Coral densities and extension rates from scientific literature collected in the field or in laboratories

Website: https://www.bco-dmo.org/dataset/736007
Data Type: Other Field Results
Version: 2
Version Date: 2020-09-30

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

Contributors	Affiliation	Role
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Abstract
As part of reef-composition surveys of Palau, Yap, and the Federated States of Micronesia (FSM), the extension rates and density of coral species were collected from Prachett et al. (2015), meta-analysis of scientific literature, and personal observations to assist with quantifying the production of reef carbonate.

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Coverage

Spatial Extent: **N**:9.65683 **E**:163.03798 **S**:5.26278 **W**:134.22899
Temporal Extent: 2017-06-02 - 2018-06-24

Dataset Description

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

Methods & Sampling

Coral growth rates and densities were derived from the Prachett et al. (2015) dataset. Averages were estimated between the minimum and maximum values. Both extension rates and densities were estimated to the lowest taxonomic level. When the species-level data were not available, the average of genus-specific data was used. Personal observations were used to increase the sample size and increase confidence in the data.

Data Processing Description

BCO-DMO Data Manager Processing Notes:
- added a conventional header with dataset name, PI name, version date;
- replaced "NaN" and "NA" with "nd" to indicate "no data";
- 2020-09-30: updated to version 2.

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Data Files

File
coral_species_info.csv (Comma Separated Values (.csv), 8.59 KB) MD5:eb7846428e389a4cd471c610475b4b98 Primary data file for dataset ID 736007

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Related Publications

Pratchett, M. S., Anderson, K. D., Hoogenboom, M. O., Widman, E., Baird, A. H., Pandolfi, J. M., Edmunds, P.J., & Lough, J. M. (2015). Spatial, temporal and taxonomic variation in coral growth--implications for the structure and function of coral reef ecosystems. Oceanography and Marine Biology: An Annual Review, 53, 215-295. https://isbnsearch.org/isbn/9781498705455
Methods

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) **Transect data of coral species and other substrate types collected in the field using line transects 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 2021-07-14 doi:10.26008/1912/bco-dmo.737508.3 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
spplist	Genus and species name	unitless
Dlist	Density averaged from meta-data	grams per milliliter (g/ml)
Lklist	Extension rates averaged from meta-data	millimeters per year (mm/yr)
extensionratematch	The extension rate was estimated from species-specific values, and when unavailable the extension rate was estimated at the genus level	unitless
Densitymatch	The density was estimated from species-specific values, and when unavailable the density was estimated at the genus level	unitless
morphologies	Coral growth form/morphology from Prachett et al (2015)	unitless
MorphRvW	Coral growth form/morphology was classified from personal observations	unitless
DlistRvW	Density estimates were made from personal observations	grams per milliliter (g/ml)
LklistRvW	Extension rates were made from personal observations	millimeters per year (mm/yr)
CP	Carbonate production	CaCO3 m-2 yr-1

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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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