AT50-04 Alvin Dive Summary

Website: https://www.bco-dmo.org/dataset/944734
Version: 1
Version Date: 2024-11-27

Project
» Collaborative Research: dispersal depth and the transport of deep-sea, methane-seep larvae around a biogeographic barrier (SALT)

Contributors	Affiliation	Role
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Eggleston, David B.	North Carolina State University (NCSU)	Principal Investigator
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Abstract
List of date, location, depth, and observers for each Alvin dive during the AT50-04 cruise. Dives were used to collect benthic invertebrates from methane seeps in the Gulf of Mexico and Northwestern Atlantic, and to recovery seafloor larval observatory (SLO) equipment deployed on TN391.

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Coverage

Location: Western Atlantic margin and Gulf of Mexico from Woods Hole to Gulfport, Mississippi, depth range 500 m-3300 m
Spatial Extent: **N**:38.048 **E**:-73.822 **S**:26.0397 **W**:-91.508
Temporal Extent: 2022-10-13 - 2022-11-01

Dataset Description

See "Related Datasets" section for other logs and sample lists from this cruise. Data from this and other cruises in this project are listed under the SALT project page https://www.bco-dmo.org/project/820030.

SALT = Seep Animal Larval Transport.

Methods & Sampling

HOV Alvin was used to collect benthic invertebrates via scoops and slurps and to recover previously deployed

equipment. Everything returned to the ship on the Alvin basket, with live animals in plastic bio boxes to provide thermal protection.

Data Processing Description

Changed date to yyyy-mm-dd

Changed coordinates to decimal degrees

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Related Datasets

IsRelatedTo

Young, C. M., Arellano, S. M., Eggleston, D. B., He, R. (2024) **AT50-04 Larval Sample List.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-11-27 http://lod.bco-dmo.org/id/dataset/944748 [view at BCO-DMO]
Relationship Description: Sampling logs and metadata collected during the same cruise as part of the same study.

Young, C. M., Arellano, S. M., Eggleston, D. B., He, R. (2024) **List of biological samples taken during the R/V Atlantis cruise AT50-04 in the Gulf of Mexico and Northwestern Atlantic in late October 2022.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-11-25 http://lod.bco-dmo.org/id/dataset/944426 [view at BCO-DMO]
Relationship Description: Sampling logs and metadata collected during the same cruise as part of the same study.

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Parameters

Parameters for this dataset have not yet been identified

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Instruments

Dataset-specific Instrument Name	
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)

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Deployments

AT50-04

Website	https://www.bco-dmo.org/deployment/944442
Platform	R/V Atlantic Explorer
Start Date	2022-10-13
End Date	2022-11-01

AT50-04_Alvin_Dives

Website	https://www.bco-dmo.org/deployment/944454
Platform	Alvin
Start Date	2022-10-14
End Date	2022-10-31
Description	Date and Dive ID for HOV Alvin Dives from R/V Atlantic Explorer cruise AT50-04. 2022-10-14 AL5110 2022-10-15 AL5111 2022-10-16 AL5112 2022-10-17 AL5113 2022-10-17 AL5114 2022-10-19 AL5115 2022-10-20 AL5116 2022-10-21 AL5117 2022-10-22 AL5118 2022-10-27 AL5119 2022-10-27 AL5120 2022-10-30 AL5121 2022-10-31 AL5122

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Project Information

Collaborative Research: dispersal depth and the transport of deep-sea, methane-seep larvae around a biogeographic barrier (SALT)

Website: https://wp.wwu.edu/arellanolab/category/salt/

Coverage: Methane seeps on the shelf and slope of Louisiana, Mississippi, Florida, North Carolina, Virginia and Maryland

NSF Award Abstract:
Ever since hydrothermal vents and methane seeps were first discovered in the deep ocean more than 40 years ago, scientists have wondered how these isolated communities, fully dependent on underwater "islands" of toxic chemicals, are first colonized by organisms, and how the populations of these specialized animals are exchanged and maintained. These fundamental processes depend on the transport of babies (larvae) by the ocean currents, yet because the larvae are microscopic and diluted in the vastness of the ocean, it is very difficult to determine where and how they drift. This project uses an autonomous underwater vehicle to collect larvae from precise regions of the water column. Larval traps on the bottom and chemical analyses of larval shells will also be used to determine the depths where larvae swim. These findings will provide realistic estimates for mathematical models that show how biology interacts with ocean currents to predict which methane seeps will be colonized by larvae originating at different depths. A detailed knowledge of larval dispersal is needed for conservation and management of the deep sea. Without such information, we cannot know the best placement of marine protected areas, nor can we facilitate the reestablishment of communities impacted by deep-sea mining, drilling, or other human activities. This project will provide hands-on at-sea training for college students to learn the rapidly vanishing skills needed for studies of larvae and embryos in their natural habitats. Learning opportunities will also be available to individuals of all ages through new, interactive exhibits on deep-sea biology and larval ecology produced for small museums and aquaria on the coasts of Oregon, Washington and North Carolina.

Reliable estimates of connectivity among metapopulations are increasingly important in marine conservation biology, ecology and phylogeography, yet biological parameters for biophysical models in the deep sea remain largely unavailable. The movements of deep-sea vent and seep larvae among islands of habitat suitable for chemosynthesis have been inferred from current patterns using numerical modeling, but virtually all such models have used untested assumptions about biological parameters that should have large impacts on the predictions. This project seeks to fill in the missing biological parameters while developing better models for predicting the dispersal patterns of methane seep animals living in the Gulf of Mexico and on the Western Atlantic Margin. Despite the existence of similar seeps at similar depths on two sides of the Florida peninsula, the Western Atlantic seeps support only a subset of the species found in the Gulf of Mexico. It is hypothesized that the ability of larvae to disperse through the relatively shallow waters of the Florida Straits depends on an interaction between the adult spawning depth and the dispersal depth of the larvae. Dispersal depth, in turn, will be influenced by larval flotation rates, swimming behaviors, feeding requirements, and ontogenetic migration patterns during the planktonic period. The recently developed SyPRID sampler deployed on AUV Sentry will be used to collect larvae from precise depth strata in the water column, including layers very near the ocean floor. Larval traps deployed on the bottom at three depths in each region will be used in conjunction with the plankton collections to determine what proportion of larvae are demersal. Comparisons of stable oxygen isotopes between larval and juvenile mollusk shells will provide information on the temperatures (and therefore depths) that larvae develop, and geochemical analyses of larval and juvenile shells will determine whether larval cohorts mix among depth strata. Ocean circulation and particle transport modeling incorporating realistic biological parameters will be used to predict the movements of larvae around the Florida Peninsula for various spawning depths and seasons.

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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851383
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851286
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851421

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