

# Parrotfish species, density counts, and fish length from field-video surveys in Palau and Yap in 2017 and in the Federated States of Micronesia in 2018

**Website:** <https://www.bco-dmo.org/dataset/734979>

**Data Type:** Other Field Results

**Version:** 2

**Version Date:** 2020-09-09

## 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 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 in 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. 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.

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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).

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>.

## **Acquisition Description**

### **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.

## 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).

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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](https://doi.org/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](https://doi.org/10.1371/journal.pone.0224887)  
*Results*

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## Related Datasets

### IsSupplementedBy

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van Woesik, R. (2018) **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 <http://lod.bco-dmo.org/id/dataset/735679> [[view at BCO-DMO](#)]

*Relationship Description: "Parrotfish species information" dataset contains information about the species observed.*

van Woesik, R. (2020) **GPS coordinates of stratified random sampled sites where coral, parrotfish, and urchin surveys were conducted in Yap and Palau in 2017 and in the Federated States of Micronesia in 2018**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 2) Version Date 2020-09-08 <http://lod.bco-dmo.org/id/dataset/735714> [[view at BCO-](#)

[DMO](#)]

*Relationship Description: The Site list contains the latitude and longitude of each site sampled.*

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## 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 (Yap or Palau)                              | unitless        |
| State      | Federated States of Micronesia state name (Kosrae or Pohnpei) | unitless        |

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## Instruments

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

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## Deployments

### vanWoesik\_Yap\_2017

|                   |   |
|-------------------|---|
| <b>Website</b>    | <a href="https://www.bco-dmo.org/deployment/744604">https://www.bco-dmo.org/deployment/744604</a> |
| <b>Platform</b>   | shoreside Yap   |
| <b>Start Date</b> | 2017-06-25  |
| <b>End Date</b>   | 2017-07-06  |

### vanWoesik\_Palau\_2017

|                   |   |
|-------------------|---|
| <b>Website</b>    | <a href="https://www.bco-dmo.org/deployment/744578">https://www.bco-dmo.org/deployment/744578</a> |
| <b>Platform</b>   | shoreside Palau   |
| <b>Start Date</b> | 2017-06-02  |
| <b>End Date</b>   | 2017-06-24  |

#### vanWoesik\_FSM\_2018

|                   |   |
|-------------------|---|
| <b>Website</b>    | <a href="https://www.bco-dmo.org/deployment/823334">https://www.bco-dmo.org/deployment/823334</a> |
| <b>Platform</b>   | shoreside Micronesia  |
| <b>Start Date</b> | 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                       |
|--|-----------------------------|
| <a href="#">NSF Division of Ocean Sciences (NSF OCE)</a> | <a href="#">OCE-1657633</a> |

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