Summary of the HOV Alvin dives that occurred on R/V Atlantis cruise AT42-24 in the Western Atlantic margin and Gulf of Mexico in February and March 2020

Website: https://www.bco-dmo.org/dataset/893852
Data Type: Cruise Results
Version: 1
Version Date: 2023-04-12

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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Abstract
This dataset is a summary of the HOV Alvin dives that occurred on R/V Atlantis cruise AT42-24 in the Western Atlantic margin and Gulf of Mexico (from Woods Hole to Gulfport, Mississippi) in February and March 2020. This was the first sampling cruise of a series of four for the project titled "Collaborative Research: dispersal depth and the transport of deep-sea, methane-seep larvae around a biogeographic barrier", also called "SALT" for short.

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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**:38.0475 **E**:-73.8225 **S**:26.0287 **W**:-91.5049
Temporal Extent: 2020-02-25 - 2020-03-11

Data Processing Description

BCO-DMO Processing:

- renamed fields to comply with BCO-DMO naming conventions;
- changed date format to YYYY-MM-DD.

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Related Datasets

IsRelatedTo

Young, C. (2024) AT42-24: Data sets, Acquisition Information, Event Log. [Dataset] Marine Geoscience Data System (MGDS). Available from https://www.marine-geo.org/tools/search/entry.php?id=AT42-24

Young, C. (2024) Calibrated Near-Bottom Magnetic Field, Navigation, Optical Backscatter, Oxygen and Temperature Data acquired during R/V Atlantis expedition AT42-24 (2020). [Dataset] Marine Geoscience Data System (MGDS). Available from http://www.marine-geo.org/tools/datasets/31942

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Parameters

Parameter	Description	Units
Date	Date of dive	unitless
Dive_Number	Dive number	unitless
Site_Name	Site name	unitless
Lat	Latitude of dive	degrees North
Lon	Longitude of dive	degrees East
Depth	Depth of dive	meters
Pilot	Alvin Pilot	unitless
Port_observer	Name of observer	unitless
Stbd_observer	Name of observer	unitless

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Instruments

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)

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Deployments

AT42-24

Website	https://www.bco-dmo.org/deployment/893627
Platform	R/V Atlantis
Start Date	2020-02-24
End Date	2020-03-13
Description	See more information at R2R: https://www.rvdata.us/search/cruise/AT42-24 During cruise AT42-24, 9 dives were conducted with HOV Alvin to collect animal samples from the seafloor. Seafloor Larval Observatories (SLOs) designed to capture larval dispersal and current data were deployed at each sampling site.

AT42-24_Alvin_Dives

Website	https://www.bco-dmo.org/deployment/944977
Platform	HOV Alvin
Start Date	2020-02-25
End Date	2020-03-11
Description	Dives 5057 to 5065.

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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
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NSF Division of Ocean Sciences (NSF OCE)	OCE-1851421

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