Summary of otolith microstructure data from Stegastes partitus collected by SCUBA dives in the Upper Florida Keys, USA from 2003-2008 (FK Fish Recruitment project, FK Population Connectivity project)

Website: https://www.bco-dmo.org/dataset/523365
Data Type: Other Field Results, experimental
Version: 1
Version Date: 2014-08-15

Project
» Scope and Consequences of Variability in the Early Life History Traits of a Caribbean Coral Reef Fish (FK Fish Recruitment)
» 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
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Abstract
Summary of data from analyses of otoliths from Stegastes partitus collected from the Florida Keys.

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Coverage

Spatial Extent: **N**:25.04348 **E**:-80.35 **S**:24.98717 **W**:-80.43787
Temporal Extent: 2001-06-13 - 2008-08-12

Dataset Description

Summary of data from analyses of otoliths from *Stegastes partitus* collected from the Florida Keys.

Methods & Sampling

Collections were made over many small boat SCUBA dives from 2003-2008; cruises and dives were not numbered.

The otoliths were extracted using standard dissecting techniques and placed in a drop of medium viscosity immersion oil on a microscope slide to clear for a minimum of 30 d. Based on ease of reading, only the lapilli were examined. The clearest lapillus was chosen from each individual and viewed under 400 magnification through a Leica DMLB microscope equipped with a polarized filter between the first stage and light source. The image was captured by a Dage MTI video camera and analyzed using Image Pro Plus 4.5 software (Media Cybernetics). Each otolith was read once blind (i.e., without sample information available) and saved as a digital file. Every 5th individual was measured a second time. The images of the remaining 1029 fish were examined to determine if there was any ambiguity in the placement of the increments and an additional 161 fish were aged a second time, resulting in a total of 418 fish aged twice. Otoliths were rejected where the difference between the first and second reads was > 5%, resulting in six exclusions. Otolith analysis was utilized to determine the following ELHTs: post-settlement age (number of concentric increments after the settlement mark), pelagic larval duration (PLD; number of concentric increments from the primordium to the settlement mark), larval and juvenile growth rates (widths between consecutive increments), and size-at-age (otolith radius-at-each age, including settlement).

Data Processing Description

Raw data were obtained directly from image processing software. This dataset includes the raw data that have not been manipulated. Please refer to the publications below for details on how these raw data were used.

See two publications using these data:
Rankin TL, & Sponaugle S. 2011. Temperature influences selective mortality during the early life stages of a coral reef fish. PLOS ONE 6: e16814. DOI: 10.1371/journal.pone.0016814
Rankin TL, & Sponaugle S. (*in review*). Characteristics of settling coral reef fish are related to recruitment timing and success.

BCO-DMO Processing Notes:
- Modified format of dates;
- Modified parameter names;
- Replaced blanks with nd;
- Added 'site_name' field;
- Added 'site_lat' and 'site_lon' from coordinates provided on project metadata form.

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Data Files

File
otolith_summary.csv (Comma Separated Values (.csv), 277.44 KB) MD5:748cbde18a125da2fa98504fc8f57c80 Primary data file for dataset ID 523365

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Related Publications

Rankin, T. L., & Sponaugle, S. (2011). Temperature Influences Selective Mortality during the Early Life Stages of a Coral Reef Fish. PLoS ONE, 6(5), e16814. doi:10.1371/journal.pone.0016814
Results

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Parameters

Parameter	Description	Units

stage	Life stage of fish upon collection. Larva = late stage larva caught in light trap; Juvenile = < 1 month old juvenile collected during visual survey.	text
date_collected	Year-month-day of collection written as YYYYMMDD.	unitless
collection	For larvae this refers to light trap number fish was collected in. For juveniles this refers to habitat of survey and collection: 1 = reef habitat; 2 = rubble habitat.	integer
site_name	Name of the site.	text
site_code	Code that refers to the site of the survey and collection located off of the upper Florida Keys. FR = French Reef; MO = Molasses Reef; PI = Pickles Reef; SI = Sand Island Reef; TR = Triangles; WB = White Banks.	text
site_lat	Latitude of the site in degrees north.	decimal degrees
site_lon	Longitude of the site in degrees west.	decimal degrees
sample	The sample number of the individual fish in the collection.	integer
std_length	Standard length.	millimeters (mm)
monthly_cohort	Month and two digit year of collection.	mon-yr
site_descrip	Description of location of survey and collection sites; offshore = reefs that part of the bank reef tract; inshore = reefs that are inshore patch reefs; only applies to juveniles.	text
collect_catch_or_density	For larvae this refers to total light trap catch; for juveniles this refers to collection density estimated from 15 5 x 1 m transects and then converted to number of juvenile fish per meter-squared.	numeric
pel_larv_dur	Pelagic larval duration in days which was estimated from the number of daily larval otolith increments.	number of days
juv_age	Juvenile age in days, which was estimated from the number of daily juvenile otolith increments.	days
date_hatched	Date of hatching which was estimated by subtracting PLD and Juv Age from Collect Date. in the format YYYYMMDD	unitless

date_spawn	Date of spawning which was estimated by subtracting 4 days from Hatch Date. in the format YYYYMMDD	unitless
lunar_day_spawn	Lunar day of spawning which was assigned based on Spawn Date with day 1 corresponding to the new moon; day 8 corresponding to the 1st quarter; day 15 corresponding to the full moon; and day 23 corresponding to the 3rd quarter	integer
lunar_phase_spawn	Lunar phase of spawning which was assigned based on Lunar Day with 1st quarter moon: days 5-11; 2nd quarter/full moon: days 12-18; 3rd quarter moon: days 19-26; 4th quarter/new moon: days 27-4.	ordinal
date_settled	Date of settlement which was estimated by subtracting Juv Age from Collect Date. in the format YYYYMMDD	unitless
lunar_day_settled	Lunar day of settlement which was assigned based on Settle Date with day 1 corresponding to the new moon; day 8 corresponding to the 1st quarter; day 15 corresponding to the full moon; and day 23 corresponding to the 3rd quarter.	integer
lunar_phase_settled	Lunar phase of settlement which was assigned based on Lunar Day with 1st quarter moon: days 5-11; 2nd quarter/full moon: days 12-18; 3rd quarter moon: days 19-26; 4th quarter/new moon: days 27-4.	ordinal
tidal_day_settled	Tidal amplitude day of settlement which was assigned based Settle Date with day 1 corresponding to the maximum tidal amplitude closest to the new moon.	?
larval_radius	Otolith radius in um at the last daily larval otolith increment.	micrometers (um)
settle_radius	Otolith radius in um at the settlement otolith increment.	micrometers (um)
otolith_radius	Otolith radius in um to the edge of the otolith.	micrometers (um)
larval_growth_avg	Mean daily larval otolith increment width in um.	micrometers (um)
juv_growth_avg	Mean daily juvenile otolith increment width in um.	micrometers (um)
juv_growth_1_2_d_avg	Mean daily juvenile otolith increment width over the first 2 days post-settlement in um.	micrometers (um)
temp_larval	Mean water temperature at 21 m depth at Conch Reef in the upper Florida Keys averaged over the larval period of each Monthly Cohort.	degrees Celsius (?)

temp_juv	Mean water temperature at 21 m depth at Conch Reef in the upper Florida Keys averaged over the juvenile period of each Monthly Cohort.	degrees Celsius (?)
density_juv	Density of juvenile conspecifics (20-30 mm SL) estimated from 15 5 x 1 m transects and then converted to number of fish per meter-squared; only surveyed in 2007 and 2008.	number of fish per square meter (fish/m^2)
density_int	Density of intermediate conspecifics (30-50 mm SL) estimated from 15 5 x 1 m transects and then converted to number of fish per meter-squared; only surveyed in 2007 and 2008.	number of fish per square meter (fish/m^2)
density_adult	Density of adult conspecifics (> 50 mm SL) estimated from 15 5 x 1 m transects and then converted to number of fish per meter-squared; only surveyed in 2007 and 2008.	number of fish per square meter (fish/m^2)

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Instruments

Dataset-specific Instrument Name	Leica DMLB microscope
Generic Instrument Name	Fluorescence Microscope
Dataset-specific Description	The clearest lapillus was chosen from each individual and viewed under 400 magnification through a Leica DMLB microscope equipped with a polarized filter between the first stage and light source. The image was captured by a Dage MTI video camera and analyzed using Image Pro Plus 4.5 software (Media Cybernetics).
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of fluorescence and phosphorescence instead of, or in addition to, reflection and absorption of visible light. Includes conventional and inverted instruments.

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Deployments

Sponaugle_SCUBA_dives

Website	https://www.bco-dmo.org/deployment/526669
Platform	FK_boat_dock
Start Date	2001-06-13
End Date	2008-08-12
Description	Collections of fish from reefs were made over many small boat SCUBA dives from 2003-2008; cruises and dives were not numbered.

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Project Information

Scope and Consequences of Variability in the Early Life History Traits of a Caribbean Coral Reef Fish (FK Fish Recruitment)

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

Coverage: Upper Florida Keys, Florida, USA

Description from NSF award abstract:
Events occurring during the pelagic larval stage of benthic marine organisms can play an important role in the regulation of open populations. The transition between the pelagic larval stage and the benthic juvenile stage (settlement and metamorphosis) is generally recognized as a critical period in the life of many benthic marine fishes such as coral reef fishes, yet the linkage between these phases had received relatively little attention. Biological traits exhibited during the larval stage can influence not only larval survival, but also the recruitment and survival of subsequent juvenile stages. Patterns of natural variability in early life history (ELH) traits, early juvenile mortality, and trait--related survival are entirely unknown. We currently have no knowledge of which larvae survive to settle successfully, and which of those then survive the early life on the reef, including the energetically expensive process of metamorphosis. While ecological theory concerning the ELH traits that confer higher survival has been developed for larval fishes in temperate systems, rarely has this theory been extended across the transition to juveniles, and very few data are available on the relationship between ELH traits and survival for tropical species such as coral reef fishes.

This field study is designed to investigate patterns of natural variability in the ELH traits of a common Caribbean coral reef fish and the consequences of this variation to the survival of young larvae and juveniles during the transition from the plankton to the reef. Multiple cohorts of newly recruited Thalassoma bifasciatum will be censused and collected from sites in the Florida Keys over several seasons (6 mos.) and hydrographic conditions to identify the relationship between environmental conditions, ELH traits, and recruitment success. Recruits will be collected from replicate sites with high and low densities of resident fishes to examine how variable growth and mortality further influence the distribution of ELH traits of recruits. Examination of the otolith record of late-stage larvae and young juveniles will enable the identification of within--cohort, among-cohort, and among-site differences in ELH traits such as larval growth rates, size-at-age, size and age at settlement, and juvenile growth rates. In addition, cohort-specific condition indices will be measured for late-stage larvae and emerging juveniles (<1 d on the reef). Longitudinal and cross-sectional analyses of otolith records will reveal whether faster-growing, larger or older larvae, or larvae of higher condition preferentially survive, and whether large recruitment events are composed of larvae or recruits with particular ELH traits. An intensive series of juvenile censuses will provide daily age-specific mortality rates, which together with the otolith-derived ELH trait analyses will define the relationship between growth, survival, and selective loss of ELH traits. As such, this field study will be the first broad in situ investigation of the relationship between ELH traits and the survival of larvae and young juvenile reef fishes. Results of this study will contribute to our understanding of the dynamics of this important transitional phase in the life history of coral reef fishes and the factors contributing to recruitment variability in these open populations.

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-9986359
NSF Division of Ocean Sciences (NSF OCE)	OCE-0550732

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