Parrotfish bite rates, volume of substrate removed, and estimates of erosional scars for each species observed in surveys at Palau, Yap, the Federated States of Micronesia, Majuro, and Kiritimati from 2017 to 2019

Website: https://www.bco-dmo.org/dataset/735679
Data Type: Other Field Results
Version: 1
Version Date: 2018-05-23

Project
» Adjustment of western Pacific Ocean coral reefs to sea-level rise and ocean warming (Coral Reef Adjustment)

Contributors	Affiliation	Role
van Woesik, Robert	Florida Institute of Technology (FIT)	Principal Investigator, Contact
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Abstract
As part of the reef-composition survey of Palau, Yap, and the Federated States of Micronesia (FSM), the erosion caused by parrotfish grazing at each site was estimated with in-situ data of size and density of parrotfish species. Data were also derived from the scientific literature on the species-specific bite rates and other processes that influence fish bioerosion rates. Field data were collected in Palau and Yap in 2017, in FSM in 2018, and in Majuro and Kiritimati in 2019.

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Coverage

Spatial Extent: **N**:9.65683 **E**:-157.54984 **S**:1.7749 **W**:171.34102
Temporal Extent: 2017 - 2019

Dataset Description

These data were published in van Woesik & Cacciapaglia (2018) and van Woesik & Cacciapaglia (2019).

Methods & Sampling

Field data were collected at the site list locations in Palau (June 2nd to 24th, 2017), Yap (June 25th to July 6th, 2017), the Federated States of Micronesia (FSM) (2018), and Kiritimati and Majuro (2019). The maximum length of each fish species was taken from the literature and the maximum size of each fish was estimated from our

field surveys. The scar proportion and bite volume was estimated using the maximum size of the fish species. Professor Peter Mumby provided bite conversion values.

Data Processing Description

BCO-DMO Data Manager Processing Notes:
- This dataset was originally submitted to BCO-DMO as files;
- removed trailing and leading spaces;
- added a conventional header with dataset name, PI name, version date;
- modified parameter names to conform with BCO-DMO naming conventions;
- Added "ScientificName" which combines Genus and Species columns;
- Species names changed to accepted name after using World Register of Marine Species taxa match tool and communication with PI:
Bulbometopon muricatum to Bolbometopon muricatum
Scarus prasiognathus to Scarus prasiognathos
Scarus psitticus to Scarus psittacus
Scarus spinos to Scarus spinus
Scarus japenensis to Chlorurus japanensis

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Data Files

File
fish_species_data.csv (Comma Separated Values (.csv), 1.06 KB) MD5:c1fb52f450a8531b894aeb86f17be4f2 Primary data file for dataset ID 735679

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Related Publications

Van Woesik, R., & Cacciapaglia, C. W. (2018). Keeping up with sea-level rise: Carbonate production rates in Palau and Yap, western Pacific Ocean. PLOS ONE, 13(5), e0197077. doi:10.1371/journal.pone.0197077
Results

Van Woesik, R., & Cacciapaglia, C. W. (2019). Carbonate production of Micronesian reefs suppressed by thermal anomalies and Acanthaster as sea-level rises. PLOS ONE, 14(11), e0224887. doi:10.1371/journal.pone.0224887
Results

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Related Datasets

IsSupplementTo

van Woesik, R. (2021) **Parrotfish species, density counts, and fish length from field-video surveys in Palau, Yap, the Federated States of Micronesia, Majuro, and Kiritimati from 2017 to 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 3) Version Date 2021-07-15 doi:10.26008/1912/bco-dmo.734979.3 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
Genus	Genus	unitless
Species	Species	untiless
bite_volume_constant	Constant to scale-bite volume based on size of individual fish	unitless
scar_proportion	Probability of scarring coral in a bite (number of scars/bites)	unitless
bite_conv_val	Constant of scale-bite rate and size of fish species relative to erosion impact	unitless
max_length	The size of largest individual fish of that species	centimeters (cm)
max_bite_volume	Volume of coral that the largest sized individual fish could remove in a single bite	centimeters cubed (cm^3)

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Deployments

vanWoesik_Palau_2017

Website	https://www.bco-dmo.org/deployment/744578
Platform	shoreside Palau
Start Date	2017-06-02
End Date	2017-06-24

vanWoesik_Yap_2017

Website	https://www.bco-dmo.org/deployment/744604
Platform	shoreside Yap
Start Date	2017-06-25
End Date	2017-07-06

vanWoesik_FSM_2018

Website	https://www.bco-dmo.org/deployment/823334
Platform	shoreside Micronesia
Start Date	2018-06-24

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Project Information

Adjustment of western Pacific Ocean coral reefs to sea-level rise and ocean warming (Coral Reef Adjustment)

Coverage: Western Pacific: Palau, Yap, Pohnpei, Kosrae, Republic of the Marshall Islands, Kiribati

NSF Award Abstract:
Increases in ocean temperatures and sea-level rise are threatening coral reef ecosystems worldwide. Indeed, some island nations are no more than 1 m above modern sea level. Yet, building sea walls on tropical coasts, to keep out the ocean, as they do in the Netherlands, is a substantial economic burden on small-island nations. Healthy coral reefs, however, have the capacity to lay down sufficient calcium carbonate to grow vertically and keep up with sea-level rise, as they did in the geological past. By contrast, damaged coral reefs do not have the capacity to keep up with sea-level rise, making the coastal communities vulnerable, and inflicting a large economic burden on the coastal societies to build sea walls. In addition, and very recently, coral reefs are being subjected to high water temperatures that are causing considerable damage to corals. This study will ask some critical questions: Are coral reefs in the western Pacific Ocean keeping up with sea-level rise? Where are reefs keeping up with sea-level rise, and what is preventing reefs in some localities from keeping up? This study will also examine whether geographical differences in ocean temperatures influence the capacity of reefs to keep up with sea-level rise. Where coral reefs cannot keep up with sea-level rise, these natural storm barriers will disappear, resulting in the loss of habitable land for millions of people worldwide. The broader impacts of the study will focus on training a post-doctoral researcher, and developing and running one-week training workshops in the proposed study locations in Palau, Yap, Chuuk, Pohnpei, Kosrae, Majuro, and Kiribati. The investigators will work with local stakeholders on the various islands, focusing on connecting science to management practices to reduce local stressors to coral reefs.

Coral reefs are one of the world's most diverse and valuable marine ecosystems. Since the mid-Holocene, some 5000 years ago, coral reefs in the Pacific Ocean have been vertically constrained by sea level. Contemporary sea-level rise is releasing these constraints, providing accommodation space for vertical reef expansion. Yet recently corals have been repeatedly subjected to thermal-stress events, and we know little about whether modern coral reefs can "keep up" with projected future sea-level rise as the ocean temperatures continue to increase. This study will examine whether and where coral reefs are keeping up with sea-level rise across a temperature gradient in the Pacific Ocean, from Palau in the west to Kiribati in the east. The spatial differences in the capacity to keep up with sea level will be explored, and it is hypothesized that differential rates of coral growth and capacity to keep up with sea-level rise will be a function of regional temperatures, local water-flow rates, and land-use. One of the major tasks of this study is to determine the contribution of the various components of each reef to potential carbonate production, across the geographical temperature gradient. The investigators will quantify the rates of carbonate production, by corals and calcareous algae, and the rates of carbonate destruction, by reef eroders, by measuring the space occupied by each benthic component at each study site. The team will then sum that information to interpret the overall capacity of the reef to produce carbonate. At each study site mobile benthic eroders will be estimated, as counts and size measurements of echinoids and herbivorous fishes. The investigators will measure the densities of the different coral species, from different habitats, and develop models that relate the coral morphologies with the potential rate of carbonate deposition. This study will assess the contribution of sea surface temperature, flow rates, and land-use practice to the capacity of reefs to keep up with sea-level rise. Two different approaches will be used to predict the relationship between carbonate production and sea-level rise. The first model will assume that the capacity of vertical reef accretion is directly related to the extension of Porites microatolls at the various island locations. The second model will take a hierarchical Bayesian approach to examine reef growth, which depends on the presence and density of calcifying organisms, and on physical, chemical, and biological erosional processes.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1657633

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