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

Website: https://www.bco-dmo.org/dataset/734979
Data Type: Other Field Results
Version: 3
Version Date: 2021-07-15

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
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
As part of reef composition survey in Palau (7°30' N, 134°30' E) and Yap (9°32' N, 138°7' E), herbivorous parrotfish were identified to species and analyzed for size from video transects. Survey depth was between 2 to 5 meters due to an interest in determining the potential of shallow-water reef carbonate production. Fishes were videoed along six, 30 m long by 4 m wide transects. The herbivorous parrotfishes in the videos were subsequently analyzed for size (cm) and identity. Surveys in Palau were conducted from June 2 to June 24, 2017, and from June 25 to July 6, 2017 in Yap. In Pohnpei (6.2°N, 158.2°E) and Kosrae (5.3°N, 162.9°E) FSM, six 10-meter transects were used to measure the benthic composition for every centimeter, at each site of 48 sites in 2018. Herbivorous parrotfishes were videoed and identified to species and their estimated length was recorded to the nearest cm along six transects, each of which was 30 m long by 4 m wide. In Majuro (7.0667° N, 171.2667° E) and Kiritimati (1.8721° N, 157.4278° W), a stratified random sampling approach was used to survey the reefs in 2019. At both locations, the sites were stratified as either (i) outer reefs, or (ii) patch reefs in lagoons. The number of sites sampled per habitat varied according to the area of available habitat at each location. Surveys were focused between 2–5 m.

Table of Contents

Coverage

Spatial Extent: **N**:9.65683 **E**:-157.54984 **S**:1.7749 **W**:171.34102
Temporal Extent: 2017-06-02 - 2019-07-22

Dataset Description

These data were published in van Woesik & Cacciapaglia (2018), van Woesik & Cacciapaglia (2019), and van Woesik & Cacciapaglia (2021).

A question mark symbol (?) in the species column indicates that the fish could be identified as a parrotfish but the species could not be identified due to the camera angle. The species name followed by a question mark indicates the identification is uncertain due to the camera angle.

A question mark symbol (?) in the size column indicates the fish could not be accurately measured due to the camera angle.

A question mark symbol (?) in a comment column indicates the species name or size is questionable; the time on the video is recorded for the fish in question.

If a comment column contains a time notation (e.g. "01:00" or ":23"), it refers to the position in the video in minutes and seconds (mm:ss) or seconds (:ss) that the fish was identified.

For more information about the parrotfish species please refer to the Parrotfish species information dataset https://www.bco-dmo.org/dataset/735679.

Methods & Sampling

Palau and Yap:
We used a stratified random sampling approach to survey the reefs of Palau and Yap (Fig A, in S1 File, van Woesik and Cacciapaglia, 2018), by randomly selecting 24 study sites at each island using the package 'sp' in R. We stratified the sites in Palau by outer reefs (8), patch reefs in the lagoon (10), and inner reefs (6). In Yap, which does not have an extensive lagoon and only supports a few rare patch reefs, we stratified the sites by outer reefs (10) and inner reefs (14). The allocation of sites per strata was dependent on the reef area. We were particularly interested in determining the potential of shallow-water reef carbonate production and therefore focused our surveys between 2–5 m. At each site we laid six, 10 m long transect tapes, which followed the contours of the reef substrate. The tapes were placed approximately 2 m between the end of one tape and the start of the next tape. Using these transects we applied the line-intercept method to quantify the planar chord length of each benthic component to the nearest centimeter. At each site we also ran six, 10 m transect lines horizontally along the substrate, above the transects that followed the reef contours, which were used to approximate rugosity, by measuring the length difference between the horizontal and the contour-following lines. Fishes were videoed along six, 30 m long by 4 m wide transects. The herbivorous parrotfishes in the videos were subsequently analyzed for size (cm) and identity. A Cannon HD Vixia HFM500 video camera was used to record the fishes. The fish sizes were estimated, using background information of corals as scales, and all fishes in Palau were verified by Geory Mereb from PICRC (Palau International Coral Reef Center, Palau).

For more details please see van Woesik and Cacciapaglia, 2018.

Federated States of Micronesia (FSM):
Twenty-four study sites were randomly selected in each of Pohnpei (6.2°N, 158.2°E) and Kosrae (5.3°N, 162.9°E) FSM using a randomly stratified sampling approach with the package sp in R. In Pohnpei, reefs were stratified as inner reefs, patch reefs, and outer reefs. In Kosrae, we only stratified the reefs as either inner reefs or outer reefs (because of the lack of patch reefs). Sample size of each strata was determined by calculating the geographic area of each reef type, using the area function from the R package raster, and allocating the number of sites in accordance with the area estimates. Reef surveys focused on the 2–5 meters depth contour to estimate shallow-water carbonate production.

Six, 10 m transects, using a modified line-intercept technique that followed the reef substrate, were used to measure the benthic composition for every centimeter, at each site of the 48 sites. A few meters gap was allocated between the ends of the transects to ensure no overlap of substrate between transects. Herbivorous parrotfishes were videoed and identified to species and their estimated length was recorded to the nearest cm along six transects, each of which was 30 m long by 4 m wide. Care was taken to record the fish-transect videos ahead of the other transects to avoid any disturbance to the fishes.

Majuro (Republic of the Marshall Islands) and Kiritimati (Republic of Kiribati):
A stratified random sampling approach was used to survey the reefs of Majuro (7.0667° N, 171.2667° E) and Kiritimati (1.8721° N, 157.4278° W), by randomly selecting 24 study sites at each island using the package 'sp' in R. In both locations, a stratified random sampling approach was used to survey the reefs for carbonate production by randomly selecting 24 sites on each island, with the exception of Kiritimati where only 22 of the 24 sites were surveyed because of inclement weather. At both locations, the sites were stratified as either (i) outer reefs, or (ii) patch reefs in lagoons. The number of sites sampled per habitat varied according to the area

of available habitat at each location. The investigators were particularly interested in determining the potential of shallow-water reef carbonate production, and therefore focused surveys between 2–5 m. Majuro was surveyed from 6/17/2019 to 7/6/2019 and Kiritimati was surveyed from 7/10/2019 to 7/22/2019.

Data Processing Description

BCO-DMO Data Manager Processing Notes:
Version 1:
- This dataset was originally submitted to BCO-DMO as files "Van Woesik and Cacciapaglia fishes Palau 2017.xlsx" and "Van Woesik and Cacciapaglia fishes Yap 2017.xlsx" which were combined and imported into the BCO-DMO system.
- added column called location with values (Palau|Yap)
- added a conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- Added column name "comment" to unlabeled column
- Missing data identifier "NA" in original file is displayed by default as "nd" for no data in the BCO-DMO system.
- Modified dataset, changed species column (first letter genus + species name) into separate genus and species columns with the genus column containing the full genus name.
- Species names were verified with the data contributor and the World Register of Marine Species taxa match tool. Species name spelling corrected to the accepted spelling (as of 2018-05-09) (Scarus rubroviolacious -> Scarus rubroviolaceus; Scarus altipinnus -> Scarus altipinnis; Scarus prasiognathus -> Scarus prasiognathos)
Version 2:
- 2020-09-09: appended data from sites in Federated States of Micronesia (FSM).
Version 3:
- 2021-07-14: appended data from Kiritimati & Majuro sites.

[table of contents | back to top]

Data Files

File
fishes.csv (Comma Separated Values (.csv), 339.29 KB) MD5:80387c5cd5d6ddbe074201531667c695 Primary data file for dataset ID 734979

[table of contents | back to top]

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

Van Woesik, R., & Cacciapaglia, C. W. (2021). Thermal stress jeopardizes carbonate production of coral reefs across the western and central Pacific Ocean. PLOS ONE, 16(4), e0249008. doi:10.1371/journal.pone.0249008
Results

[table of contents | back to top]

Related Datasets

IsSupplementedBy

van Woesik, R. (2020) **Parrotfish bite rates, volume of substrate removed, and estimates of erosional scars for each species observed in surveys at Palau, Yap, and the Federated States of Micronesia in 2017 and 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2018-05-09 doi:10.26008/1912/bco-dmo.735679.1 [view at BCO-DMO]
Relationship Description: "Parrotfish species information" dataset contains information about the species observed.

van Woesik, R. (2021) **GPS coordinates of stratified random sampled sites where coral, parrotfish, and urchin surveys were conducted 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.735714.3 [view at BCO-DMO]
Relationship Description: The Site list contains the latitude and longitude of each site sampled.

[table of contents | back to top]

Parameters

Parameter	Description	Units
site_num	Site number	unitless
study_site	Study site (one letter)	unitless
transect	Transect number	unitless
genus	Parrotfish genus	unitless
species	Parrotfish species	unitless
size	Total fish length	centimeters (cm)
comment1	Comment	unitless
comment2	Comment	unitless
country	Country of survey	unitless
State	State of study site	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Cannon HD Vixia HFM500 video camera
Generic Instrument Name	Camera
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

[table of contents | back to top]

Deployments

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_Palau_2017

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

vanWoesik_FSM_2018

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

vanWoesik_Kiritibati_2019

Website	https://www.bco-dmo.org/deployment/855679
Platform	Kiritimati
Description	Kiritimati (1.8721° N, 157.4278° W)

vanWoesik_Majuro_2019

Website	https://www.bco-dmo.org/deployment/855678
Platform	shoreside_Majuro
Description	reefs of Majuro (7.0667° N, 171.2667° E)

[table of contents | back to top]

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.

[table of contents | back to top]

Funding

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

[table of contents | back to top]