

Summary of AUV Sentry dives that occurred during R/V Thomas G. Thompson cruise TN391 (Woods Hole, Massachusetts to Gulfport, Mississippi) in May and June 2021

Website: <https://www.bco-dmo.org/dataset/894034>

Data Type: Cruise Results

Version: 1

Version Date: 2023-04-17

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 AUV Sentry dives that occurred during R/V Thomas G. Thompson cruise TN391 (Woods Hole, Massachusetts to Gulfport, Mississippi) in May and June 2021. This cruise was number three in a series of four cruises from 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

Spatial Extent: N:39.04834 E:-73.8202 S:26.02124 W:-91.5051

Temporal Extent: 2021-05-26 - 2021-06-17

Methods & Sampling

ROV Jason dives were coordinated with AUV Sentry Dives utilizing the SyPRID plankton sampler. Dives were conducted during R/V Thomas G. Thompson cruise TN391 (Woods Hole, Massachusetts to Gulfport, Mississippi) in May and June 2021.

Data Processing Description

BCO-DMO Processing:

- converted date-time fields to ISO 8601 format;
- renamed fields to comply with BCO-DMO naming conventions.

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Related Datasets

IsRelatedTo

Eggleston, D. B., Young, C. M., Arellano, S. M., He, R. (2023) **Summary of ROV Jason dives that occurred during R/V Thomas G. Thompson cruise TN391 (Woods Hole, Massachusetts to Gulfport, Mississippi) in May and June 2021.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-04-17 <http://lod.bco-dmo.org/id/dataset/894001> [[view at BCO-DMO](#)]
Relationship Description: ROV Jason dives were coordinated with AUV Sentry Dives on the TN391 cruise.

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Parameters

Parameter	Description	Units
Dive_Number	Dive number	unitless
Site	Site name	unitless
Zooka	?	unitless
Start_ISO_DateTime_UTC	Start date and time (UTC) of dive in ISO 8601 format	unitless
End_ISO_DateTime_UTC	End date and time (UTC) of dive in ISO 8601 format	unitless
Start_Lat	Latitude at start of Sentry deployment	degrees North
Start_Lon	Longitude at start of Sentry deployment	degrees East
Depth	Depth of sampling	meters (m)
Duration	Duration of deployment in hours and minutes	unitless
Volume_sampled	Volume sampled	liters (L)
number_of_larvae	Number of larvae	individuals
larvae_per_liter	Number of larvae per liter	larvae per liter
number_of_morphotypes	Number of morphotypes present	unitless
number_of_new_morphotypes	Number of new morphotypes?	unitless
Preservation	Preservation method	unitless
Container	Type of container	unitless
number_of_containers	Number of containers	unitless
Container_Packaging	Description of container packaging	unitless
Storage	Description of container storage	unitless
Recipient_of_Sample	Recipient of the sample (either WWU or OIMB)	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	AUV Sentry
Dataset-specific Description	AUV Sentry with SyPRID attached
Generic Instrument Description	<p>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</p>

Dataset-specific Instrument Name	
Generic Instrument Name	Sentry Precision Robotic Impeller Driven Sampler
Generic Instrument Description	<p>The SyPRID (Sentry Precision Robotic Impeller Driven) sampler is an innovative deep-rated (6000 m) plankton sampler that partners with the Sentry Autonomous Underwater Vehicle (AUV) to obtain paired, large-volume plankton samples at specified depths and survey lines to within 1.5 m of the seabed and with simultaneous collection of sensor data. SyPRID uses a perforated Ultra-High-Molecular-Weight (UHMW) plastic tube to support a fine mesh net within an outer carbon composite tube (tube-within-a-tube design), with an axial flow pump located aft of the capture filter. The pump facilitates flow through the system and minimizes the bow wave at the mouth opening. The cod end, a hollow truncated cone, is also made of UHMW plastic and is designed to 'soften' the landing of zooplankton on the capture surface. SyPRID attaches as a saddle-pack to the Sentry vehicle. Sentry itself is configured with a flight control system that enables autonomous survey paths to altitudes as low as 1.5 m. In its inaugural deployment at the Blake Ridge Seep (2160 m) on the US Atlantic Margin, SyPRID was operated for 6 h at an altitude of 5 m. It recovered plankton samples from that stratum in excellent condition and with greater larval numbers than recovered in a typical 'near-bottom' MOCNESS sample from comparable habitats and depths. The prototype SyPRID and its next generations will enable studies of plankton or other particulate distributions associated with patchy habitats, localized physico-chemical strata (e.g., above and below the thermocline), or discrete water masses at an unprecedented spatial resolution for a large volume system [1]. More information is available by contacting: Carl Kaiser Program Manager Applied Ocean Physics & Engineering NDSF AUV Operations Manager Office Phone: +1 508 289 3269 ckaiser@whoi.edu [1] Billings, A., Kaiser, C., Young, C. M., Hiebert, L. S., Cole, E., Wagner, J. K. S., & Van Dover, C. L. (2017). SyPRID sampler: A large-volume, high-resolution, autonomous, deep-ocean precision plankton sampling system. In Deep Sea Research Part II: Topical Studies in Oceanography (Vol. 137, pp. 297–306). Elsevier BV. https://doi.org/10.1016/j.dsr2.2016.05.007</p>

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Deployments

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.

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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.wvu.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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