Larvae from Seafloor Larval Observatory (SLO) benthic traps with RNALater deployed during cruise TN391 (Jun 2021) and recovered on cruise AT50-04 (Oct 2022) in the Gulf of Mexico and Western Atlantic

Website: https://www.bco-dmo.org/dataset/966932
Data Type: Cruise Results
Version: 1
Version Date: 2025-07-07

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

Contributors	Affiliation	Role
Arellano, Shawn M.	Western Washington University - Shannon Point Marine Center (SPMC)	Principal Investigator
Eggleston, David B.	North Carolina State University (NCSU)	Principal Investigator
Young, Craig M.	University of Oregon	Principal Investigator
He, Ruoying	North Carolina State University (NCSU)	Co-Principal Investigator
Plowman, Caitlin Q.	University of Oregon	Technician
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Abstract
As part of the Seep Animal Larval Transport (SALT) project, Seafloor Larval Observatories were deployed at various methane seep sites in the Gulf of Mexico and the Western Atlantic. These observatories included tilt current meters, settlement substrate (scrubbies and sipuncollectors), technicap carousels, and homemade PVC larval traps. The technicap carousels and PVC larval traps had tubes full of fixatives that passively collected larvae from their deployment on TN391 (Jun 2021) and their recovery on AT50-04 (Oct 2022). The technicap carousels only had one tube collecting samples at a time and a motor that changed tubes each month to obtain discrete monthly samples for 12 months. The PVC traps had four sampling tubes, collecting the entire time for an integrated sample. The technicaps were full of RNALater to aid in genetic identification of larvae, and each PVC trap had two tubes of RNAlater and two tubes with 10% buffered formalin to aid in morphological identification of larvae. These data show the morphotypes and abundances of RNALater preserved larvae sorted from the technicaps and larval traps.

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Coverage

Location: Western Atlantic margin and Gulf of Mexico from Pensacola, FL to Woods Hole, depth range 500 m-3300 m
Temporal Extent: 2022-10-13 - 2022-11-01

Dataset Description

SLO metadata tablea are included as supplemental tables in this dataset (See "Files" section).
* 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.
SLO = Seafloor Larval Observatory

Methods & Sampling

Larvae were passively collected via benthic tube traps filled with RNALater. Some samples are from Technicap carousels that only had one tube collecting at a time and a motor that rotated sample tubes each month for 12 discrete monthly samples. Others were from homemade PVC larval traps that collected integrated samples. Traps were deployed in June 2021 on TN391 and recovered in October 2022 on AT50-04. Once recovered, sample tubes were capped and stored in a refrigerator (~4 °C) for months to a year before being processed. Samples were examined under dissecting microscopes and individual larvae picked out by hand by a team of trained graduate and undergraduate students. Isolated larvae were photographed under a compound microscope, individually tubed in fresh RNALater, and shipped to Shawn Arellano's lab at Western Washington University for genetic identification.

Data Processing Description

Samples were examined under dissecting microscopes and individual larvae picked out by hand by a team of trained graduate and undergraduate students. Isolated larvae were photographed under a compound microscope, individually tubed in fresh RNALater, and shipped to Shawn Arellano's lab at Western Washington University for genetic identification.

Additional metadata to accompany data table:

Data compiled on: 11-Jun-25 by: C.Q. Plowman

Description: Larval tube traps deployed as part of the Seafloor Larval Observatories
1) Technicap Carousels - 12 tubes of RNALater and a motor that moves to a new tube each month <- These data
2) PVC Larval Traps - two traps, each with 4 tubes of fixative deployed at each site
2 filled with RNALater to aid in genetic identification of larvae <- These data
2 filled with 10% buffered formalin to aid in morphological identification of larvae <- Sorting still in progress
These data are from traps deployed on TN391 and recovered on AT50-04
Sorting occurred in the Young Lab at the Oregon Institute of Marine Biology by a team of graduate and undergraduate students

BCO-DMO Processing Description

* Sheet "Data" of submitted file "AT50-04_Larval Sorting_tube traps_RNALater_11Jun25.xlsx" was imported into the BCO-DMO data system for this dataset. Values "NA" and "n/a" imported as missing data values.   Table will appear as Data File: *.csv (along with other download format options).

Missing Data Identifiers:
* In the BCO-DMO data system missing data identifiers are displayed according to the format of data you

access. For example, in csv files it will be blank (null) values. In Matlab .mat files it will be NaN values. When viewing data online at BCO-DMO, the missing value will be shown as blank (null) values.

* Column names adjusted to conform to BCO-DMO naming conventions designed to support broad re-use by a variety of research tools and scripting languages. [Only numbers, letters, and underscores. Can not start with a number]

Problem Description

None

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Related Datasets

IsRelatedTo

Young, C. M., Arellano, S. M., Eggleston, D. B., He, R. (2024) **AT50-04 Alvin Dive Summary.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-11-27 http://lod.bco-dmo.org/id/dataset/944734 [view at BCO-DMO]
Relationship Description: Related 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) **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: Related 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: Related 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. (2025) **MOCNESS tow and sampling metadata from 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 2025-07-08 http://lod.bco-dmo.org/id/dataset/967487 [view at BCO-DMO]
Relationship Description: Related sampling logs and metadata collected during the same cruise as part of the same study.

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Parameters

Parameter	Description	Units
Sample_Method	The type of benthic trap used, either a Technicap carousel with discrete monthly samples or a homemade PVC tube trap with integrated samples.	unitless
Equipment_Num	Equiptment number. Allows one to match the specific trap and thus the deployment location information using the AT50-04 Master Sample List.	unitless
Tube_Num	Refers to the individual sample tube. For Technicaps, this allows the samples to be matched to a specific month. For the PVC larval traps, there are two replicate tubes per trap.	unitless
RecoveryDive	Recovery Dive lists the Alvin (AL####) dive on which the equipment and samples were recovered.	unitless
Site	Site lists the name of the seep site at which the equipment was deployed.	unitless
Sample_ID	Sample ID is an internal code to keep track of sample throughout the various processing steps. It follows the format of: CruiseID_Dive_EquipmentType_LarvalMorphotypeCode_SampleNumber	unitless
Form_Morphotype_ID	Identifier (internal) for morphotype that starts with a two-letter code and sometimes includes a specific number [keys to the two-letter codes are in the Larval Morphotype Key table (see supplemental files)].	unitless
Photo_ID	Photo_ID Lists the file name(s) for any associated photo(s). It is the same as the sample ID but includes the magnification at which the photo was taken.	unitless
Notes	Notes has any applicable notes recorded during sample processing.	unitless
Num_Individuals_in_tube	Lists how many individual larvae (of the same morphotype) were put into each new sample tube.	unitless
Fixation_Method_in_tube	Lists the fresh chemical in the tubes of newly isolated larvae.	unitless
Box_Num	Box number identifies which cryovial box houses that sample	unitless
Current_Location	Curent Location shows that all samples have been sent to Shawn Areallano's lab for genetic processing.	unitless

Instruments

Dataset-specific Instrument Name	tube trap
Generic Instrument Name	no_bcodmo_term
Dataset-specific Description	Technicap brand 12-tube carousel and motor in a custom plastic housing. Homemade PVC larval tube traps.
Generic Instrument Description	No relevant match in BCO-DMO instrument vocabulary.

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

TN391

Website	https://www.bco-dmo.org/deployment/893731
Platform	R/V Thomas G. Thompson
Start Date	2021-05-25
End Date	2021-06-20
Description	See more information at R2R: https://www.rvdata.us/search/cruise/TN391 During the TN391 cruise, we conducted 14 dives with the ROV Jason to collect animal specimens from the seafloor and to recover/redeploy Seep Larval Observatories (SLOs) from each sample site. We also had 12 dives with the AUV Sentry to use the SyPRID plankton sampler. Additionally, five CTD casts were conducted during the duration of the cruise.

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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