Multispecies larval otolith increment data from samples collected on R/V F.G. Walton Smith cruises WS0714, WS0720, WS0809 in the Straits of Florida from 2007-2008 (FK Population Connectivity project)

Website: https://www.bco-dmo.org/dataset/529658
Data Type: Cruise Results
Version: 2
Version Date: 2016-10-04

Project
» Linkages Between Larvae and Recruitment of Coral Reef Fishes Along the Florida Keys Shelf: an Integrated Field and Modeling Analysis of Population Connectivity in a Complex System (FK Population Connectivity)

Contributors	Affiliation	Role
Cowen, Robert K.	Oregon State University (OSU-HMSC)	Principal Investigator
Kourafalou, Vassiliki	University of Miami Rosenstiel School of Marine and Atmospheric Science (UM-RSMAS)	Co-Principal Investigator
Paris-Limouzy, Claire B.	University of Miami Rosenstiel School of Marine and Atmospheric Science (UM-RSMAS)	Co-Principal Investigator
Sponaugle, Su	Oregon State University (OSU-HMSC)	Co-Principal Investigator
Shulzitski, Kathryn	University of Miami Rosenstiel School of Marine and Atmospheric Science (UM-RSMAS)	Contact
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Multispecies larval otolith increment data from samples collected on R/V F.G. Walton Smith cruises WS0714, WS0720, WS0809 in the Straits of Florida from 2007-2008.

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Coverage

Spatial Extent: **N**:24.98 **E**:-80.97 **S**:23.15 **W**:-84.81
Temporal Extent: 2007-04-23 - 2007-09-22

Dataset Description

Otolith increment data from five species of coral reef fish collected in the Straits of Florida as 1) larvae in the

plankton inside and outside of mesoscales eddies, 2) late-stage larvae over reefs, and 3) juveniles in reef and rubble habitats.

Related publications and references:
Guigand CM, Cowen RK, Llopiz JK, Richardson DE (2005) A coupled asymmetrical multiple opening closing net with environmental sampling system. Mar. Tech. Soc. J 39, 22-24. doi:10.4031/002533205787444042

Shulzitski K, Sponaugle S, Hauff M, Walter K, D'Alessandro EK, Cowen RK (2015) Close encounters with eddies: oceanographic features increase growth of larval reef fishes during their journey to the reef. Biol Lett 20140746. doi:10.1098/rsbl.2014.0746

Shulzitski K, Sponaugle S, Hauff M, Walter K, Cowen RK (2016) Encounter with mesoscale eddies enhances survival to settlement in larval coral reef fishes. PNAS. doi:10.1073/pnas.1601606113

Methods & Sampling

Ichthyoplankton samples were collected during three cruises aboard the R/V Walton Smith: WS-07-14 (May 29 - June 13, 2007), WS-07-20 (July 30 - August 13, 2007), and WS-08-09 (June 17 - July 1, 2008). During each cruise, samples were collected at seven stations along each of six cross-shelf transects spanning the western Straits of Florida. Ichthyoplankton was collected using a modified Multiple Opening Closing Net and Environmental Sensing System (MOCNESS, Guigand et al. 2005). The MOCNESS sampled discrete 20-m depth bins down to 80 m using paired nets (4 m2 and 1 m2) fitted with 1-mm and 150-µm mesh, respectively. All tows were conducted during daylight hours; samples were preserved immediately in 95% ethanol, and transferred to 70% ethanol upon returning to the laboratory. Specimens used in this study were all collected with the large-mesh nets (i.e., 1-mm). During and after the cruises (i.e., June – September 2007; July – September 2008), late-stage larvae and juveniles were sampled from American Shoal (AS) and Looe Key (LK) reefs in the lower Florida Keys. Four replicate light-traps were deployed at each reef 1 m below the surface and 50 m apart. Traps fished from sunset to sunrise during 15-d periods encompassing both the new and third-quarter lunar phases, when most coral reef fishes settle. One week into light-trap sampling, juvenile collections were initiated by SCUBA divers using quinaldine and hand nets.

The investigators followed standard procedures for analyzing otolith microstructure of a subset of fish from five species (Xyrichtys novacula, Thalassoma bifasciatum, Cryptotomus roseus, Sphyraena barracuda, and Stegastes partitus) to obtain individual growth rates and ages. Standard length (SL) or notochord length (NL) was measured to the nearest 0.01 mm for each fish using a Leica MZ12 dissecting microscope, a Cool Snap-Pro monochrome digital camera, and Image-Pro Plus 4.5 image analysis software (Media Cybernetics). Sagittal (X. novacula, T. bifasciatum, and C. roseus) or lapillar (S. partitus) otoliths were dissected from each sample and stored in immersion oil ~7-14 days while lapillar otoliths of S. barracuda were dissected and sectioned to facilitate reading. All otoliths from a given species were analyzed by a single reader. Otoliths were read along the longest axis at 400X magnification (with the exception of S. barracuda lapilli which were read at 1000X magnification) through a Leica DMLB microscope and with the aid of the digital camera and Image-Pro Plus software. All otoliths were read at least twice, and if the reads differed by ≤ 5%, one read was randomly chosen for analysis. If reads differed by > 5%, a third read was conducted. This third read was then compared to the first two reads. If either comparison differed by ≤ 5%, one read from that comparison was randomly chosen for analysis; otoliths where all reads differed by > 5% were removed from any further analysis.

Data Processing Description

For individuals used in a study to address selective mortality, the investigators provide complete otolith data including increment number, increment width, and otolith radius. For individuals that were only used in a study comparing recent otolith growth between larvae collected inside and outside of mesoscale eddies, the investigators provide a subset of otolith data including larval age, average recent growth, and last otolith radius.

BCO-DMO Processing Notes:
- Modified parameter names to conform with BCO-DMO naming conventions;
- Added the official cruise identifier in the cruise_id column;
- Replaced blanks (missing values) with 'nd' to indicate 'no data';
- Replaced spaces with underscores;

- Replaced "no eddy" with "NE" and "eddy" with "ED" for consistency;
- Formatted dates to mm/dd/yyyy.

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Data Files

File
FL_eddy_otolith.csv (Comma Separated Values (.csv), 3.42 MB) MD5:ef90c2d7a936726b7664d1812470aa54 Primary data file for dataset ID 529658

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Related Publications

Guigand, C. M., Cowen, R. K., Llopiz, J. K., & Richardson, D. E. (2005). A Coupled Asymmetrical Multiple Opening Closing Net with Environmental Sampling System. Marine Technology Society Journal, 39(2), 22–24. doi:10.4031/002533205787444042
Methods

Shulzitski, K., Sponaugle, S., Hauff, M., Walter, K. D., & Cowen, R. K. (2016). Encounter with mesoscale eddies enhances survival to settlement in larval coral reef fishes. Proceedings of the National Academy of Sciences, 113(25), 6928–6933. doi:10.1073/pnas.1601606113
Methods

Shulzitski, K., Sponaugle, S., Hauff, M., Walter, K., D'Alessandro, E. K., & Cowen, R. K. (2015). Close encounters with eddies: oceanographic features increase growth of larval reef fishes during their journey to the reef. Biology Letters, 11(1), 20140746. doi:10.1098/rsbl.2014.0746
Methods

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Parameters

Parameter	Description	Units
cruise_id	Official cruise identifier	unitless
cruise	Designates the cruise during which the larva was collected. The dates of the cruises are as follows: June 2007 (May 29 - June 13), August 2007 (July 30 - August 13), and June 2008 (June 17 - July 1). Hatch window was calculted for all larvae, late-stage larvae, and juveniles. Thus, the cruise designation for each late-stage larva and juvenile was based on the cruise designation of larvae included in their 30 day hatch window.	unitless
species	Species name assigned to each individual based on morphological or genetic identification.	unitless

life_stage	Life stage assigned to each individual. Each "larva" was collected from the plankton using a modified MOCNESS net system; each "Late-stage larva" was collected using light traps that intercept larva as they settle to the reef; each juvenile was collected from reef or rubble habitat using SCUBA, quinaldine, and hand nets.	unitless
eddy_group	Refers to the group assigned to each larva determined by whether or not the station in which it was collected was located inside a mesoscale eddy ("ED") or well outside of a mesoscale eddy ("NE"). Late-stage larvae and juveniles were all assigned to the survivor group ("SUR").	unitless
individual	Refers to the unique number assigned to each individual larva, late-stage larva, or juvenile.	unitless
sample	Refers to the sample number assigned to the MOCNESS net in which the larva was collected, the light trap in which the late-stage larva was collected, or the reef and rubble juvenile collection. Sample formats: e.g.: (WS-07-20)M-44-046(M4:20-40) WS-07-20 = Cruise ID M = Sampling Gear ID (M=MOCNESS) 44 = Master Station 46 = Sequential Station M4 = Net Type (M4=4 square meter MOCNESS frame) 20 = Mininum target depth of tow 40 = Maximum target depth of tow e.g.: AS070712-1 AS = Site designation (AS=American Shoal reef; LK=Looe Key reef) 070712 = Date (year, month, day) 1 = Collection number	unitless
std_len	Refers to standard length measured in mm.	millimeters (mm)
larval_age	Refers to the larval age in days. This is calculated as the total number of increments minus one, since the first increment number designates the core of the otolith.	days
avg_recent_growth	Refers to the average of the last three full daily otolith incrememts measured in um.	micrometers (um)
date_gmt	The GMT date of collection in mm/dd/yyyy format.	unitless
lat	The latitude in decimal degrees of the sampling station.	decimal degrees
lon	The longitude in decimal degrees of the sampling station.	decimal degrees

hatch_date	Date of hatch calcluated by subtracting the total age from the collection date; in mm/dd/yyyy format.	unitless
juv_age	Refers to the number of juvenile increments enumerated on the otolith.	days
total_age	Refers to the total age. For larvae and late-stage larvae this is the same as the larval age. For juveniles this is calculated by adding the larval and juvenile ages together.	days
last_otolith_radius	Refers to outermost otolith radius (distance from the core to the edge of the otolith) measured in um.	micrometers (um)
increment_num	Refers to the number of larval increments marked on the otolith (for larvae and late-stage larvae all increments are larval increments). The first increment is marked at the core of the otolith and the final increment is marked at the outermost edge of the otolith (for larvae and late-stage larvae) or at the inside of the metamorphic band (for juveniles of Thalassoma bifasciatum).	unitless
larval_otolith_radius	Refers to larval otolith radius (distance from the core to outside edge of the larval increment) measured in um.	micrometers (um)
increment_width	Refers to width of each larval increment (um). The outermost larval increment for larvae and late-stage larvae may not be fully formed so was removed from the dataset.	micrometers (um)

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Instruments

Dataset-specific Instrument Name	Cool Snap-Pro monochrome digital camera
Generic Instrument Name	Camera
Dataset-specific Description	Standard length (SL) or notochord length (NL) was measured to the nearest 0.01 mm for each fish using a Leica MZ12 dissecting microscope, a Cool Snap-Pro monochrome digital camera, and Image-Pro Plus 4.5 image analysis software (Media Cybernetics).
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

Dataset-specific Instrument Name	modified Multiple Opening Closing Net and Environmental Sensing System (MOCNESS, Guigand et al. 2005)
Generic Instrument Name	Coupled Asymmetrical MOCNESS
Dataset-specific Description	Ichthyoplankton was collected using a modified Multiple Opening Closing Net and Environmental Sensing System (MOCNESS, Guigand et al. 2005). The MOCNESS sampled discrete 20-m depth bins down to 80 m using paired nets (4 m2 and 1 m2) fitted with 1-mm and 150-µm mesh, respectively. All tows were conducted during daylight hours; samples were preserved immediately in 95% ethanol, and transferred to 70% ethanol upon returning to the laboratory. Specimens used in this study were all collected with the large-mesh nets (i.e., 1-mm).
Generic Instrument Description	The Coupled Asymmetrical Multiple Opening/Closing Net and Environmental Sensing System (MOCNESS) couples two sub-systems (1-m2 and 4-m2 net sizes) working in synchronization. The system allows for sampling of both zooplankton prey and icthyoplankton predator fields by employing a combination system of two sets of nets with different mesh and mouth sizes. This Coupled Asymmetrical MOCNESS, first described by Guigand et al. (2005), was constructed using a 1-m2 and a 4-m2 MOCNESS system from Biological Environmental Sampling System Inc. (B.E.S.S. Inc.). The individual net frames were removed and a new frame was constructed, joining the two systems, at the Rosentiel School of Marine and Atmospheric Science (RSMAS) in Miami. Refer to: Guigand, C.M., Cowen, R.K., Llopiz, J.K., and Richardson, D.E. 2005. A coupled asymmetrical multiple opening closing net with environmental sampling systems. Mar. Technol. Soc. J. 39(2): 22–24. doi:10.4031/002533205787444042.

Dataset-specific Instrument Name	Leica MZ12 dissecting microscope
Generic Instrument Name	Microscope - Optical
Dataset-specific Description	Standard length (SL) or notochord length (NL) was measured to the nearest 0.01 mm for each fish using a Leica MZ12 dissecting microscope.
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

Dataset-specific Instrument Name	Leica DMLB microscope
Generic Instrument Name	Microscope - Optical
Dataset-specific Description	Otoliths were read along the longest axis at 400X magnification (with the exception of S. barracuda lapilli which were read at 1000X magnification) through a Leica DMLB microscope and with the aid of the digital camera and Image-Pro Plus software.
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

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Deployments

WS0714

Website	https://www.bco-dmo.org/deployment/529668
Platform	R/V F.G. Walton Smith
Start Date	2007-05-29
End Date	2007-06-14
Description	See more information about this cruise from the R2R Cruise Catalog.

WS0720

Website	https://www.bco-dmo.org/deployment/529670
Platform	R/V F.G. Walton Smith
Start Date	2007-07-29
End Date	2007-08-14
Description	See more information about this cruise from the R2R Cruise Catalog.

WS0809

Website	https://www.bco-dmo.org/deployment/529671
Platform	R/V F.G. Walton Smith
Start Date	2008-06-17
End Date	2008-07-01
Description	See more information about this cruise from the R2R Cruise Catalog.

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Project Information

Linkages Between Larvae and Recruitment of Coral Reef Fishes Along the Florida Keys Shelf: an Integrated Field and Modeling Analysis of Population Connectivity in a Complex System (FK Population Connectivity)

Website: http://yyy.rsmas.miami.edu/groups/reef-fish-ecology/

Coverage: Upper Florida Keys, Florida, USA

Description from NSF award abstract:
This project deals with the important and timely theme of marine population connectivity. The degree to which populations of benthic marine organisms are connected via the dispersal of larval propagules is a central unanswered ecological and oceanographic question. The complex oceanography of marine systems, and high mortality and diffuse concentrations of larvae make direct measurement of larval sources generally unfeasible, particularly for marine populations distributed along open coastlines. In addition, ecological population connectivity is not only a function of the physical transport of larvae, but also the interaction of factors influencing larval growth, survival, and condition at settlement. For example, oligotrophic open-ocean environments may lead to slower larval growth, longer pelagic larval durations, and lower survivorship of larvae compared to larvae from nutrient-rich nearshore waters. Data indicate that the relative condition of larvae influences their survival on the reef and the degree to which they contribute to the population. Ultimately, as ocean currents, spawning patterns, larval survivorship, settlement, and their interactions are highly variable, the only method for examining ecological population connectivity over multiple time and space scales in oceanographically complex environments will be data-validated three dimensional biophysical models capable of

assessing dispersal outcomes over a wide range of temporal and spatial variation.

The overall goal of this study is to quantify the relative contributions of upstream (far-field) versus local (near-field) sources of reef fish larvae to the Florida Keys. The proposed study will integrate a comprehensive, three dimensional hydrodynamic model with a Lagrangian particle tracking model to connect the pathways between observed ichthyoplankton distributions and larval settlement.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0550732

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