Trajectories of fifty-five biodegradable drifters in the Belizean Barrier Reef.

Website: https://www.bco-dmo.org/dataset/729896
Data Type: Other Field Results
Version: 1
Version Date: 2018-03-08

Project
» An Integrative Investigation of Population Connectivity Using a Coral Reef Fish (Elacatinus Dispersal I)

Contributors	Affiliation	Role
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Abstract
Trajectories of fifty-five biodegradable drifters in the Belizean Barrier Reef.

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Coverage

Spatial Extent: **Lat**:16.82 **Lon**:-87.97
Temporal Extent: 2013-05 - 2013-07

Dataset Description

Trajectories of fifty-five biodegradable drifters.

Methods & Sampling

Methodology:

Methodology is explained in Lindo-Atichati et al. (2016). As a brief summary, we constructed a hierarchy of four ocean-atmosphere models operating at multiple scales within a 1 × 1 deg domain of the Belizean Barrier Reef. The four models are: 1) A Low-resolution Ocean model and Low-resolution Atmospheric model (LOLA); (2) A High-resolution Ocean model and Low-resolution Atmospheric model (HOLA); (3) A High-resolution Ocean

model and High-resolution Atmospheric model (HOHA); (4) A High-resolution Ocean model and High-resolution Atmospheric model with Tidal forcing (HOHAT). The ocean models are based on the HYbrid Coordinate Ocean Model (HYCOM, Bleck, 2002; Chassignet et al., 2003; Wallcraft et al., 2009). The atmospheric models are based on the non-hydrostatic Weather Research and Forecasting (WRF) and on the Navy Operational Global Atmospheric Prediction System (NOGAPS). The drifter data was from surface drifters provided by the Consortium for Advanced Research on Transport of Hydrocarbon in the Environment (CARTHE).

Sampling and analytical procedures:

From May 30 to July 2 of 2013, 55 drifter deployments were made at 1–5 km off a 40 km stretch of the BBR centered on South Water Caye (16.82 deg N, 87.97 deg W) (Fig. 2 b and c of Lindo-Atichati et al (2016)). The hierarchy of four ocean-atmosphere models were used for the larger area from 16.35 to 17.30 deg N, and from 87.48 to 88.47 deg W (Fig. 1 of Lindo-Atichati et al (2016)).

Instruments:

The drifters are drogued at 40 cm and designed to sample the near-surface current while minimizing windage. They are tracked using Global Positioning System (GPS) every second with 5 m accuracy. The GT-31 GPS receivers are set in a waterproof housing attached to the drifter.

Data Processing Description

Data was processed with AWK IEEE Std 1003.1-2008 for data extraction, with Matlab version R2014a for data manipulation and statistical analysis, and with Generic Mapping Tools GMT version 4 for mapping.

BCO-DMO Data Processing Notes:

-Converted lat and lon to decimal degrees
-Added ISO_DateTime_UTC column to data
-Reformatted column names to comply with naming standards
-Added orig_file_name column to capture the metadata in all original file names

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Data Files

File
drifter.csv (Comma Separated Values (.csv), 52.12 MB) MD5:18ce344160d1ca849152fd27fbcb4b12 Primary data file for dataset ID 729896

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Related Publications

Lindo-Atichati, D., Curcic, M., Paris, C. B., & Buston, P. M. (2016). Description of surface transport in the region of the Belizean Barrier Reef based on observations and alternative high-resolution models. Ocean Modelling, 106, 74–89. doi:10.1016/j.ocemod.2016.09.010
Methods

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Parameters

Parameter	Description	Units
orig_file_name	Original file name in which data were submitted	unitless
GPS_dataType	GPS data type [GPGGA = Global Positioning System Fix Data; GPGLL = Lat, Lon, time data only]	unitless
date	UTC date; yyyymmdd	unitless
UTC_time	UTC time; HHMMSS	unitless
lat	Latitude	decimal degrees
lon	Longitude	decimal degrees
fix_quality	Fix quality [0 = invalid; 1 = valid]	unitless
satellite_number	Number of satellites being used	count
HDOP	HDOP [Horizontal dilution of precision;	unitless
altitude	Altitude in meters above sea level	meters
geoid	Geoid in meters above WGS84 ellipsoid	meters
checksum_data	Checksum data; internal GPS field required to continue recording	unitless
ISO_DateTime_UTC	DateTime ISO UTC formatted	yyyy-MM-dd'T'HH:mm:ss
geoid_units		M
altitude_units		M

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Instruments

Dataset-specific Instrument Name	GPSMAP 76Cx (Garmin)
Generic Instrument Name	GPS receiver
Dataset-specific Description	Used to collect GPS data
Generic Instrument Description	Acquires satellite signals and tracks your location. This term has been deprecated. Use instead: https://www.bco-dmo.org/instrument/560

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Deployments

Belize_2010

Website	https://www.bco-dmo.org/deployment/704795
Platform	lab Buston
Description	Buston lab expeditions to Belize beginning in 2010.

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Project Information

An Integrative Investigation of Population Connectivity Using a Coral Reef Fish (Elacatinus

Dispersal I)

Website: http://people.bu.edu/buston/lab/Welcome.html

Coverage: Belizean Barrier Reef System (16.803 degrees North 88.096 degrees West)

Understanding the patterns, causes and consequences of larval dispersal is a major goal of 21st century marine ecology. Patterns of dispersal determine the rates of larval exchange, or connectivity, between populations. Both physical factors (e.g., water movement) and biological factors (e.g., larval behavior) cause variation in population connectivity. Population connectivity, in turn, has major consequences for all aspects of an organism's biology, from individual behavior to metapopulation dynamics, and from evolution within metapopulations to the origin and extinction of species. Further, understanding population connectivity is critical for the design of effective networks of marine reserves, creation of vital tools in conservation, and the development of sustainable fisheries.

Over the last decade, three methods, each of which tells something slightly different, have emerged as leading contenders to provide the greatest insights into population connectivity. First, coupled biophysical models make assumptions regarding water flow, larval behavior and ecology, to predict population connectivity. Second, indirect genetic methods use spatial distributions of allele frequencies to infer population connectivity. Third, direct genetic methods use parentage analyses, tracing recruits to specific adults, to measure population connectivity. Despite advances, lack of integration means that we do not know the predictive skill of biophysical models, or the extent to which patterns of dispersal predict spatial genetic structure. The overall objective of this proposal is to conduct an integrated investigation of population connectivity, using all three methods in one tractable system: the neon goby, Elacatinus lori, on the Belizean Barrier Reef. There are three motives for this choice of study system: i) fourteen highly polymorphic microsatellite loci have been developed, facilitating the assignment of recruits to parents using parentage analyses and the measurement of dispersal; ii) the physical oceanography of the Belizean Barrier Reef is well-studied, facilitating the development and testing of coupled biophysical models; and, iii) E. lori has a relatively small biogeographic range, facilitating analysis of the spatial distribution of allele frequencies throughout its range.

Broader Impacts. The grant will support one postdoc and two graduate students who will be trained in scientific diving, marine fieldwork, population genetics, biophysical modeling, and mathematical modeling, and will gain collaborative research experience. PIs will incorporate research findings in their courses, which cover all these topics. The grant will also broaden participation of under-represented groups by supporting six undergraduates from groups traditionally underrepresented in STEM fields. In each year of the project there will be an All Participants meeting to reinforce the network of participants. A project website will be developed, in English and Spanish, on the theme of larval dispersal and population connectivity. This will include a resource for K-12 marine science educators developed in collaboration with a marine science educator. All PIs will ensure that results are broadly disseminated to the scientific community and general public via appropriate forms of media.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1260424

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