Sentry have proven extremely beneficial, allowing PIs to visit promising sites to collect samples and data in person within hours of their being discovered, and UNOLs driven technological advances have improved the ability for scientific outreach and collaboration via telepresence Alvin is named for Allyn Vine, a WHOI engineer and geophysicist who helped pioneer deep submergence research and technology. (from https://www.whoi.edu/what-we-do/explore/underwater-vehicles/hov-alvin/, accessed 2022-09-09)

Dataset-specific Instrument Name	ROV Doc Ricketts
Generic Instrument Name	ROV Doc Ricketts
Generic Instrument Description	The remotely operated vehicle (ROV) Doc Ricketts is operated by the Monterey Bay Aquarium Research Institute (MBARI). ROV Doc Ricketts is capable of diving to 4000 meters (about 2.5 miles). The R/V Western Flyer is the support vessel for Doc Ricketts and was designed with a center well whose floor can be opened to allow Doc Ricketts to be launched from within the ship into the water below. For a complete description, see: https://www.mbari.org/at-sea/vehicles/remotely-operated-vehicles/rov-doc...

Dataset-specific Instrument Name	ROV Lu'ukai
Generic Instrument Name	ROV Lu'ukai
Generic Instrument Description	The UH remotely operated vehicle (ROV) Lu'ukai is a small work-class ROV that can be operated from the R/V Kilo Moana to conduct investigations in waters up to 6,000 meters deep. After beginning operations in early 2018, the Lu'ukai has supported a study of deep-sea biodiversity and ecological processes in the western Clarion-Clipperton Zone, an area where numerous manganese nodule mining exploration claims are located; has maintained and upgraded sensors at the ALOHA Cabled Observatory, the world's deepest operating ocean observatory; and has recovered a failed telecommunications cable used to support acoustic research in local waters.

Dataset-specific Instrument Name	scalpel
Generic Instrument Name	scalpel
Generic Instrument Description	A scalpel, or lancet, or bistoury, is a small and extremely sharp bladed instrument used for dissection and surgery.

Deployments

AT42-10

Website	https://www.bco-dmo.org/deployment/840850
Platform	R/V Atlantis
Start Date	2019-04-28
End Date	2019-05-09
Description	Collaborative Research: Assessing the relative importance of small vs large particles as sources of nutrition to abyssal communities AT42-10; Alvin Dive numbers: D5027-D5030

Pulse 72

Website	https://www.bco-dmo.org/deployment/840845
Platform	R/V Western Flyer
Start Date	2019-10-16
End Date	2019-10-25
Description	Collaborative Research: Assessing the relative importance of small vs large particles as sources of nutrition to abyssal communities Dive numbers: D1196, D1197, D1201

KM1914

Website	https://www.bco-dmo.org/deployment/866828
Platform	R/V Kilo Moana
Start Date	2019-07-18
End Date	2019-07-28
Description	See additional cruise information from Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/KM1914

KM2002

Website	https://www.bco-dmo.org/deployment/866784
Platform	R/V Kilo Moana
Start Date	2020-01-17
End Date	2020-01-26
Description	See additional cruise information from Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/KM2002

KM2008

Website	https://www.bco-dmo.org/deployment/866879
Platform	R/V Kilo Moana
Start Date	2020-07-24
End Date	2020-08-03
Description	See additional cruise information from Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/KM2008

Project Information

Collaborative Research: Assessing the relative importance of small vs large particles as sources of nutrition to abyssal communities (Abyssal food web)

Coverage: California current, Station M (34º 50' N, 123º W) and North Pacific Subtropical Gyre, Station Aloha (22º 45' N, 158º W)

NSF Award Abstract:
The abyssal plains of the oceans cover roughly half of the earth's surface, host enormous reservoirs of biodiversity and mineral resources, and play important roles in nutrient recycling and carbon sequestration. The most important process controlling the structure and function of these ecosystems is the quantity and quality of food (mostly sinking organic particles) that reaches the deep-sea floor. However, we do not fully understand the processes provisioning this vast ecosystem. We propose to evaluate the relative importance of small and larger "marine snow" particles that sink to deep-sea benthic communities by using the stable isotope signature of amino acids within various food sources and trace their consumption by fauna on the seafloor. This project compares ecosystems from the productive waters off California with the nutrient poor central Pacific, north of Hawaii. This project provides novel insights into how surface ocean processes are coupled to food-webs at the deep ocean seafloor and how changes in food sources potentially impact deep-sea communities. This project also provides excellent training opportunities for graduate students, a postdoctoral researcher, and undergraduates at UH and USC, particularly underrepresented minorities who pursue majors in the geosciences. The project will sponsor an annual G6-12 teacher workshop to inform Hawaii educators

about the deep sea and broadly disseminate knowledge to the community. All results are communicated broadly to inform the public as concerns regarding abyssal ecosystems are rising due to interests in deep-sea mining.

The most important process controlling the structure and function of abyssal ecosystems is the quantity and quality of organic material that ultimately reaches the deep-sea floor. Despite the strong relationship between euphotic zone export flux and benthic ecology, studies of abyssal ecosystems have observed a deficit between food supply and benthic community demand. Additional work is therefore needed, particularly with regards to understanding the sources of nutrition to the deep-sea benthos. Recent evidence suggests that small particles may be significant contributors to carbon export, increasing in relative importance with depth in the mesopelagic and reaching the abyssal seafloor. This project is to evaluate the relative importance of small and larger "marine snow" particles to deep-sea benthic communities using a combination of particle flux measurements and state of the art compound specific stable isotope analysis of amino acids (AA-CSIA) at two abyssal locations that contrast in overlying productivity, seasonality, and export magnitude. Time series measurements at these locations (Sta. M off California and Sta. Aloha off Hawaii) provide a rich context for the work. In the mesopelagic central North Pacific larger particles (>53 um) can be resolved from microbially reworked, smaller (0.7-53 um) particles using AA-CSIA. This project is characterizing the isotopic compositions of key individual compounds in a continuum of particle sizes (< 1.0 um suspended particles to large sinking particles >53 um) collected using in situ filtration near the seafloor and bottom-moored sediment traps, thereby defining source-specific isotopic signatures that can be traced into benthic fauna and sediments (that are collected by ROVs and epibenthic sleds). This research to understand pelagic-benthic coupling from particles to megafauna using isotopic measurements at the compound-level will yield novel insights into the importance of small microbially reworked particles to deep-sea benthic food webs. This will more precisely couple surface ocean processes to food-webs at the deep ocean seafloor with implications for understanding climate change effects and the efficiency of energy transfer to higher trophic levels. Furthermore, isotopic measurements can also be used to further parameterize ecosystem models by quantifying trophic position across size classes and thus estimate predator-prey mass ratios in relation to variation in body size spectra, functional type, and ultimately to carbon flux and remineralization. Finally, the results will help refine interpretations of deep-sea paleorecords of past nitrogen dynamics by calibrating potential changes in organic matter isotope values between the surface and seafloor archives.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1829612