

Deployment, environmental, and larval behavior information from drifting in situ chamber (DISC) deployments in Southwater Caye, Belize between June and August of 2016

Website: <https://www.bco-dmo.org/dataset/739595>

Data Type: Other Field Results

Version: 1

Version Date: 2018-07-27

Project

» [Collaborative Research: The Role of Larval Orientation Behavior in Determining Population Connectivity](#)
(Elacatinus Dispersal II)

Contributors	Affiliation	Role
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Abstract

These data include deployment, environmental, and larval behavior information from a drifting in situ chamber (DISC). The DISC instrument was developed by Claire Paris at the Rosenstiel School of Marine and Atmospheric Sciences (RSMAS) of the University of Miami to observe the movement behavior and orientation of pelagic larvae at sea. The DISC version used for this project was equipped with a 8-inch diameter behavioral chamber, a video camera looking up into the chamber, 3 analog and one digital compass, and environmental sensors for temperature, light, and magnetic field, a drogue, and a surface float with a GPS. A single larva was deployed at a time in the chamber. Two DISC instruments were released at sea at the same time, similar to ocean drifters. They were visually tracked for a set period of time (20-30 minutes) from a small boat and retrieved for the next set of larval deployment. The DISC was deployed in Southwater Caye, Belize (16°43'08"N 88°08'56"W).

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Coverage

Spatial Extent: N:16.83897 E:-88.06593 S:16.78007 W:-88.0817

Temporal Extent: 2016-06-03 - 2016-08-16

Dataset Description

Related Datasets (data collection during same DISC deployments):

* DISC: Data package <https://www.bco-dmo.org/dataset/739221>

* DISC: Temperature and Light <https://www.bco-dmo.org/dataset/739220>

* DISC: Depth, Temperature, and Salinity <https://www.bco-dmo.org/dataset/739541>

Methods & Sampling

The DISC is a free-floating, cylindrical behavioral observation chamber composed of clear acrylic and is used to monitor the behavior of marine larvae in situ. During each trial, an individual fish larva is placed inside of the central arena (20 cm diameter, 10 cm height) which is transparent to odor, light, and sound. The bottom of the arena is made of clear plexiglass, while the top is made of a fine mesh, and the walls are made of a black opaque film. Larvae can swim freely inside of the arena, and their behavior is recorded using a camera system which is supplemented by information on the rotation of the DISC and by records of the environment (temperature, light intensity, salinity, GPS).

For more information about DISC methodology see dataset "DISC: data package" <https://www.bco-dmo.org/dataset/739221>.

Data Processing Description

BCO-DMO Data Manager Processing Notes:

- * added a conventional header with dataset name, PI name, version date
- * modified parameter names to conform with BCO-DMO naming conventions
- * Added ISO timestamp (UTC) for start and stop
- * Values rounded to three decimal places except for lat/lons (5 decimal places) and p_value (2).

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Data Files

File
Belize_Data.csv (Comma Separated Values (.csv), 83.13 KB) MD5:145632b3abd294130489b0490a0d48bd Primary data file for dataset ID 739595

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Parameters

Parameter	Description	Units
deploy_id	The deployment ID; each experiment has a unique number	unitless
leg	The leg ID; each boat trip to collect data was given a unique number	unitless
date_start	The date on which the deployment began; format mm/dd/yyyy	unitless
date_stop	The date on which the deployment ended, though no deployments went through midnight in this dataset; format mm/dd/yyyy	unitless
time_start	The time at which the deployment began; i.e. the beginning of acclimation time; format HH:MM	unitless

time_stop	The Time at which the deployment ended; ie 20 minutes after the start time; format HH:MM	unitless
ISO_DateTime_UTC_start	Timestamp (UTC) in standard ISO 8601:2004(E) format YYYY-mm-ddTHH:MM	unitless
ISO_DateTime_UTC_stop	Timestamp (UTC) in standard ISO 8601:2004(E) format YYYY-mm-ddTHH:MM	unitless
disc_id	An identifier for which DISC this deployment was conducted in (Either DISC A or DISC B)	unitless
depth	The depth of the DISC's chamber during the deployment	meters below surface (m)
bin_id	The ID of the rearing bin the larva was pulled from for the deployment	unitless
batch_id	When a batch of larva was split into multiple bins, multiple bins would have the same batch ID	unitless
fish_age	The age of the larva used for the deployment (Days-post-hatch)	elapsed days
lat_start	The starting latitude for the deployment	decimal degrees
lon_start	The starting longitude for the deployment	decimal degrees
lat_stop	The ending latitude for the deployment	decimal degrees
lon_stop	The ending longitude for the deployment	decimal degrees
sky	The condition of the sky during the deployment; A factor identified either clear; mixed; light clouds; cloudy; or rain	unitless
sea	An indication of the roughness of the sea; A factor identified as 1; 2; 3; 4; or 4+	unitless
wind_dir	The direction (angle) the wind was blowing from during the deployment	degrees
wind_speed	The speed of the wind during the deployment	unknown
tide	The tidal cycle (A factor either ebb or flood)	unitless

location	Distance from the reef (A factor either near or far)	unitless
start_wp	The identifier of the GPS waypoint taken at the start of the deployment from a handheld GPS	unitless
end_wp	The identifier of the GPS waypoint taken at the end of the deployment from a handheld GPS	unitless
drift_direction	The direction the DISC drifted in during the deployment, based on the GPS waypoints taken at start and stop of the deployment (An angle in degrees; cardinal reference)	degrees
drift_distance	This distance the DISC travelled during the deployment, based on the GPS waypoints at beginning and end	meters (m)
In_Behavior	An indication of the health of the larvae at the start of deployment based on diver-assessed behavior (A unitless factor; from 0-5)	unitless
Out_Behavior	An indication of the health of the larvae at the end of deployment based on diver-assessed behavior (A unitless factor; from 0-5)	unitless
n	The number of points used to produce circular statistics	unitless
mean	The mean circular position of a larva, based on the manual track of its location in DISC images (An angle in degrees; cardinal reference)	degrees
se_mean	The standard error of the circular mean above	degrees
kappa	A measure of circular concentration, such that if kappa is 0 the distribution is uniform and if kappa is large the distribution becomes more concentrated around the mean (A unitless number greater than 0)	unitless
variance	The variance of the circular distribution; equal to $1/k$ (A unitless number greater than 0)	unitless
r	The rho-value of the circular distribution; essentially a bounded equivalent of kappa; such that 0 is a uniform distribution and 1 is a distribution of points all equal to the mean (A unitless number greater than 0)	unitless
p_value	The p-value of a Rayleigh's test of uniformity	dimensionless

signif	A logical TRUE or FALSE indicating if the p-value is significant at an alpha of 0.05	Boolean (True False)
turn_n	The number of points used to calculate turning statistics, which will be equal to or smaller than n because it requires three consecutive points being tracked (unitless integer)	unitless
turn_abs_mean	The average turning angle throughout the deployment; absolute value is used so direction of the turn is not represented	degrees
turn_freq_gt45	The number of turns made during the deployment which were greater than 45 degrees	unitless
speed_n	The number of points used to calculate speed statistics, which will be equal to or smaller than n because it requires two consecutive points being tracked	unitless
speed_mean	The average of instantaneous swimming speeds made throughout the deployment	centimeters per second (cm/s)
speed_sd	The standard deviation of instantaneous speeds throughout the deployment	centimeters per second (cm/s)
speed_median	The median value of instantaneous speeds throughout the deployment	centimeters per second (cm/s)
meanTemp	The average temperature of the water throughout the deployment	degrees Celsius
maxTemp	The maximum temperature recorded during the deployment	degrees Celsius
minTemp	The minimum temperature recorded during the deployment	degrees Celsius
meanLight	The average light value recorded during the deployment	lumens per square meter (lux)
maxLight	The maximum value of light recorded during the deployment	lumens per square meter (lux)
minLight	The minimum value of light recorded during the deployment	lumens per square meter (lux)
rotationRange	The amount of rotation the DISC underwent during the deployment	degrees

art	A logical TRUE or FALSE indicating whether or not the concentration of individual points was higher BEFORE accounting for rotation of the DISC	Boolean (True False)
current_strength	The current speed during the deployment; calculated using the drift distance and the length of time of the deployment	centimeters per second (cm/s)
current_bearing	The bearing of the individual larva relative to the direction of the current; calculated from the drift direction and the individual bearing (mean variable)	degrees
wind_bearing	The bearing of the individual larva relative to the direction of the wind; calculated from the wind direction and the individual bearing (mean variable)	degrees
zenith	The zenith angle of the sun - calculated from the date; time; and position of the deployment	degrees
azimuth	The azimuth angle of the sun - calculated from the date; time; and position of the deployment	degrees
azmean	The bearing of the individual larva relative to the azimuth angle of the sun; calculated from the azimuth angle and the individual bearing (mean variable)	degrees
lat	The 'mean' latitude of the deployment in between the starting latitude and ending latitude	decimal degrees
lon	The 'mean' longitude of the deployment in between the starting longitude and ending longitude	decimal degrees
tran_lat	The latitude at the center of the transect where larvae were collected from sponges	decimal degrees
tran_lon	The longitude at the center of the transect where larvae were collected from sponges	decimal degrees
tran_ang	The angle from the center of the individual deployment to the transect center	degrees
tran_bearing	The bearing of the individual larva relative to the angle towards the transect center; calculated from the tran_ang and the individual bearing (mean variable)	degrees
lab_lat	The latitude of the lab where larvae were reared on Southwater Cay	decimal degrees

lab_lon	the longitude of the lab where larvae were reared on Southwater Cay	decimal degrees
lab_ang	The angle from the center of the individual deployment to the rearing lab	degrees
lab_bearing	The bearing of the individual larva relative to the angle towards the lab; calculated from the lab_ang and the individual bearing (mean variable)	degrees
moonAlt	The altitude angle of the moon - calculated from deployment date; time; and position	degrees
moonAz	The azimuth angle of the moon - calculated from the deployment date; time; and position	degrees
moonHor	A logical TRUE or FALSE indicating if the moon was over the horizon or not	Boolean (True False)
moon_bearing	The bearing of the individual relative to the azimuth angle of the moon; calculated from the moon azimuth and the individual bearing (mean variable)	degrees

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Deployments

DISC_Deployments_Belize

Website	https://www.bco-dmo.org/deployment/740951
Platform	Belize_reefs
Start Date	2016-06-03
End Date	2016-08-18

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Project Information

Collaborative Research: The Role of Larval Orientation Behavior in Determining Population Connectivity (Elacatinus Dispersal II)

Coverage: Belizean Barrier Reef System

Description from NSF award abstract:

Understanding how far young fish move away from their parents is a major goal of marine ecology because this dispersal can make connections between distinct populations and thus influence population size and

dynamics. Understanding the drivers of population dynamics is, in turn, essential for effective fisheries management. Marine ecologists have used two different approaches to understand how fish populations are connected: genetic methods that measure connectivity and oceanographic models that predict connectivity. There is, however, a mismatch between the predictions of oceanographic models and the observations of genetic methods. It is thought that this mismatch is caused by the behavior of the young, or larval, fish. The objective of this research is to study the orientation capabilities of larval fish in the wild throughout development and under a variety of environmental conditions to see if the gap between observations and predictions of population connectivity can be resolved. The project will have broader impacts in three key areas: integration of research and teaching by training young scientists at multiple levels; broadening participation of undergraduates from underrepresented groups; and wide dissemination of results through development of a website with information and resources in English and Spanish.

The overall objective of the research is to investigate the role of larval orientation behavior throughout ontogeny in determining population connectivity. This will be done using the neon goby, *Elacatinus lori*, as a model system in Belize. The choice of study system is motivated by the fact that direct genetic methods have already been used to describe the complete dispersal kernel for this species, and these observations indicate that dispersal is less extensive than predicted by a high-resolution biophysical model; *E. lori* can be reared in the lab from hatching to settlement providing a reliable source of larvae of all ages for proposed experiments; and a new, proven behavioral observation platform, the Drifting In Situ Chamber (DISC), allows measurements of larval orientation behavior in open water. The project has three specific objectives: to understand ontogenetic changes in larval orientation capabilities by correlating larval orientation behavior with developmental sensory anatomy; to analyze variation in the precision of larval orientation in different environmental contexts through ontogeny; and to test alternative hypotheses for the goal of larval orientation behavior, i.e., to determine where larvae are heading as they develop.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1459156

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