

Coral colony sizes and conditions, of three species of the *Orbicella* complex (*Orbicella annularis*, *O. faveolata* and *O. franksi*) in two donor sites of a reciprocal transplant experiment, Varadero and Punta Brava, 2017

Website: <https://www.bco-dmo.org/dataset/786632>

Data Type: Other Field Results

Version: 1

Version Date: 2020-01-09

Project

» [RAPID: Coral robustness: lessons from an "improbable" reef](#) (Varadero Reef)

Contributors	Affiliation	Role
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Abstract

This dataset contains the primary data of the bathymetric survey of three species of the *Orbicella* complex (*Orbicella annularis*, *O. faveolata* and *O. franksi*). The surveys were performed in two donor sites of a reciprocal transplant experiment: Varadero and Punta Brava. The number of colonies and some physiological traits recorded on a belt transect deployed perpendicular to the reef slope at a series of depths are reported.

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Coverage

Spatial Extent: N:10.3065 E:-75.5856 S:10.1848 W:-75.7442

Temporal Extent: 2017-05-20 - 2017-05-27

Dataset Description

This dataset contains the primary data of the bathymetric survey of three species of the *Orbicella* complex (*Orbicella annularis*, *O. faveolata* and *O. franksi*). The surveys were performed in two donor sites of a reciprocal transplant experiment: Varadero and Punta Brava. The number of colonies and some physiological traits recorded on a belt transect deployed perpendicular to the reef slope at a series of depths are reported.

The number of colonies of each species was recorded on a 50x1 m belt transect deployed perpendicular to the reef slope at a series of depths. Six depths were assessed in Varadero (2, 3, 4.5, 6, 7.5 and 9m) and eight in Rosario (3, 5, 7, 9, 13, 17, 21 and 25m). The colony size (minimum and maximum diameter and height in cm) and percentage of old mortality and recent mortality of all *Orbicella* colonies encountered within the transect are reported.

These data were used in the manuscript "Degradation of the underwater light environment: physiological and ecological consequences for reef corals" submitted to the Journal Nature Communications Biology. [under review, 2019-12-28]

Acquisition Description

The Varadero Reef is located south-west of the Cartagena Bay close to the southern strait that connects the Bay to the Caribbean Sea in Colombia. The Bay is a receiving estuary from the Magdalena River through the Canal del Dique, a man-made channel whose construction and operation dates back almost a century. The bathymetric distribution of the *Orbicella* species complex was evaluated at two reference sites with contrasting exposure to the Dique channel freshwater plume: 1) Varadero reef close to the Dique channel mouth (10° 18'23.3"N, 75° 35'08.0"W), and 2) Rosario reef located 21 km southwest of Varadero, significantly less exposed to the turbid plume from the Dique channel (10° 11'12.1"N, 75° 44'43.0"W).

To estimate the potential negative effect of perturbing the optical properties of water and light penetration on coral survival, we performed ecological surveys of *Orbicella* spp. populations.

Populations were sampled along the whole depth range at which *Orbicella* spp. were observed. Random dives near the experimental sites allowed us to define the depth limits of distribution. The number of colonies of each species was recorded on 10x1 m belt transects deployed perpendicular to the reef slope at six depths in Varadero (2, 3, 4.5, 6, 7.5 and 9m) and eight in Rosario (3, 5, 7, 9, 13, 17, 21 and 25m). Colony size (length D1, wide D2 and height H, in centimeters) and percentage of mortality (both recent and old mortality, using the AGRAA protocol) were also recorded at all transects.

A diving computer Leonardo Cressi Sub was used to determine the depths of surveys. A 50m measuring tape was used to determine the length of the belt transect. A 1m PVC pipe carried by the diver was used to determine the width of each transect.

Processing Description

BCO-DMO Processing Notes:

- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- blank values were replaced with no data value 'nd'

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Related Publications

Degradation of the underwater light environment: physiological and ecological consequences for reef corals” submitted to the Journal Nature Communications Biology [under review, 2020-01] [[details](#)]

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Parameters

Parameter	Description	Units
Site	coral fragment donor site	unitless
Depth	depth at which the survey was performed	meters
Transect	transect identifier	unitless
taxon_code	Orbicella species code: Oann= <i>O. annularis</i> ; Ofav= <i>O. faveolata</i> ; Ofra= <i>O. franksi</i>	unitless
diam_max	Longest diameter of the colony	centimeters
diam_min	Shortest diameter of the colony	centimeters
height	Height of the colony	centimeters
mortality_old	Visible old mortality of the coral tissue (percentage)	unitless
mortality_new	Visible recent mortality of the coral tissue (percentage)	unitless
mortality_total	Total mortality (percentage)	unitless

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Instruments

Dataset-specific Instrument Name	Cressi Leonardo Scuba Dive Computer
Generic Instrument Name	Pressure Sensor
Dataset-specific Description	Used to determine the depths of surveys.
Generic Instrument Description	A pressure sensor is a device used to measure absolute, differential, or gauge pressures. It is used only when detailed instrument documentation is not available.

Dataset-specific Instrument Name	
Generic Instrument Name	Measuring Tape
Dataset-specific Description	A 50m measuring tape was used to determine the length of the belt transect. A 1m PVC pipe carried by the diver was used to determine the width of each transect.
Generic Instrument Description	A tape measure or measuring tape is a flexible ruler. It consists of a ribbon of cloth, plastic, fibre glass, or metal strip with linear-measurement markings. It is a common measuring tool.

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Project Information

RAPID: Coral robustness: lessons from an "improbable" reef (Varadero Reef)

Coverage: Caribbean Sea (10° 18' 10"N, 75° 34' 55"W)

NSF Award Abstract: Coral reefs provide invaluable services to coastal communities, but coral populations worldwide are in a state of unprecedented decline. Studying resilient reefs is of primary importance for coral conservation and restoration efforts. A unique natural experiment in coral resilience to stress has been playing out in Cartagena Bay, Colombia since the Spanish conquistadors diverted the Magdalena River into the Bay in 1582. Varadero Reef at the southern mouth of the Bay has survived centuries of environmental insults and changing conditions with up to 80% coral cover. This reef provides an ideal system to test biological robustness theory. Given that Varadero is a highly perturbed system, we hypothesize that while likely more robust to perturbation than nearby pristine reefs, it will be less physiologically efficient. Some of the large star coral colonies (*Orbicella faveolata*) at this site have existed since before the construction of the Canal del Dique. These coral specimens contain invaluable information regarding the conditions of the Magdalena River watershed and its construction in the XIV century. Changes in turbidity of the plume associated with the urban industrial and agricultural development of Colombia can be documented as variations in calcification rates and changes in the microstructure of the skeleton. The Colombian

government has announced the approval for the construction of a shipping channel that will go right over this reef, with the goal to start dredging as early as Fall 2016 or early 2017. The RAPID funding mechanism would enable immediate collection of data and information of why this reef has survived centuries of environmental stress that can shed light on what genotype combinations of coral and its microbial constituents will fare better in similar conditions at other reef locations around the world. Coral reef conservation biology will benefit from this study by generating data for the development of stress diagnostic tools to identify resilient corals. This project will help broaden participation in science by training a diverse cohort of students to work effectively in the global arena while fostering productive collaborations with several Colombian researchers and educational institutions. Students will also gain cultural empathy and sensitivity through direct engagement with the members of society who are most directly impacted by coral reef degradation (e.g. fishermen). Student researchers from Penn State University will work alongside their Colombian counterparts to develop a series of bilingual blog posts to record the cultural and scientific aspects of this project's research expeditions. The blog postings will be submitted for wide dissemination to the Smithsonian's Ocean Portal where Penn State students have published in the past. An educational coral kit developed by the Medina Lab and extensively tested in schools in the US has been translated into Spanish and will be used in local schools in Cartagena and vicinities. All expedition data and metadata will be incorporated into the Global Coral Microbiome Project's interactive web portal, a responsive outreach tool allows researchers, students and/or teachers to access a wealth of information about every coral colony we sample and to virtually explore coral reefs around the world from any internet-enabled device. This research will generate information to understand functional traits related to symbioses stability under different perturbation regimes. Comparative analyses of microbiome modifications generated during the reciprocal transplantation will allow us to document possible differential responses of the holobionts to acute and chronic stressors relative to corals not exposed to significant levels of perturbation. The development of local bio-optical models of coral calcification and the characterization of the coral holobiont will permit the distinction between the effects in calcification attributed to local turbidity from those that can be attributed to differences in host genotype and/or microbial community composition and function. The information recorded in coral skeletons can be used to reconstruct the rates of agricultural, industrial and urban development of Colombia through the last 5 centuries as changes in the turbidity of the effluent of the Magdalena River.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1642311

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