

Photosynthesis-Irradiance curve (P-E) raw data for coral *Orbicella faveolata* from Varadero and Rosario reef sites, Colombia, Oct. 2016 and May 2017 (Varadero Reef project)

Website: <https://www.bco-dmo.org/dataset/719130>

Data Type: experimental

Version: 2

Version Date: 2018-03-05

Project

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

Contributors	Affiliation	Role
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Abstract

This dataset contains the results of the photosynthetic parameters calculated based on the analysis of the P-E curves from coral fragment of the species *Orbicella faveolata* used in the transplant experiment between three sites: Varadero (10°18'23.3"N, 75°35'08.0"W), Rosario (10°11'12.1"N, 75°44'43.0"W) and Abanico (10°18'5.80"N, 75°34'37.10"W). The tag number/color of each fragment, the date of data collection, and the sites of origin and destination are specified.

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Coverage

Spatial Extent: Lat:10.3028 Lon:-75.5819

Temporal Extent: 2016-10 - 2017-05

Dataset Description

This dataset contains the raw data from the Photosynthesis-Irradiance (P-E) curves for each coral *Orbicella faveolata* from Varadero and Rosario Reef sites.

Related Reference:

Pizarro V, Rodríguez SC, López-Victoria M, Zapata FA, Zea S, Galindo-Martínez CT, Iglesias-Prieto R, Pollock J, Medina M. (2017) Unraveling the structure and composition of Varadero Reef, an improbable and imperiled coral reef in the Colombian Caribbean. PeerJ 5:e4119 <https://doi.org/10.7717/peerj.4119>

Methods & Sampling

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 depth of the particular transplant site in Varadero is 3.5m, while in Abanico, a nearby site with low coral cover, and Rosario, a site inside a marine protected area located south-west with relatively high coral cover, is 3m and 12m.

The P-E curves were constructed by measuring the consumption/evolution of oxygen by each coral fragment used in the transplant experiment after exposing them to different levels of increasing light intensity. A high precision fiber-optical sensor connected to a PC-based oxygen meter was used to measure the oxygen concentration at each light level in hermetic water-jacked chambers with filtered seawater (0.45µm) and controlled magnetic stirrers producing agitation. The temperature was maintained at 28°C. Dark respiration was calculated by averaging the oxygen consumption rate at the beginning (pre-illumination) and at the end (post-illumination) of each incubation. Photosynthetic descriptors were calculated from the P-E curves based on Iglesias-Prieto and Trench (1994) and Osinga et al. (2012).

The software Pyro Oxygen Logger (PyroScience GmbH, Germany) was used to manage the oximeter and data operations during incubations.

Methodology Reference:

- Iglesias-Prieto, R. & R.K. Trench. 1994. Acclimation and adaptation to irradiance in symbiotic dinoflagellates. I. Responses of the photosynthetic unit to changes in photon flux density. *Mar Ecol Prog Ser* 113: 163-175. Stable URL: <http://www.jstor.org/stable/24849586>.
- Osinga, R., R. Iglesias-Prieto and S. Enríquez. 2012. Measuring photosynthesis in symbiotic invertebrates: a review of methodologies, rates and processes. 220-256. In: Najafpour, M.N. (Ed.) *Applied Photosynthesis*. Intech. 422 p. Full text url: <http://library.wur.nl/WebQuery/wurpubs/fulltext/245530>

Data 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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Data Files

File
PE_raw_all_v2.csv (Comma Separated Values (.csv), 71.17 KB) MD5:6bb306aafd0632618f2bbfbd2098a458
Primary data file for dataset ID 719130

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Related Publications

Iglesias-Prieto, R. & R.K. Trench. 1994. Acclimation and adaptation to irradiance in symbiotic dinoflagellates. I. Responses of the photosynthetic unit to changes in photon flux density. *Mar Ecol Prog Ser* 113: 163-175. Stable URL: <http://www.jstor.org/stable/24849586>
Methods

Johnson, M. D., Price, N. N., & Smith, J. E. (2014). Contrasting effects of ocean acidification on tropical fleshy and calcareous algae. *PeerJ*, 2, e411. doi:[10.7717/peerj.411](https://doi.org/10.7717/peerj.411)
Related Research

Osinga, R., R. Iglesias-Prieto & S. Enríquez. 2012. Measuring photosynthesis in symbiotic invertebrates: a review of methodologies, rates and processes. 220-256. In: Najafpour, M.N. (Ed.) *Applied Photosynthesis*.

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Parameters

Parameter	Description	Units
Species	taxonomic species name	unitless
Parent_Colony_id	parent colony number	unitless
Parent_tag_color	parent colony tag color	unitless
Fragment_id	fragment number	unitless
Fragment_tag_color	fragment tag color	unitless
Date_collected	date collected	unitless
Transplanted_from	location coral fragment was transplanted from	unitless
Transplanted_to	location coral fragment was transplanted to	unitless
Chamber_channel	sample chamber identifier	unitless
Light_Level	light level	unitless
Light_integ	light intensity	micromol quanta/meter ² /second
Slope_O2_prod	rate of oxygen production curve	micromol O2/centimeter ² /hour
Rate_O2_prod	rate of oxygen production was normalized per surface area	micromol O2/centimeter ² /hour

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Instruments

Dataset-specific Instrument Name	cosine light sensor (Waltz)
Generic Instrument Name	Light Meter
Generic Instrument Description	Light meters are instruments that measure light intensity. Common units of measure for light intensity are $\mu\text{mol}/\text{m}^2/\text{s}$ or $\mu\text{E}/\text{m}^2/\text{s}$ (micromoles per meter squared per second or microEinsteins per meter squared per second). (example: LI-COR 250A)

Dataset-specific Instrument Name	Optical oxygen meter FireStingO2 (Pyroscience)
Generic Instrument Name	Oxygen Sensor
Dataset-specific Description	Used to measure oxygen evolution.
Generic Instrument Description	An electronic device that measures the proportion of oxygen (O ₂) in the gas or liquid being analyzed

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.

Funding

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

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