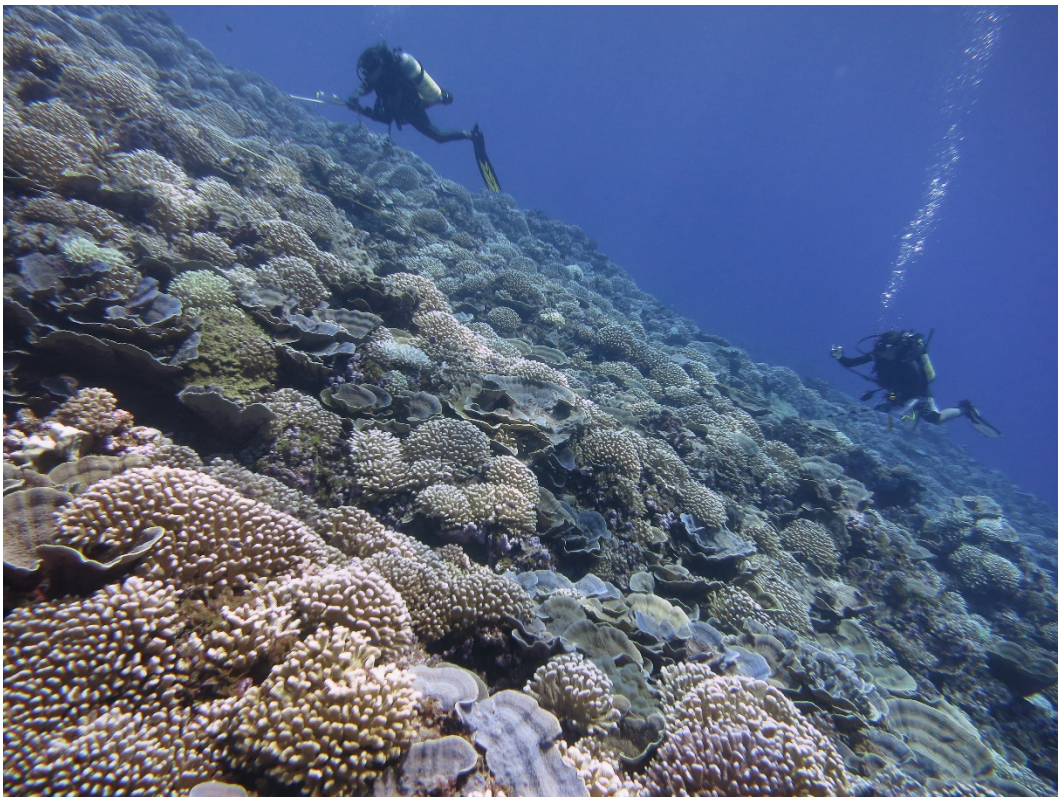
Pacific Islands Fisheries Science Center
Ecosystem Sciences Division

Coral Reef Ecosystem Monitoring Report for the National Marine Sanctuary of American Samoa: 2018



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Executive summary

This report provides an overview of key findings and the current status of coral reefs surveyed by the NOAA Pacific Reef Assessment and Monitoring Program (RAMP) in the National Marine Sanctuary of American Samoa (NMSAS) and surrounding territorial waters between June and July 2018, as well as a temporal comparison to similar surveys conducted during the 2015 RAMP research cruise. These surveys are a component of the Pacific Reef Assessment and Monitoring Program (Pacific RAMP)—a long-term, integrated, ecosystem-scale study led by NOAA's Pacific Islands Fisheries Science Center (PIFSC), Ecosystem Sciences Division (ESD), at about 40 U.S.-affiliated Pacific islands.

The report is divided into three thematic sections:

1- Benthic composition and coral demographics:

   This section reports on site- and sub-island/atoll level (hereafter referred to as "reporting units"), estimates of (1) benthic cover for hard corals, crustose coralline algae, macroalgae, and turf algae; (2) colony density (no. colonies m^{-2}) of juvenile (<5 cm) and adult (≥5 cm) corals; (3) partial mortality as percentage of old and recent dead; (4) prevalence of bleaching (all levels of severity combined: pale to white), and acute and chronic diseases; and (5) coral generic richness.

2- Reef fishes:

   This section reports on the site- and sub-island/atoll level estimates of (1) biomass density (g m^{-2}) of all fishes, piscivores, fishes >50 cm total length (TL), and the IUCN listed *Acanthurus lineatus* and (2) generic and species richness of the fish assemblages.

3- Ocean and climate change:

   This section reports on (1) the time series of representative subsurface temperature (°C) recorders and (2) site- and island/atoll-level estimates of reef aragonite saturation state and other seawater carbonate chemistry parameters.

For the purpose of this report, biological variables were summarized at differing geographic reporting units based on the sub-island/atoll level according to their management status as follows. Sanctuary Management Areas include: Swains Island/Swains Sanctuary, Rose Atoll Sanctuary, Ta'u Sanctuary, Aunu'u zones A and B, and Fagatele/Fagalua (which includes Fagatele bay and Fogama'a/Fagalua bay). Non-Sanctuary Areas include: Ofu and Olosega islands, Ta'u, and Tutuila NE, NW, SE, and SW. In 2018, NOAA Ship delays shifted survey execution by 4 months from February–March (when they traditionally occur) to June–July. Unfortunately, high winds and rough sea conditions in June and July limited small boats' access to much of the east- and south-facing forereef habitats, thereby reducing the spatial extent of the 2018 surveys in comparison to 2015. With the exception of the Ta'u Sanctuary and the Tutuila NW sector, the number of sites surveyed in 2018 for all other reporting units was on average <50% the effort undertaken in 2015. As a result, the graphical output comparing the 2018 and 2015 survey data needs to be interpreted with caution.

Salient findings of this study include:

- At the regional level, there was a significant decline in coral cover from 28.7% ± 2.6 in 2015 to 18.2% ± 2.0 in 2018, a 30% increase in crustose coralline algae (CCA) cover from 17.0% ± 1.6 in 2015 to 22.2% ± 2.5 in 2018, and a substantial reduction of macroalgae from 3.4% ± 0.6 in 2015 to 0.7% ± 0.3 in 2018.

- For all reporting units, density of adult coral colonies in 2018 was greater than that of juveniles across depth strata.

- Mean coral generic richness decreased for most reporting units between 2015 and 2018; however, those differences were not significant except for NE Tutuila. Despite the loss in mean richness, total generic richness per reporting unit did not change over time.

- Coralline orange lethal disease (CLOD) was patchily distributed, and occurrence varied extensively between survey years, as well as within and between reporting units. These differences were driven by reduced number of sites surveyed in 2018 (e.g., Fagatele/Fagalua Sanctuary area) and/or the absence of cases observed in either survey year (e.g., NE Tutuila). Contrastingly, no lesions were recorded at Rose Atoll and Swains Island.

- Two sites along both the northern forereef of Rose and Swains had notably large total fish biomass driven by the biomass of large piscivorous fishes (>50 cm TL). Piscivorous fishes were present at most of the surveyed sites in American Samoa, with the exception of Tutuila. Large fishes were not observed in Fagatele or Fagalua.

- *Acanthurus lineatus* species was notably rare at Swains.

- Total fish biomass significantly increased between 2015 and 2018 at Fagatele and Rose Sanctuary management areas, as well as Ta‘u and SE Tutuila. Substantial increases in the biomass of *Acanthurus lineatus* between 2015 and 2018 were recorded at NW Tutuila, SW Tutuila, and Ofu and Olosega. However, observed biomass was also highly variable at those reporting units.

- Omega aragonite values in American Samoa are traditionally the highest measured across ~40 islands and atolls periodically visited by NOAA’s Pacific RAMP. Locally, Rose Atoll typically exhibits the highest omega aragonite levels and Tutuila the lowest. Within the islands of American Samoa there is not a lot of temporal variation, hence Omega aragonite values were very similar between survey years 2015 and 2018.

- In 2015–2017, summer sea surface temperatures exceeded the bleaching threshold for several months during each year. These sharp and repeated ocean temperature rises during the 2015–2016 El Niño caused prolonged thermal stress and subsequent coral bleaching, which was recorded by the coral demographic surveys in March–April 2015. During this warming event, Swains Island experienced the greatest thermal anomalies with water temperatures of almost 31°C and consequently, the most extensive levels of coral bleaching. By the summer of 2018, the ocean warming event had receded, and temperatures were within the typical range.

Methods

In 2018, biological surveys (benthic and fish) implemented a modified one-stage stratified random sampling (StRS) design (Ault et al. 2006; Smith et al. 2011) to assess the survey domain which encompassed all hard-bottom reef habitat from 0 to 30 m deep within the islands of American Samoa. The stratification scheme incorporated three depth categories—i.e., shallow (0–6 m), mid-depth (>6–18 m), and deep (>18–30 m) where present, and a number of geographic reporting units with differing management status—i.e., Sanctuary Management Areas: Swains Island Sanctuary, Rose Atoll, Ta‘u Sanctuary, Aunu‘u zones A and B, and Fagatele/Fagalua; non-Sanctuary Areas: Swains Island (only reef fishes), Ofu and Olosega islands, Ta‘u, and Tutuila NE, NW, SE, and SW. A complete list of reporting units for benthic and fish surveys is available in Table 1 and Table 3. Rapid Ecological Assessment (REA) sites were randomly selected within each stratum (depth/reporting unit combination), with survey effort proportional to the hard-bottom area within each of the specified strata.

In 2018, the delay in NOAA ship operations shifted sampling to the peak of the high wind season (June–July) resulting in a substantial decrease in the number of surveys, particularly throughout east- and south-facing coral reef habitats. With the exception of the Ta‘u Sanctuary and the Tutuila NW, the number of StRS sites surveyed in 2018 for all other reporting units was on average <50% the effort undertaken in 2015. As such, reporting in many Sanctuary Management Areas, with the exception of Rose, is limited due to low sample size. This was especially true for the Aunu‘u Research Zone (zone B) where adverse conditions completely prevented any surveys. As a result, the graphical output below on the differences between the 2018 and 2015 survey years need to be interpreted with caution.

Benthic Composition and Coral Demographics

In 2018, benthic and coral community structure and composition surveys at each site were conducted along one, 30-m belt transect. Adult coral colonies (≥5 cm) were surveyed, bottom-time permitting, in two to four, 1.0 × 2.5-m segments, located at the 0–2.5 m, 5.0–7.5 m, 10–12.5 m, and 15–17.5 m mark along the transect. Survey area covered a total of 5 to 10 m^2 per transect. All colonies whose center fell within 0.5 m on either side of the transect line were identified to the genus level (Appendix 1), measured for size (maximum diameter to nearest cm), and morphologically classified. In addition, partial mortality and condition of each colony were assessed. Partial mortality was estimated as percent of the colony in terms of ‘old dead’ and ‘recent dead,’ and causation of recent mortality was ascribed only when evident. The condition of each colony, including disease and bleaching, was noted, along with the extent (percent of colony affected) and severity (index scaled from mild to acute). Juvenile coral colonies (<5 cm) were surveyed along three 1.0 m wide by 1.0 long segments at the 0–1.0 m, 5.0–6.0 m, and 10.0–11.0 m (covering 3 m^2) mark of the transect. Juvenile colonies were distinguished in the field by a distinct tissue and skeletal boundary (not a fragment of a larger colony). Each juvenile colony was identified to genus and measured for size by recording both the maximum and perpendicular diameter to the nearest 5 mm. Finally, crustose coralline algae lethal orange disease (CLOD) was enumerated and recorded. Methodological details can be found in Swanson et al. (2018).

Still photographs were collected using the photoquadrat method to document the benthic community composition at predetermined points along the transect line with a high-resolution digital camera mounted on a pole. The camera was white balanced with an 18% grey card prior to taking imagery. Photographs were taken every meter from the 1-m to the 30-m mark. Benthic imagery was collected at additional stratified random sites surveyed for fish assemblages, using the same approach. This generated 30 photographs per benthic and fish survey site, all of which were analyzed implementing the computer software CoralNet (Beijbon et al. 2015). Recently, Williams et al. (2019) established that a fully automated CoralNet ‘robot,’ trained on previous imagery, generated site-level coral cover and CCA cover comparable to human analysts. Therefore, to efficiently extract cover data from 2018 surveys, we used the

fully automated CoralNet robot. Benthic taxa were analyzed to the functional group level, including hard corals, coralline algae, macroalgae, and turf algae While we provide robot-generated macro and turf algae cover, the robot's ability to accurately identify these categories is less accurate than human analysts. A list of benthic metrics surveyed and reported herein is presented in Table 2.

Benthic cover estimates were generated from photoquadrat surveys conducted for benthic and fish assemblages and, therefore, included larger sample sizes for both Sanctuary and non-Sanctuary management areas. Coral demographic estimates were generated from surveys only conducted for benthic assemblages, the unbalanced sample sizes between survey years precludes some broad statements pertaining to spatial and temporal patterns and trends.

For each reporting unit (Table 1; Figure 1), sites within each depth stratum were averaged and weighted proportional to stratum area. Weighted averages were then summed across depth strata to obtain a mean estimate for each reporting unit. If there were not at least two sites in a reporting unit per each of the three depth strata within a survey year, then that reporting unit-year mean was removed from the summary analyses presented herein. The mean weighted estimates for each reporting unit (Table 1) were then used for the spatial and temporal comparisons. Comparative statistics between the survey years 2015 (NOAA 2016) and 2018 (this study) were computed only for those metrics with appropriate sample sizes, based on the 95% confidence interval of the difference in means, whereby if the 95% confidence interval of the difference between means includes zero, the difference between the means is not significant ($P > 0.05$).

Table 1. Summary of benthic surveys conducted in Sanctuary and non-Sanctuary reporting units during the 2018 and 2015 Pacific Reef Assessment and Monitoring Program cruises in the NMSAS.

	2018		2015	
Reporting Unit	**Cover**	**Demographic**	**Cover**	**Demographic**
Sanctuary Management areas				
Rose Atoll	29	14	48	10
Fagatele/Fagalua	9/7	4/4	40/8	13/6
Swains Island	15	7	41	18
Ta'u	10	5	8	5
Aunu'u Zone A	4	4	6	6
Aunu'u Zone B	0	0	37	10
Non-Sanctuary areas				
Ta'u	27	10	59	16
Ofu and Olosega	39	17	82	30
NE Tutuila	31	12	39	17
NW Tutuila	35	13	26	8
SE Tutuila	7	3	68	22
SW Tutuila	12	5	20	7

Coralline lethal orange disease occurrence index (DOI) was estimated as the number of cases (counts) relative to the percent of CCA cover at each survey site as follows: DOI = [(total # of CLOD cases) ÷ (% CCA cover)]. For each reporting unit, CLOD occurrence estimates were computed by directly averaging all sites with each reporting unit; no proportional weighting by depth stratum area was implemented. Values close to or greater than 1 suggest high disease occurrence; comparatively, numbers close to zero indicate low occurrence. No temporal comparative statistics were computed for CLOD occurrence due the unbalanced sample size between survey years.

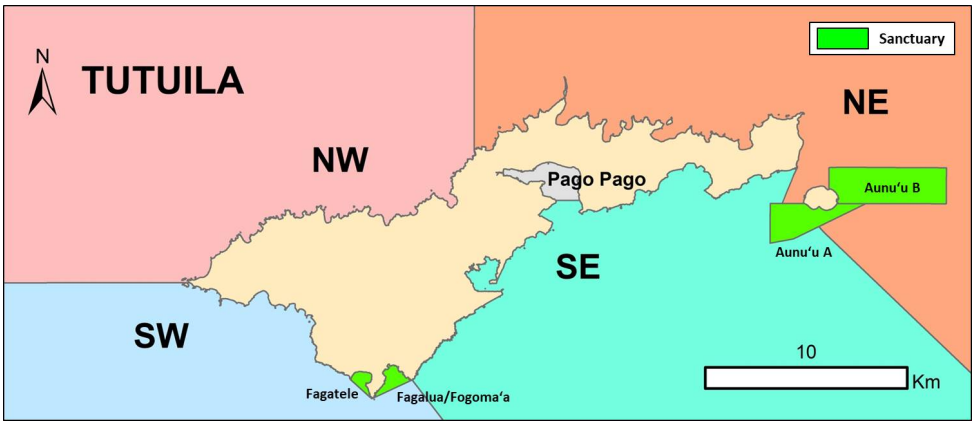

Figure 1. Map illustrating the different reporting units around Tutuila, American Samoa, including four cardinal quadrants, as well as the Sanctuary management areas displayed in green.

Finally, to address the differences in sampling designs between 2015 (2-stage design; NOAA 2016) and 2018 (1-stage design), site-level estimates were calculated by averaging both transects in 2015 and using the single transect in 2018, with the exception of generic richness where estimates were generated based on a standardized survey area (Table 2).

Raw site-level benthic cover and coral demographic data are presented in Appendices 2 and 3.

Table 2. Summary of benthic survey metrics and definitions.

Metric	Definition
Colony Density	Number of colonies m^{-2}
Old Partial Mortality	Average percent of a colony with old mortality for all colonies
Recent Partial Mortality	Average percent of colony with recent mortality for all colonies
Prevalence of Acute Diseases	Percentage of the colonies that are affected by a disease causing active colony mortality
Prevalence of Chronic Diseases	Percentage of the colonies that are affected by a disease not causing active mortality
Prevalence of Bleaching	Percentage of the colonies with any level of pigmentation loss
Generic Richness	Number of genera within a 7 m^2 area at each site. Sampling area was standardized across all sites and years.
Benthic Cover	Percentage of substrate covered by a given benthic category (e.g., coral, CCA, macroalgae, turf algae)
CLOD occurrence	Number of coralline lethal orange disease cases ÷ CCA cover

Reef Fishes

The survey protocol followed the modified stationary point count (SPC) method developed by Ault et al. (2006). Upon reaching a target survey site, a 30-m transect line was laid across the substrate following the bottom contour. Divers used the transect line to locate the centers (7.5 m and 22.5 m) and two edges (0 m and 15 m; or 15 m and 30 m) of their visually estimated 15-m cylindrical survey plot. Each SPC consisted of two components: a 5-minute species enumeration period in which divers recorded all species present in or moving through their cylinder, followed by a tallying portion, in which divers systematically recorded the number and size (total length to nearest cm) of all fishes of each taxon on their list. The tallying

portion was conducted as a series of rapid visual sweeps, with one species grouping counted per sweep. The goal was to obtain a near-instantaneous record of fishes present within each cylinder. In cases where a species was observed during the enumeration period but not present in the cylinder during the tallying period, divers recorded their best estimates of the size and number observed in their first encounter during the enumeration period and marked the data recorded as "non-instantaneous". Herein, both instantaneous and non-instantaneous data are pooled together. Details of our specific survey methods can be found in Ayotte et al. (2015). Finally, 30 digital still photographs were collected along the 30-m transect to record the benthic community composition. Images were analyzed using the software CoralNet following the benthic protocol described above.

For all reef fish surveys, data from the two adjacent cylinders were pooled into a mean value for each site. Using the count and size estimate data collected in each replicate survey, the body-weight of each individual fish was calculated using length-to-weight (LW) conversion parameters and, where necessary, length-length (LL) parameters. LW and LL conversion parameters were taken from FishBase (Froese and Pauly 2010; Kulbicki et al. 2005). Biomass per fish was calculated using the standard length-weight equation. For each reporting unit (Table 3), sites within each stratum were averaged and weighted proportional to stratum area. Weighted averages were then summed across strata to obtain biomass density estimates for each reporting unit. If a reporting unit did not have at least two sites per depth strata —i.e., shallow (0–6 m), mid-depth (>6–18 m), and deep (>18–30 m)—in a survey year, then that reporting unit-year mean was removed from the summary analyses presented herein. The mean weighted estimates for each reporting unit (Table 3) were then used for the spatial and temporal comparisons. Comparative statistics between the survey years 2015 (NOAA 2016) and 2018 (this study) were computed based on the 95% confidence interval of the difference in means, following the same approach as for the benthic metrics, for those for those reef fish metrics with appropriate sample sizes.

Table 3. Summary of reef fish surveys conducted in sanctuary and non-sanctuary reporting units during the 2018 and 2015 Pacific Reef Assessment and Monitoring Program cruises in the NMSAS.

Reporting Unit	No. reef fish surveys		
	2018	2016	2015
Sanctuary Management areas			
Rose Atoll	16	47	37
Swains Island Sanctuary	20	0	23
Aunu'u zone A	0	0	0
Aunu'u zone B	0	0	27
Fagatele and Fagalua	8	0	27
Ta'u	5	9	3
Non-Sanctuary areas			
Ta'u	23	41	43
Ofu and Olosega	25	11	52
NE Tutuila	20	15	27
NW Tutuila	23	32	18
SE Tutuila	12	0	47
SW Tutuila	18	0	15
Swains Island	10	0	9

Raw site-level fish biomass data are presented in Appendix 4.

Ocean and Climate Change

Ocean and climate change monitoring surveys were achieved by means of *in situ* observations of ocean temperature; autonomous and discrete grab sampling for analyses of near reef and surface seawater carbonate chemistry; and distinct biological installations designed to provide integrated, ecosystem-wide response data (e.g., calcification). Methodological details can be found in the 2018 Pacific RAMP Project Report (NMFS 2018).

Temperature data were collected using high-accuracy temperature loggers (Sea-Bird Scientific®, models: SBE39 and SBE56). For reporting, temperature sensor deployments were grouped by site, and temperature data from successive deployments at each site were concatenated. Raw data were averaged hourly, and gaps of longer than one hour in the time-series (due to instrument failure or battery death) were padded with null values.

Aragonite saturation state (Omega aragonite) data were estimated based on discrete seawater samples analyzed for two parameters: dissolved inorganic carbon (DIC) and total alkalinity (TA). Because the marine carbonate system is influenced by salinity, temperature, and pressure, these data were obtained from CTD casts and used during analysis with DIC and TA values to calculate values for omega aragonite. All carbonate system collection and measurement methodologies followed Dickinson et al. (2007).

Raw site-level water chemistry data, salinity, temperature, and pressure derived from CTD casts are presented in Appendix 5.

Results

Benthic Composition and Coral Demographics

2018 Site-level Data

The site-level bubble maps highlight the spatially variable nature of the benthic cover data across islands and management areas (Figure 2A–D).

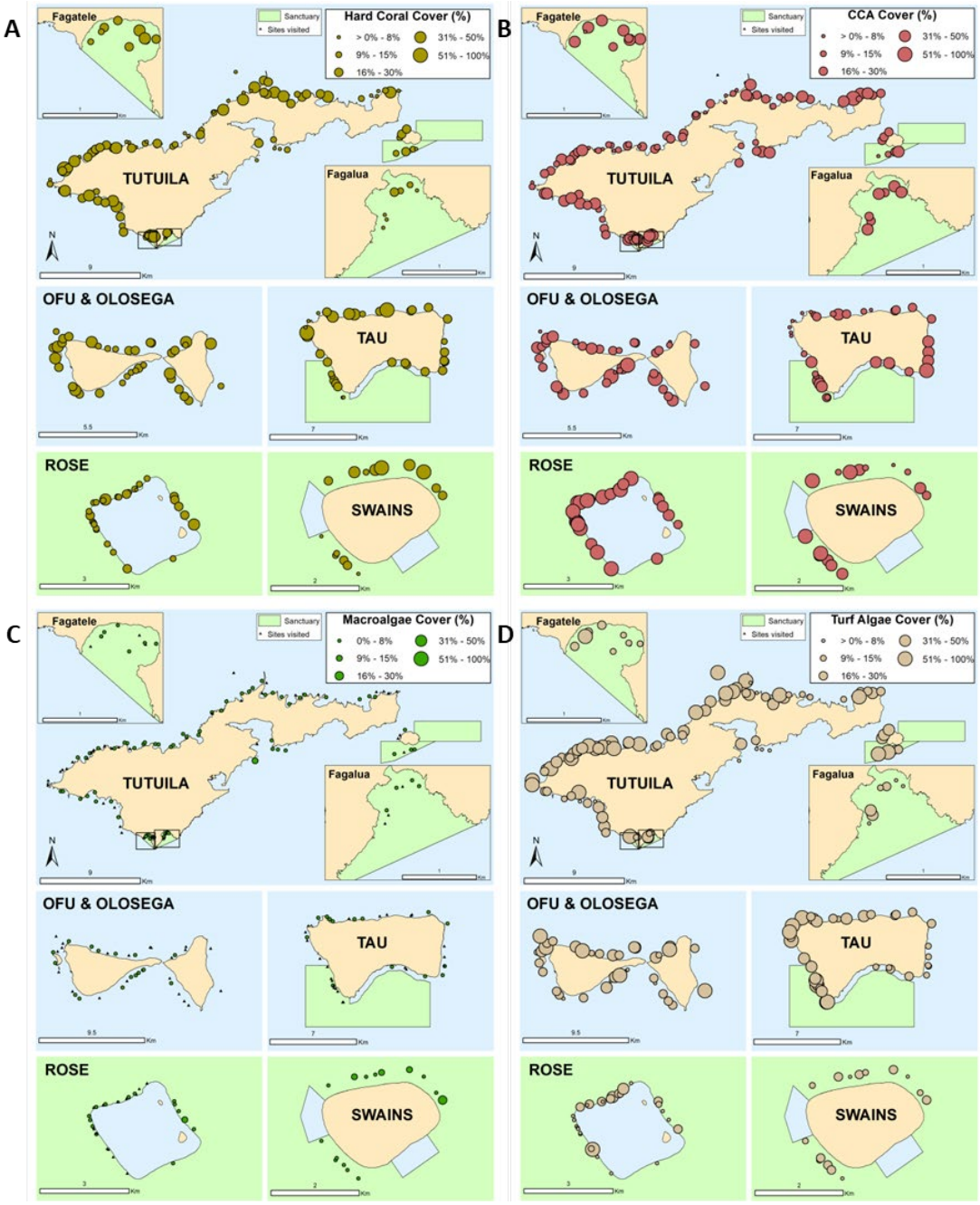

Figure 2. Site-level benthic cover of principal benthic functional groups: hard corals, crustose coralline algae (CCA), macroalgae, and turf algae for reporting units in American Samoa surveyed in 2018.

In 2018, coral cover was variable and moderate within and between the reporting units, with Fagalua and Rose Atoll exhibiting comparatively lower coral cover compared to other areas. CCA cover was moderately high across the reporting units, with Rose Atoll, as expected from historical records, ranking higher than the rest. Contrastingly, fleshy macroalgae cover was notably low across the survey areas, albeit found at a handful of sites around Swains Island. Turf algae showed variable but moderately high levels, particularly at Tutuila, Ofu and Olosega and Ta'u, with the lower levels of turf algae recorded at both Rose Atoll and Swains Island.

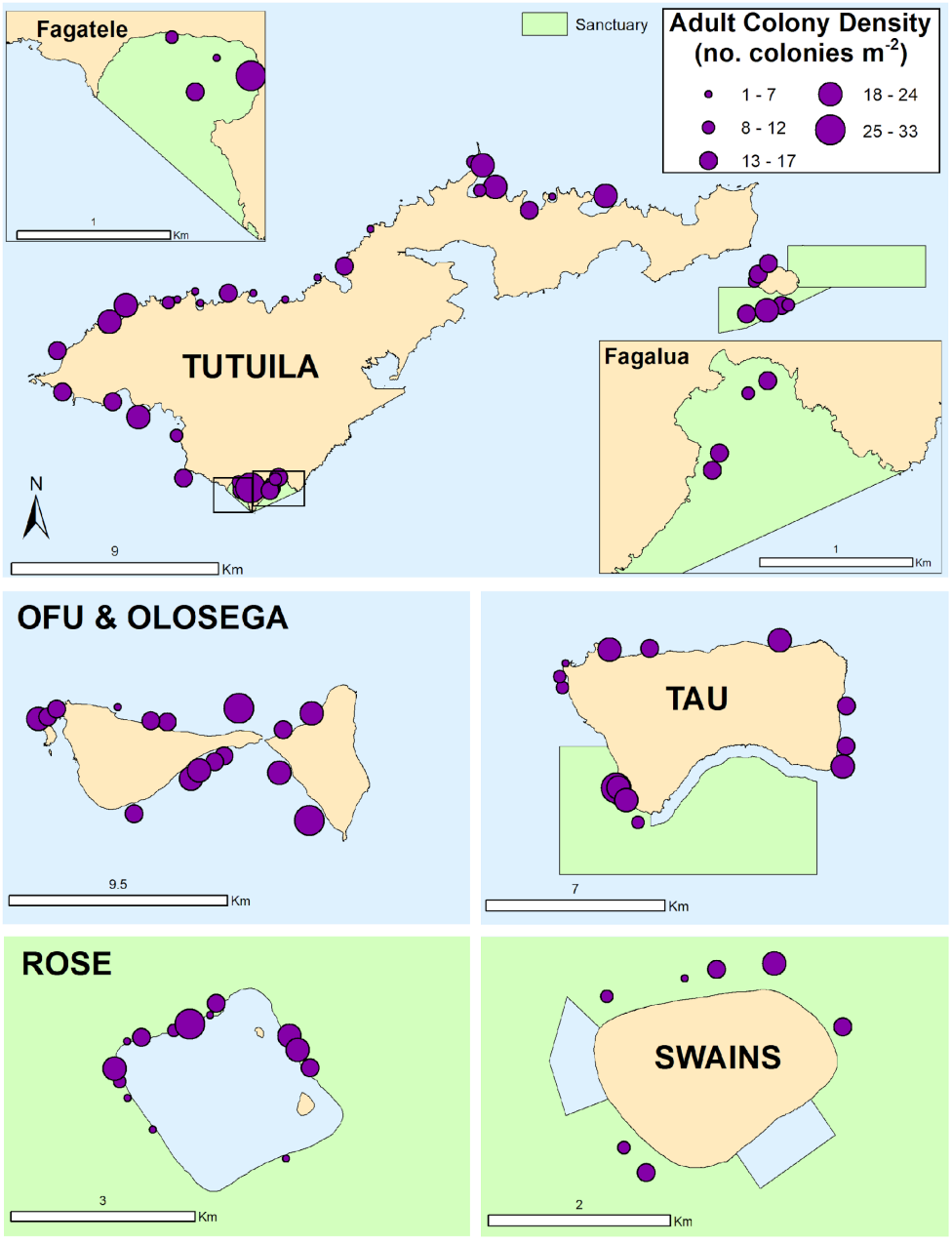

Figure 3. Site-level density (no. colonies m^{-2}) of adult (≥5 cm) coral colonies by site for reporting units in American Samoa surveyed in 2018.

Coral colony densities are mainly driven by the site-specific coral species assemblage and colony size distribution, together with competition for space. In coral community assemblages, higher colony densities are generally indicative of a community skewed toward smaller colony sizes. In 2018, colony densities were spatially variable with no clear trends for any reporting unit (Figure 3). The limited sample sizes attained during the 2018 coral demographic surveys at Swains Island, Ta‘u Sanctuary, and Fagatele/Fagalua preclude any broad statements regarding trends and patterns in those Sanctuary management areas.

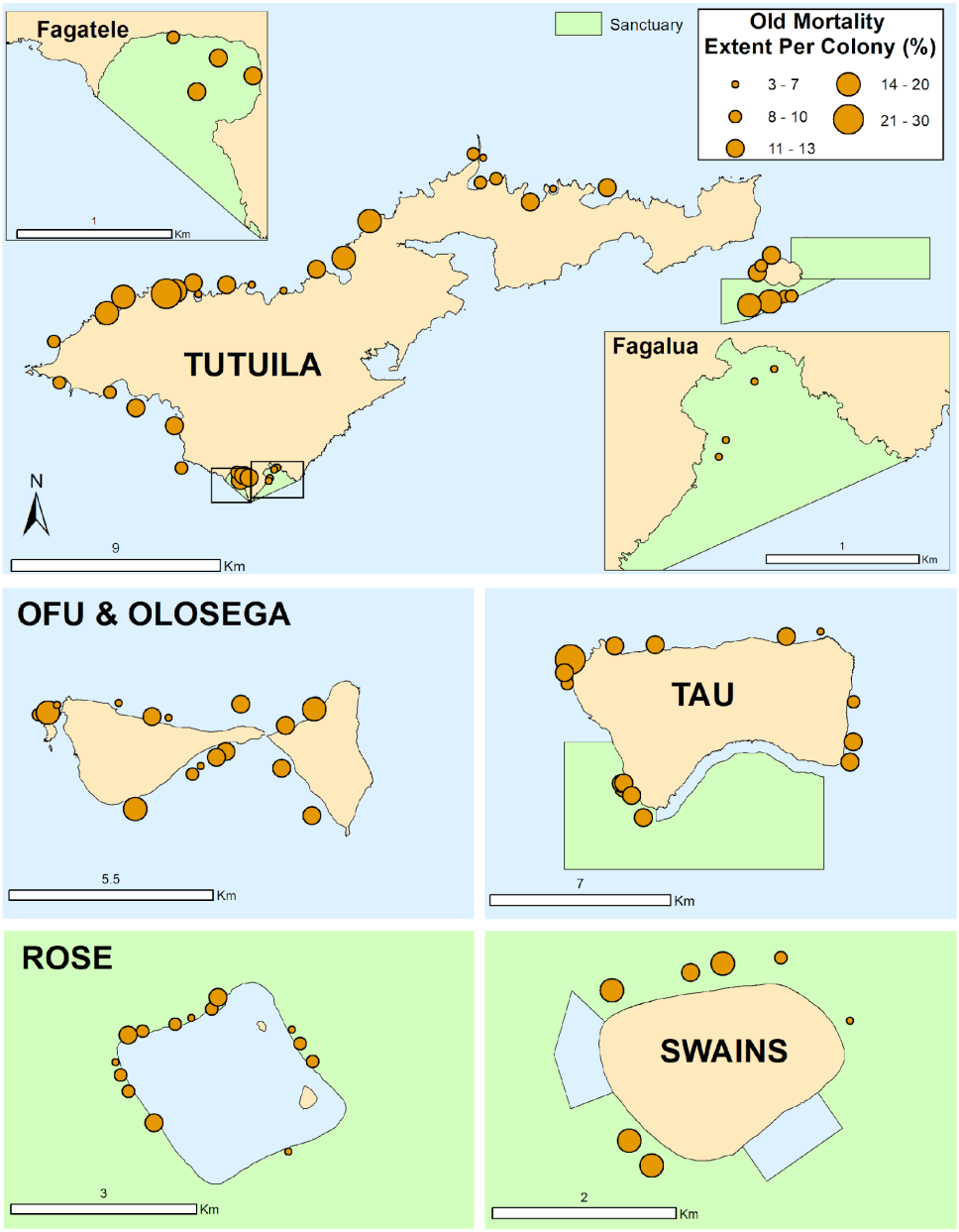

Figure 4. Site-level percent colony old mortality for reporting units in American Samoa surveyed in 2018.

Site-specific patterns of colony old mortality indicate that Rose Atoll reported the lowest levels compared to all other reporting units (Figure 4). This also suggests that corals at Rose Atoll probably sustained the lowest levels of colony mortality in the aftermath of the 2015 bleaching event; likely driven by reduced thermal stress during the 2015 bleaching event, as well as the successive warming events that occurred in 2016 and 2017 (Figure 25).

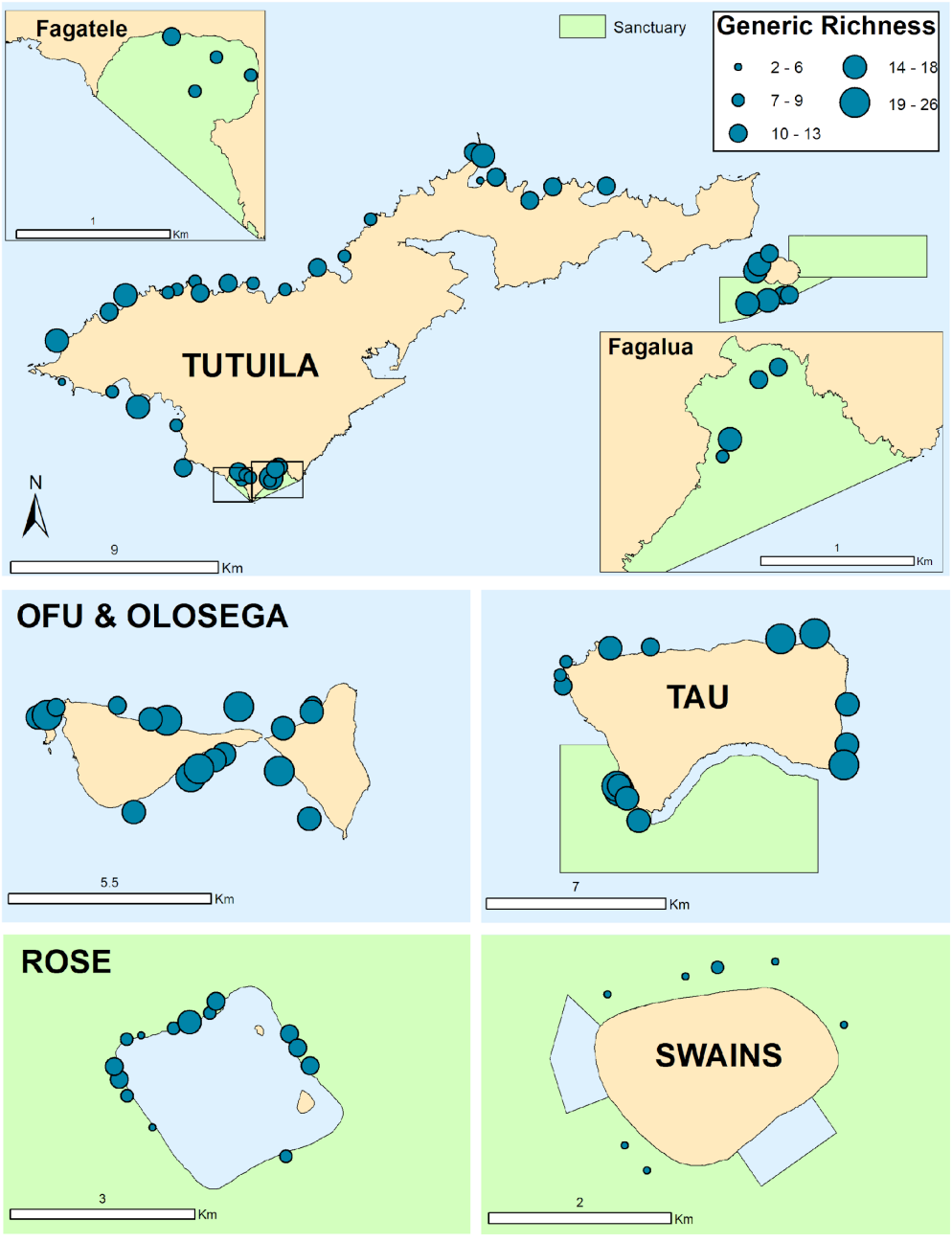

Figure 5. Site-level coral generic richness for reporting units in American Samoa surveyed in 2018.

Patterns of generic richness were consistent with historical observations, with higher number of genera per site observed Ofu and Olosega and Ta‘ū compared to Tutuila (Brainard et al. 2008). Generic richness at Fagatele Bay was unexpectedly low and may be biased by the limited survey effort (4 sites) and the selection of random sites that may have fallen on habitats that had low coral richness. As expected, Swains Island and Rose Atoll exhibited lower levels of generic richness (Figure 5) compared to the other reporting units.

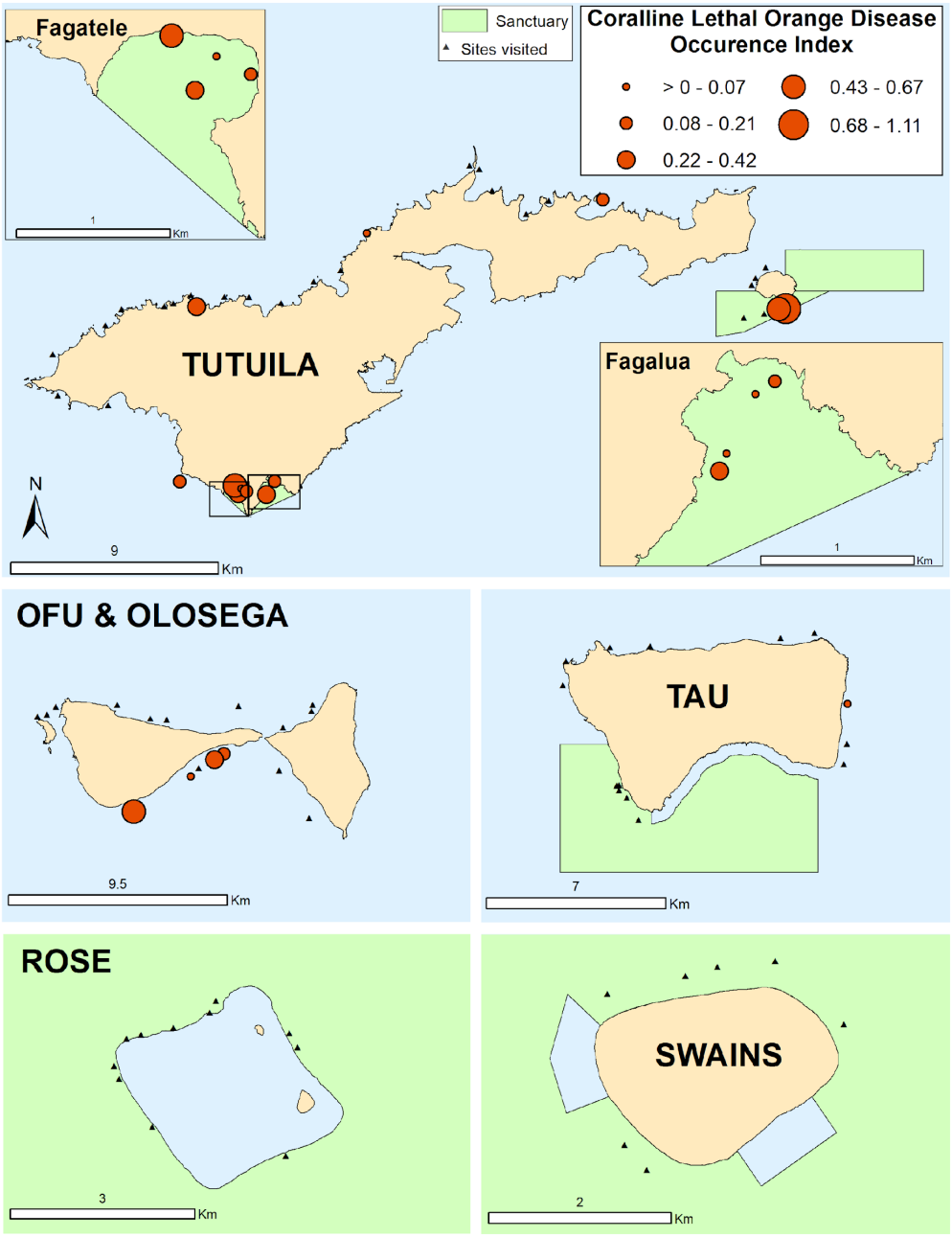

Figure 6. Site-level occurrence of the coralline lethal orange disease (CLOD) by site for reporting units in American Samoa surveyed in 2018.

No lesions of CLOD were recorded at Rose Atoll and Swains Island. Conspicuously high occurrence levels were found in the Fagatele/Fagalua and Aunu‘u Sanctuary management areas (Figure 6).

2018 Stratum-level Estimates

The figures below illustrate mean depth stratum-level estimates of benthic cover (Figure 7); coral colony density (no. colonies m^{-2}) and coral generic richness (Figure 8); and colony old mortality and condition (prevalence of bleaching and diseases) (Figure 9). For these comparative spatial bar graphs, we pooled all site-level data within each depth stratum, within each of the reporting units listed in Table 1.

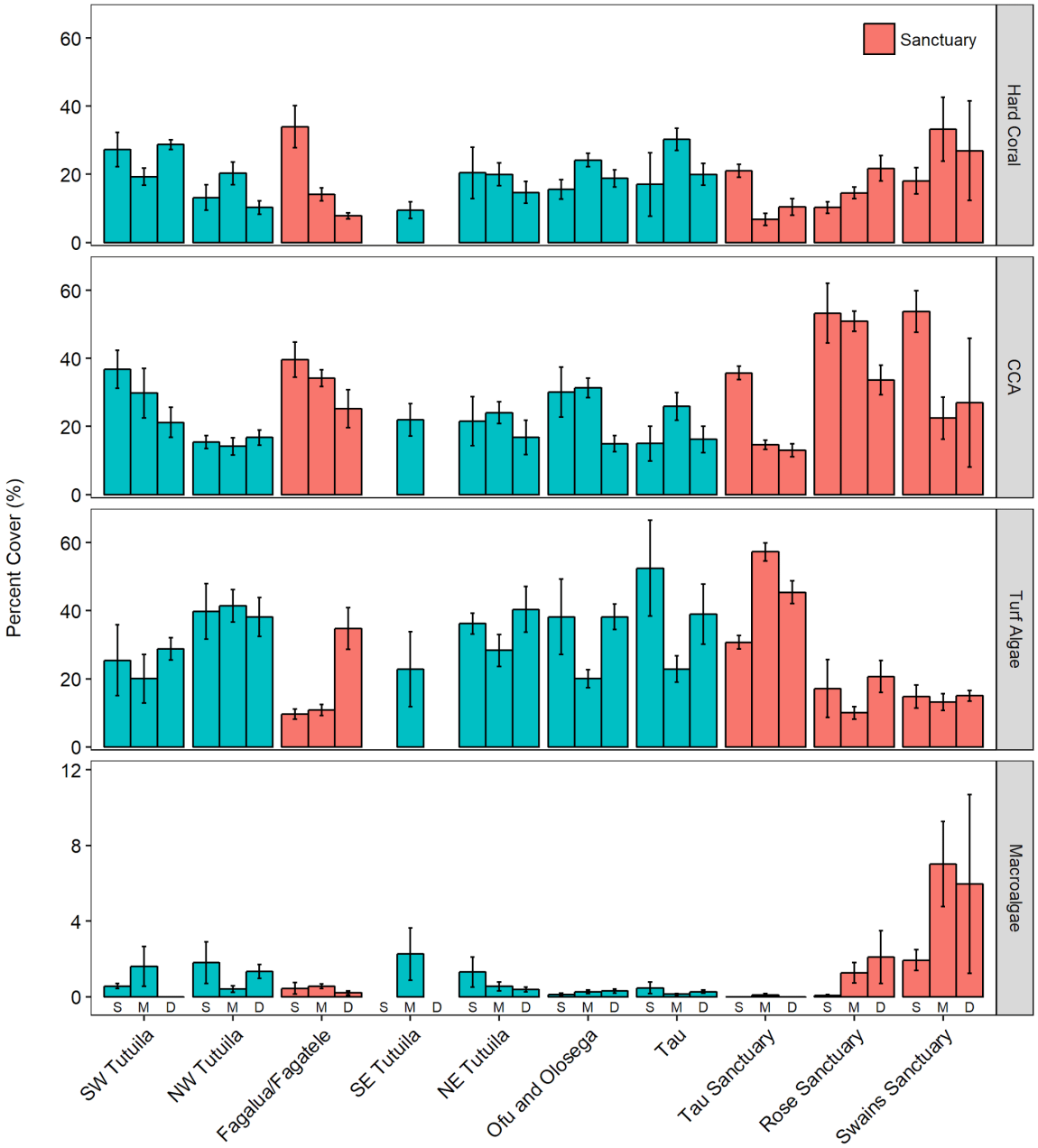

Figure 7. Mean (± 1 SE) percent benthic cover of hard corals, crustose coralline algae (CCA), turf algae, and macroalgae by stratum (S = shallow: 0–6 m; M = mid-depth: >6–18 m, and D = deep: >18–30 m) for reporting units in American Samoa surveyed in 2018. Absence of data for some reporting units indicates lack of surveys within that particular depth stratum. Note the varying scale of the y-axes among plots.

Depth stratum level mean estimates for each reporting unit indicate, as expected, that coral cover was usually greater in the shallow and mid-depth strata compared to the deep habitats. Rose Atoll and Tutuila SW were the only reporting units to exhibit greater coral cover at depth. CCA cover was also greater on the shallow and mid-depth habitats, and in agreement with historical records, conspicuously high at Rose Atoll. Turf algae cover varied between reporting units, as well as between depth strata; and fleshy macroalgae cover was consistently low between reporting unit strata with the exception of Swains Island. There was a two- to three-fold difference in macroalgae cover on the mid-depth and deep strata at Swains compared to other reporting units (Figure 7).

Density was greater for adult colonies than juvenile colonies for all reporting units and depth strata (Figure 8A). This trend is typical across most coral reefs systems in the U.S. Pacific Jurisdictions. Generic richness (Figure 8B) matched historical surveys. While Ofu and Olosega harbored a greater number of genera per reporting unit than Tutuila (15–20 and 8–15, genera, respectively), overall island-wide generic richness was greater in Tutuila (29 genera) than Ofu and Olosega (22 genera) in 2018.

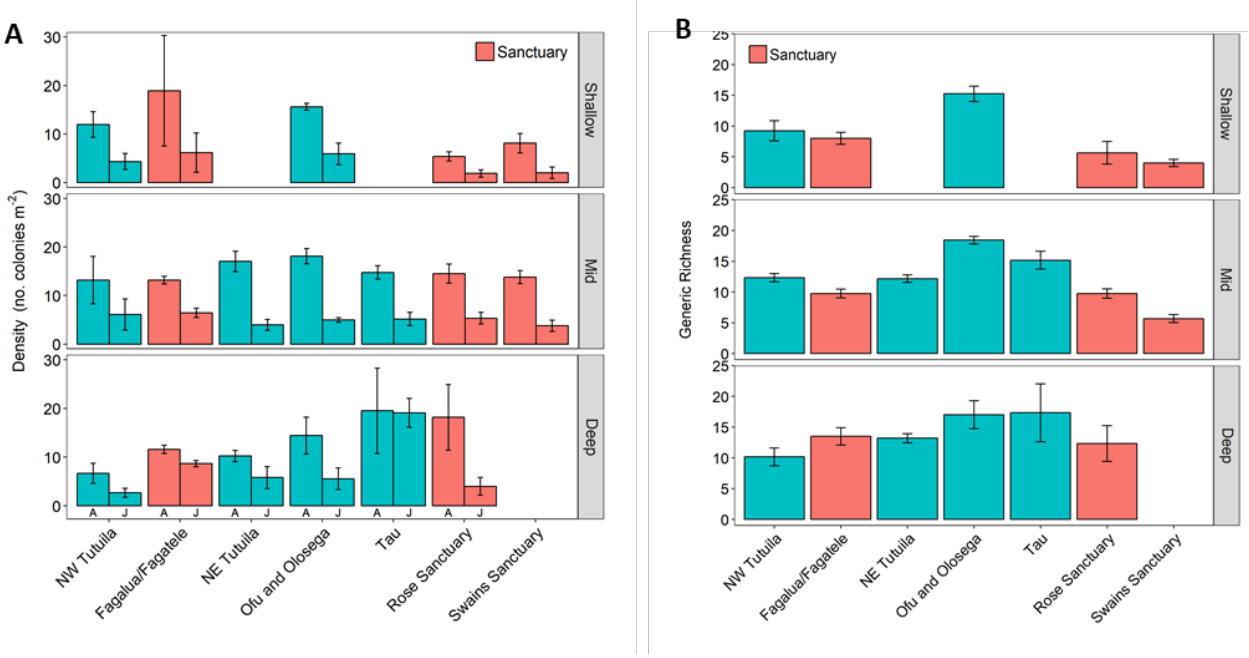

Figure 8. Mean (± 1 SE) estimates of: (A) density (colonies m^{-2}) of adult (A: ≥ 5 cm) and juvenile (J: <5 cm) coral colonies; (B) coral generic richness, by strata (shallow: 0–6 m; mid-depth: >6–18 m, and deep: >18–30 m) for reporting units in American Samoa surveyed in 2018. Absence of data for some reporting units indicates lack of surveys within that particular depth stratum.

With the exception of Ta‘u, estimates of recent partial mortality were low across all reporting units, and old mortality was predictably higher in the shallow and mid-depth strata compared to the deep habitats (Figure 9A). Differential thermal bleaching prevalence across depth strata (Figure 9B) is generally the main driver determining the patterns of post-bleaching mortality. Despite the spatial differences between depth strata and reporting units, the prevalence of acute and chronic diseases remained low after the 2015 bleaching event (Figure 9B). This is noteworthy, given that coral susceptibility to disease can be intensified by thermal stress events (Bruckner and Hill 2006).

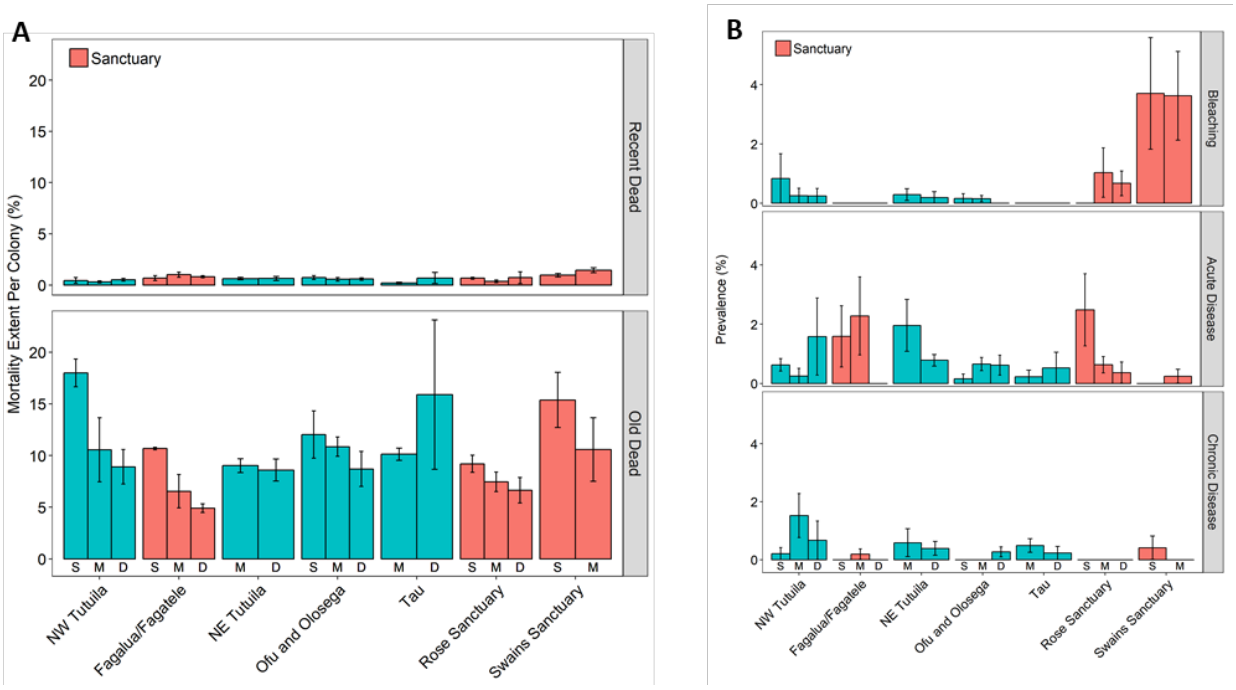

Figure 9. Mean (± 1 SE) estimates of: (A) percent partial colony mortality (recent and old); and (B) prevalence (%) of bleaching and diseases (acute and chronic) by strata (S = shallow: 0–6 m; M = mid-depth: >6–18 m, and D = deep: >18–30 m) for reporting units in American Samoa surveyed in 2018. Absence of data for some reporting units indicates lack of surveys within that particular depth stratum.

Temporal Comparisons

The figures below illustrate mean estimates of benthic cover (Figure 10), coral colony density (no. colonies m^{-2} and coral generic richness (Figure 11), colony old mortality and condition (prevalence of bleaching and diseases) (Figure 12), and CLOD occurrence (Figure 13) contrasted between survey years 2015 and 2018 for those reporting units with appropriate samples sizes. For these comparative spatial graphs (except CLOD occurrence), we pool all site-level data within each depth stratum, within each of the reporting units listed in Table 1. Statistical temporal comparisons were made by assessing the 95% confidence interval of the difference between survey year means (Tables 4, 5,6). Despite a much limited survey effort in 2018 (due to weather conditions) compared to 2015, some general spatial patterns are described below.

For all reporting units combined, coral cover dropped from 28.7% ± 2.6 in 2015 to 18.2% ± 2.0 in 2018, representing a 36% decline. CCA cover increased from 17.0 ± 1.6 in 2015 to 22.2 ± 2.5 in 2018 (30.1% increase), and macroalgae decreased from 3.4% ± 0.6 in 2015 to 0.7% ± 0.3 in 2018. Significant mean coral cover losses between 2015 and 2018 were reported for Rose Atoll Sanctuary (mean ± SE: 20.1 ± 1.7 and 14.9 ± 1.3, respectively), Ofu and Olosega (32.4% ± 1.6 and 20.8% ± 1.4, respectively), Ta‘u non-Sanctuary (33.5% ± 2 and 25.9% ± 2.6, respectively), NE Tutuila (31.5% ± 3.3 and 18.2% ± 2.8, respectively), and NW Tutuila (24.6% ± 3.9 and 14.5% ±1.7, respectively) (Table 4). It is important to note that the temporal coral cover loss reported for Fagatele/Fagalua is likely biased by the limited survey effort attained in 2018 (16 sites) compared to 2015 (48 surveys) (Table 1). Local experts agree that losses within this Sanctuary management area were not as considerable as illustrated in Figure 10 (Sudek and Vargas-Ángel, pers. obs.). Likewise, benthic cover changes reported for SE Tutuila need to be interpreted with caution given the limited number of sites surveyed in 2018 compared to 2015 (7 and 68 sites, respectively.

A significant increase in CCA cover was found at Rose Atoll Sanctuary management area, Ta‘u non-Sanctuary, and NE and NW Tutuila (Table 4). Rose Atoll and Swains Island exhibited the greatest levels of CCA both before and after the 2015 bleaching event (Figure 10). The 2018 levels of CCA at Swains were historically high (mean ± SE: 44.6 ± 4.6). These values are close to those recorded at Rose Atoll, which are the highest among the ~40 island and atolls periodically visited by NOAA’s Pacific RAMP. The decrease in coral cover and increase in CCA at Swains Island likely emerged from the mass bleaching event that resulted in the mortality of *Pocillopora* corals. Coral cover declined more than 70%, from 15.3% ± 3.5 in 2015 to 4.2% ± 1.6 in 2018 (mean ± SE), creating open space for the proliferation of CCA over the dead coral skeletons.

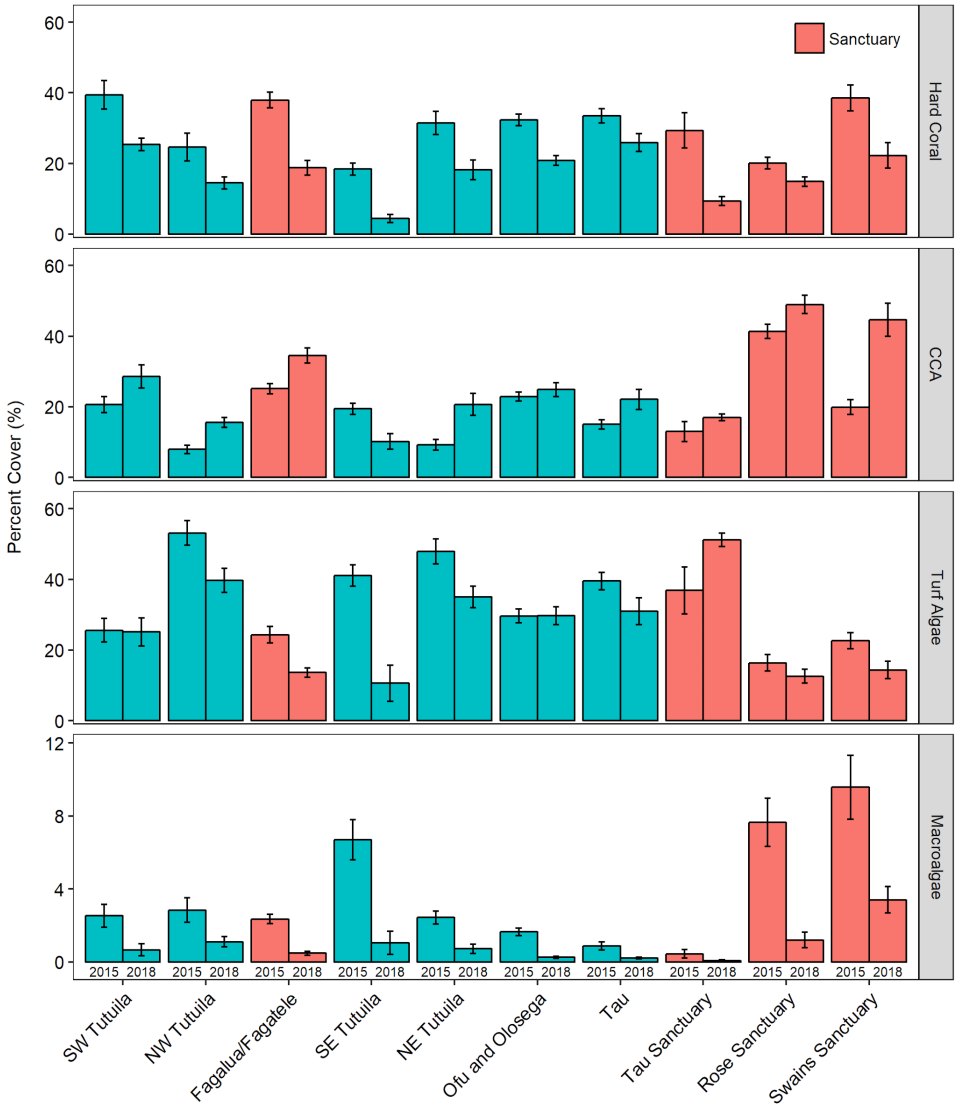

Figure 10. Temporal comparison (2015 and 2018) of mean (± 1 SE) percent benthic cover of hard corals, crustose coralline algae (CCA), macroalgae, and turf algae for reporting units in American Samoa. Note the varying ranges of y-axes among plots.

Turf algae cover was spatially variable both before and after the 2015 coral bleaching. Significant losses of turf were reported for NE Tutuila (Table 4). Overall, Rose Atoll exhibited the lowest levels of turf algae both before and after the bleaching event.

Table 4. Statistical temporal comparison based on the 95% confidence interval of the differences between survey year means for cover of hard coral cover, CCA, turf algae, and macroalgae for select* reporting units in American Samoa surveyed in 2015 and 2018. Significant differences are indicated with – or + to represent a decrease or increase, respectively. *see methods section for details.

CORAL COVER	No. of sites		Difference in means	Significant (α = 0.05)
Reporting Unit	2015	2018		
Rose Sanctuary	48	29	5.20	–
Ofu and Olosega	82	39	11.58	–
Ta‘u	59	27	7.55	–
NE Tutuila	39	31	13.28	–
NW Tutuila	26	35	10.15	–
CCA COVER	**No. of sites**		**Difference in means**	**Significant (α = 0.05)**
Reporting Unit	**2015**	**2018**		
Rose Sanctuary	48	29	7.58	+
Ofu and Olosega	82	39	2.02	
Ta‘u	59	27	7.08	+
NE Tutuila	39	31	11.47	+
NW Tutuila	26	35	7.63	+
MACROALGAE COVER	**No. of sites**		**Difference in means**	**Significant (α = 0.05)**
Reporting Unit	**2015**	**2018**		
Rose Sanctuary	48	29	6.45	–
Ofu and Olosega	82	39	1.40	–
Ta‘u	59	27	0.67	–
NE Tutuila	39	31	1.72	–
NW Tutuila	26	35	1.74	–
TURF ALGAE COVER	**No. of sites**		**Difference in means**	**Significant (α = 0.05)**
Reporting Unit	**2015**	**2018**		
Rose Sanctuary	48	29	3.78	
Ofu and Olosega	82	39	0.11	
Ta‘u	59	27	8.61	
NE Tutuila	39	31	12.86	–
NW Tutuila	26	35	13.48	–

Levels of macroalgae decreased between 2015 and 2018 for all islands, with the greatest reduction occurring at Swains Island and Rose Atoll. Although not illustrated in Figure 10, levels of the encrusting macroalgae, *Peyssonnelia*, registered a nearly 200% increase for all reporting units after the 2015 bleaching event. Increased levels of encrusting macroalgae following a major bleaching event were also reported at other reefs in the Pacific Remote Islands Marine National Monument following the 2015–2016 bleaching event, including Baker, Howland, and Jarvis islands, as well as Wake Atoll (Vargas-Ángel et al. 2019).

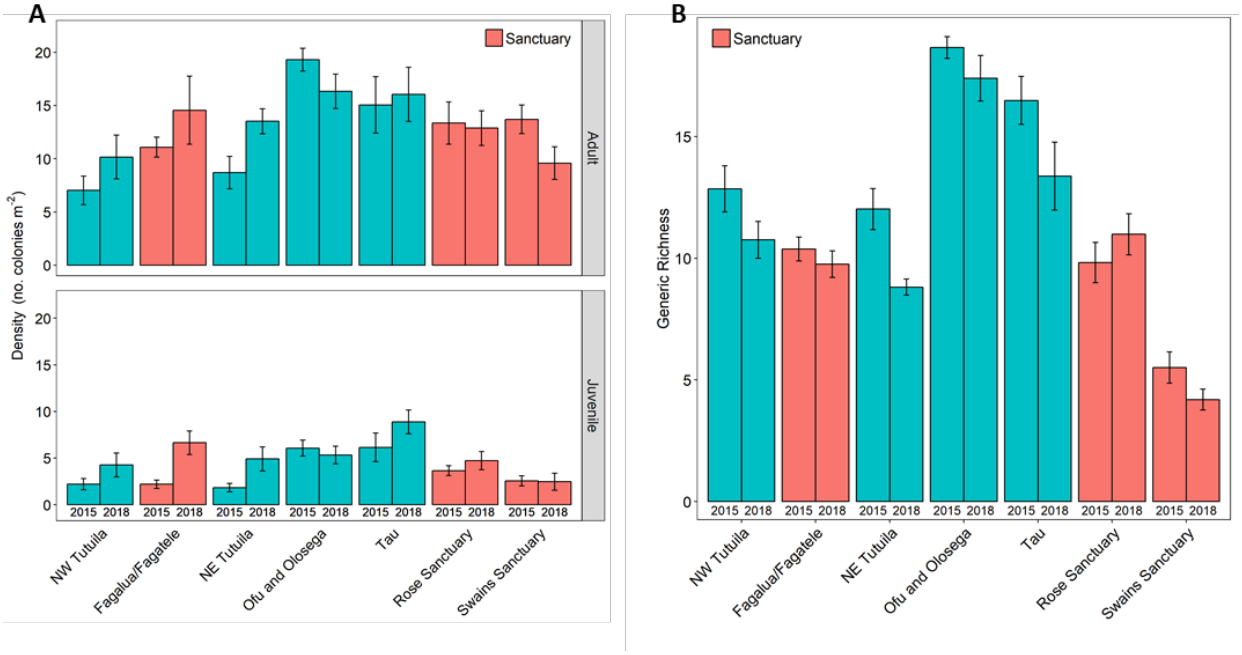

Figure 11. Temporal comparison (2015 and 2018) of mean (± 1 SE): (A) density (colonies m^{-2}) of adult (≥ 5 cm) and juvenile (<5 cm) of coral colonies; and (B) generic coral richness for reporting units in American Samoa.

Although adult colony densities varied between survey years (Figure 11A), differences were not significant, except for NE Tutuila (Table 5) where numbers increased in 2018. No statistical temporal comparisons were conducted for Fagatele/Fagalua or Swains due to the unbalanced sample sizes between survey years (Table 1). Local experts agree that colony density increases within the Fagatele/Fagalua Sanctuary management area were not as considerable as illustrated in Figure 11A (Sudek and Vargas-Ángel pers. obs.). At Swains Island, adult coral colony density losses were driven by a staggering >60% loss of *Pocillopora* colonies. In contrast to the Fagatele/Fagalua Sanctuary management, local experts (Sudek and Lawrence pers. obs.) agree that the 2015 bleaching event had a visible effect in the coral community demographics at Swains Island. Juvenile colonies (<5 cm diameter) also varied between 2015 and 2018 (Figure 11A), but differences were not significant except for NE Tutuila (Table 6). This increase may have been driven by a post-bleaching recruitment pulse over newly available substrate. Generic richness remained unchanged between survey years (Figure 11B, Table 6). Significant between-year differences for NE Tutuila were driven by the lack of 2018 surveys in the shallow depth stratum (Figure 8): mean generic richness for the mid-depth and deep strata combined remained unchanged between survey years (mean ± SE; 8.4 ± 1.2 in 2015 and 8.8 ± 0.5 in 2018).

Old mortality decreased for most reporting units, except at NE Tutuila and Swains (Figure 12A; Table 6). Fission of colonies following partial mortality, together with the associated challenges to determine colony boundaries, particularly for encrusting corals abundantly present in Tutuila and Manu‘a, may be

implicated in the lower post-bleaching levels of partial mortality. In addition, while the higher levels of coral bleaching reported in the 2015 surveys (Figure 12B) are expected based on the timing of the event and the monitoring survey, background levels of bleaching (<5%) in 2018 for Rose Atoll and Swains Island likely represent natural colony pallor common on these reef systems. Acute and chronic coral diseases remained at background levels (1–2%) with no significant differences between years (Table 6).

Table 5. Statistical temporal comparison based on the 95% confidence interval of the difference between survey year means for adult and juvenile colony density, and percentage of old and recent colony mortality for select* reporting units in American Samoa surveyed in 2015 and 2018. Significant differences are indicated with – or + to represent a decrease or increase, respectively. *See methods section for details.

ADULT COLONY DENSITY	**No. of sites**		**Difference in means**	**Significant (α = 0.05)**
Reporting Unit	**2015**	**2018**		
Rose Sanctuary	9	11	0.47	
Ofu and Olosega	30	17	2.98	
Tau	12	9	0.98	
NE Tutuila	12	11	4.81	+
NW Tutuila	8	13	3.13	
JUVENILE COLONY DENSITY	**No. of sites**		**Difference in means**	**Significant (α = 0.05)**
Reporting Unit	**2015**	**2018**		
Rose Sanctuary	9	11	1.07	
Ofu and Olosega	30	17	0.73	
Tau	12	9	2.73	
NE Tutuila	12	11	3.07	+
NW Tutuila	8	13	2.07	
% OLD DEAD	**No. of sites**		**Difference in means**	**Significant (α = 0.05)**
Reporting Unit	**2015**	**2018**		
Rose Sanctuary	9	11	2.29	
Ofu and Olosega	30	17	0.56	
Tau	12	9	2.67	
NE Tutuila	12	11	1.02	
NW Tutuila	8	13	1.80	
% RECENT DEAD	**No. of sites**		**Difference in means**	**Significant (α = 0.05)**
Reporting Unit	**2015**	**2018**		
Rose Sanctuary	9	11	0.27	
Ofu and Olosega	30	17	0.26	+
Tau	12	9	0.17	
NE Tutuila	12	11	0.36	+
NW Tutuila	8	13	0.25	

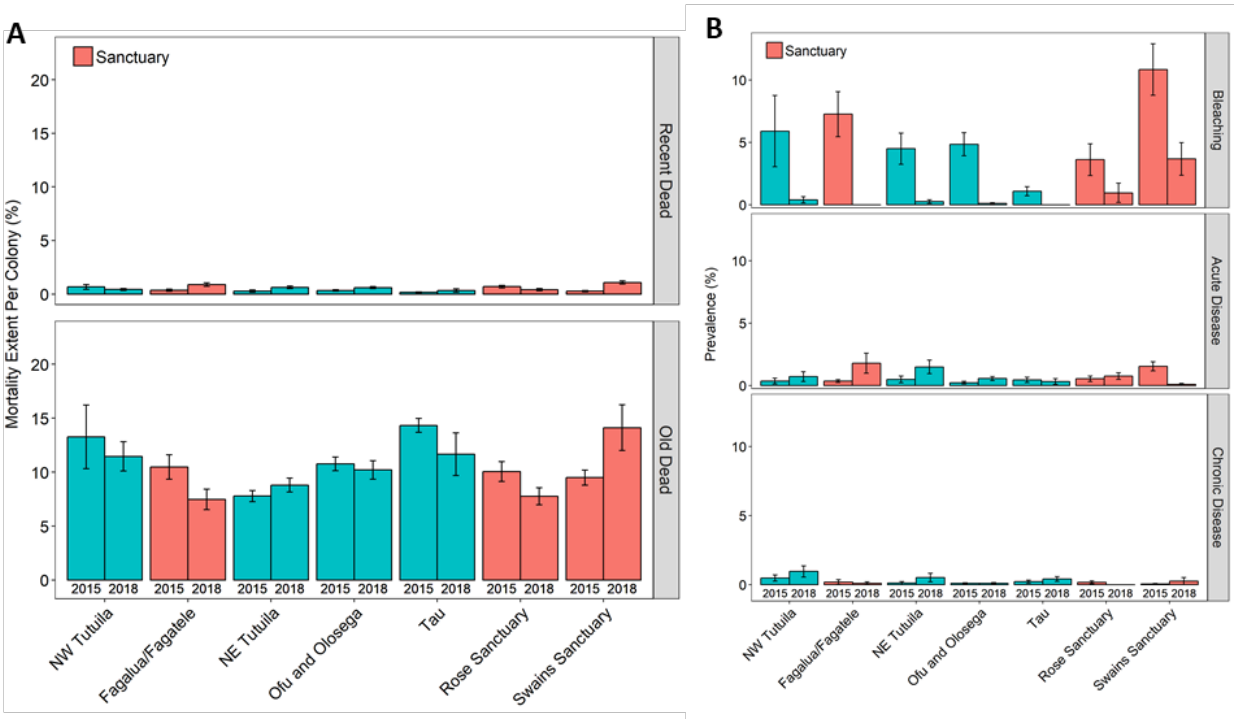

Figure 12. Temporal comparison (2015–2018) of mean (± 1SE): (A) percent colony mortality (recent and old); and (B) bleaching and coral diseases (acute and chronic) for reporting units in American Samoa.

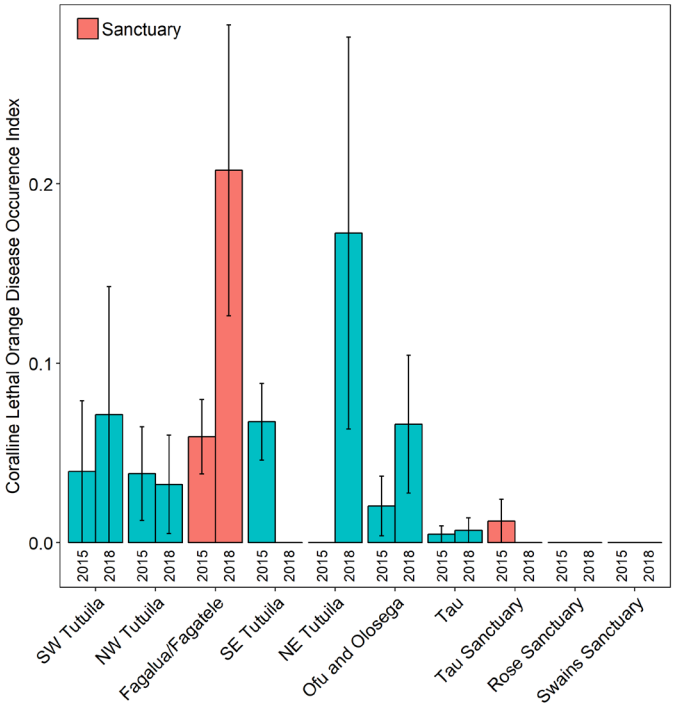

Figure 13. Temporal comparison (2015–2018) of mean (± 1SE) Coralline Lethal Orange Disease (CLOD) occurrence for different reporting units in American Samoa.

Overall, mean CLOD occurrence was low (≤ 0.2) across survey years. The limited number of sites surveyed in 2018 resulted in the high variation for that survey year (Figure 13). No cases were recorded in NE Tutuila in 2015, but several were documented in 2018. Elevated water temperatures are critical to infection and propagation of CLOD (Cervino et al. 2005); warm water temperatures and increased CCA cover in the aftermath of the 2015 bleaching are likely implicated in the proliferation of CLOD registered in 2018.

Table 6. Statistical temporal comparison based on the 95% confidence interval of the difference between survey year means for bleaching prevalence, acute and chronic diseases, and coral generic richness for select* reporting units in American Samoa surveyed in 2015 and 2018. Significant differences are indicated with – or + to represent a decrease or increase, respectively. *See methods section for details.

BLEACHING PREVALENCE	# of sites		Difference in means	Significant (α = 0.05)
Reporting Unit	**2015**	**2018**		
Rose Sanctuary	9	11	2.66	
Ofu and Olosega	30	17	4.74	–
Tau	12	9	1.08	–
NE Tutuila	12	11	4.24	–
NW Tutuila	8	13	5.50	
ACUTE DISEASE PREVALENCE	**# of sites**		**Difference in means**	**Significant (α = 0.05)**
Reporting Unit	**2015**	**2018**		
Rose Sanctuary	9	11	0.23	
Ofu and Olosega	30	17	0.33	
Tau	12	9	0.13	
NE Tutuila	12	11	1.01	
NW Tutuila	8	13	0.35	
CHRONIC DISEASE PREVALENCE	**# of sites**		**Difference in means**	**Significant (α = 0.05)**
Reporting Unit	**2015**	**2018**		
Rose Sanctuary	9	11	0.16	
Ofu and Olosega	30	17	0.00	
Tau	12	9	0.19	
NE Tutuila	12	11	0.40	
NW Tutuila	8	13	0.47	
CORAL GENERIC RICHNESS	**# of sites**		**Difference in means**	**Significant (α = 0.05)**
Reporting Unit	**2015**	**2018**		
Rose Sanctuary	9	14	1.16	
Ofu and Olosega	30	17	1.26	
Tau	16	9	3.11	
NE Tutuila	17	11	3.21	–
NW Tutuila	8	13	2.10	

Reef Fishes

2018 Site-level Data

The following section displays site-level bubble maps, which report on the biomass density (g m^{-2}) of all fishes (Figure 14), piscivores (Figure 15), fishes >50 cm TL (Figure 16), and the striped surgeonfish, *Acanthurus lineatus* (Figure 17).

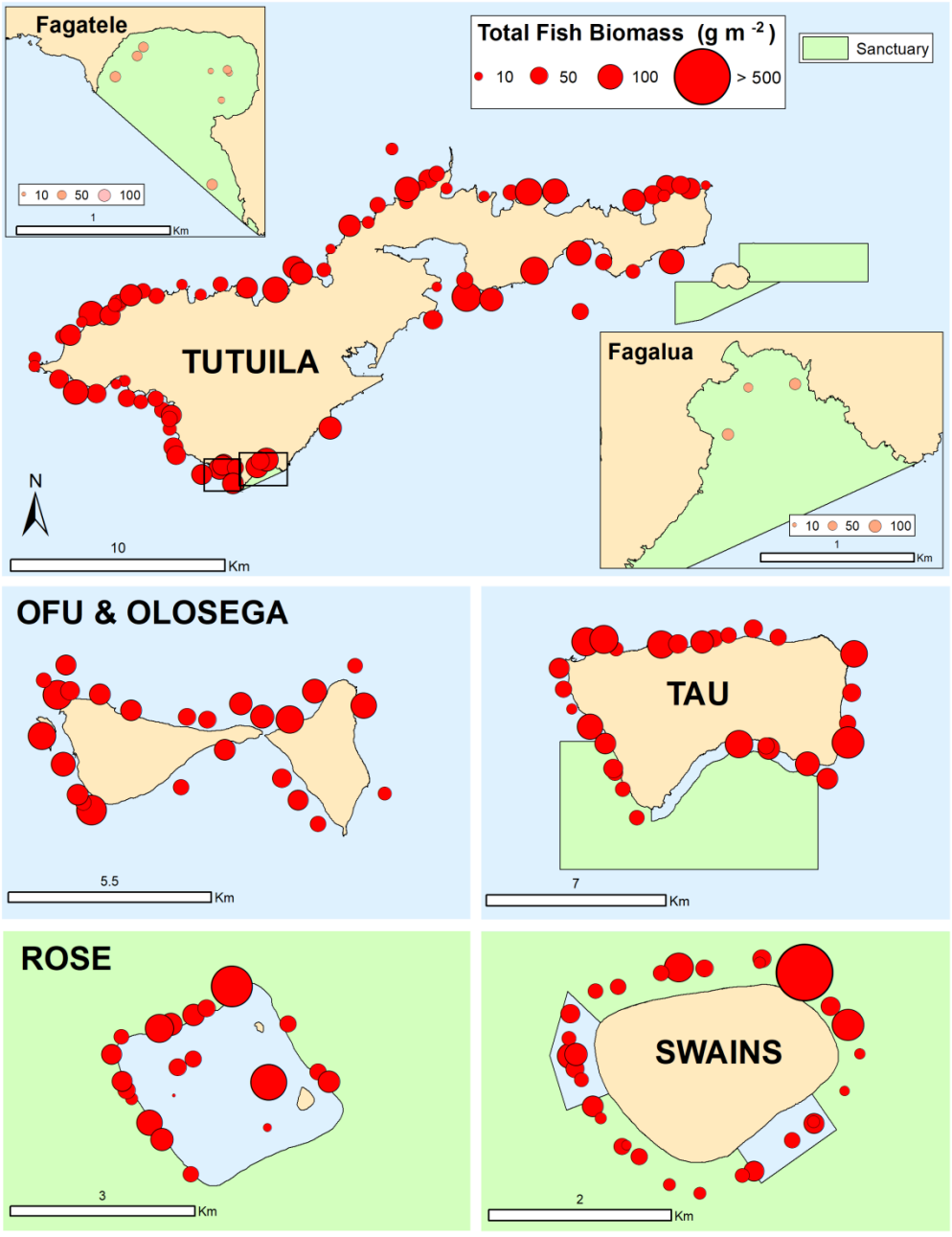

Figure 14. Site-level biomass density of all fishes (g m^{-2}) for reporting units in American Samoa surveyed in 2018.

Overall fish biomass was notably large at certain sites along the northern forereef of Rose and Swains (Figure 14), which appears to be mostly driven by enhanced biomass of large (>50 cm TL) piscivorous fishes at those surveyed sites (Figure 15 and Figure 16). Piscivorous fishes were present at most of the surveyed sites in American Samoa, with the exception of Tutuila where no piscivores were basent from most of the sites surveyed (Figure 15).

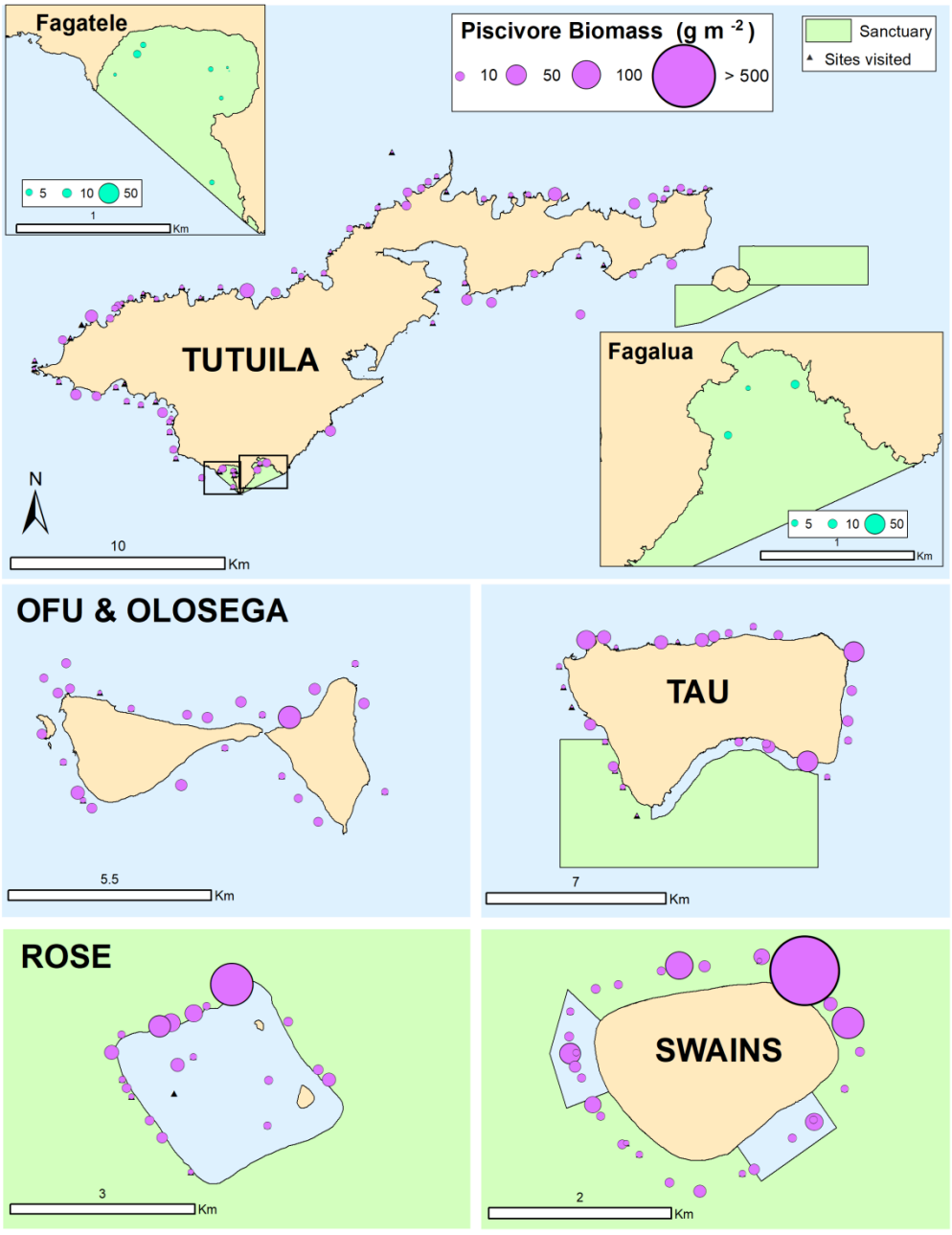

Figure 15. Site-level biomass density of all piscivores (g m^{-2}) for reporting units in American Samoa surveyed in 2018.

Large fishes (>50 cm TL) were patchily distributed, likely in part due to the transient or schooling nature of such species (Figure 16). Large fishes were not observed in Fagatele or Fagalua perhaps due to those inlets and coves having lower water movement (e.g., lack of currents) that is often associated with larger species. The patchy distribution of *Acanthurus lineatus* is shown in Figure 17. This species was notably absent at within the Swains Sanctuary Management area.

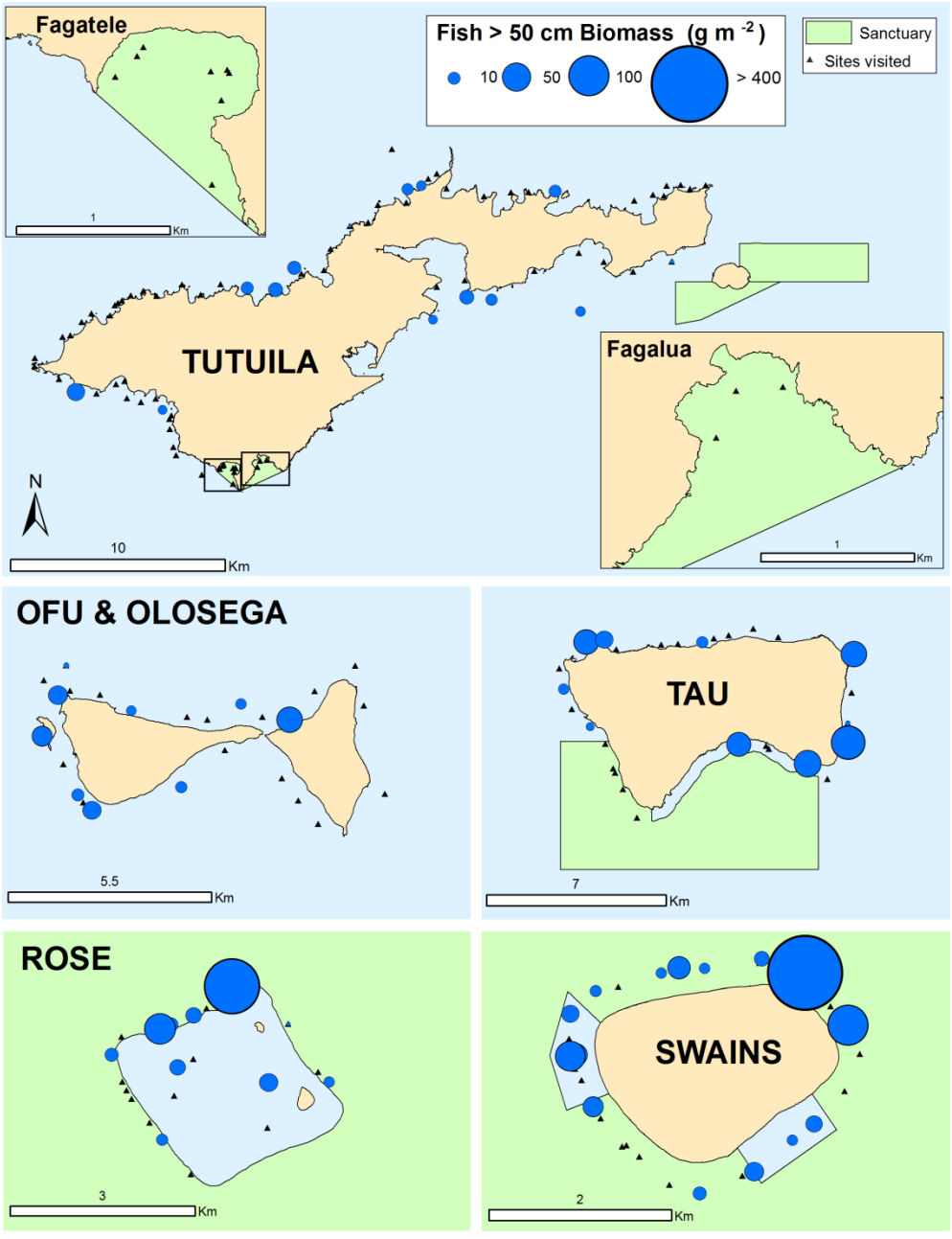

Figure 16. Site-level biomass density of all fishes >50 cm TL (g m^{-2}) for reporting units in American Samoa surveyed in 2018.

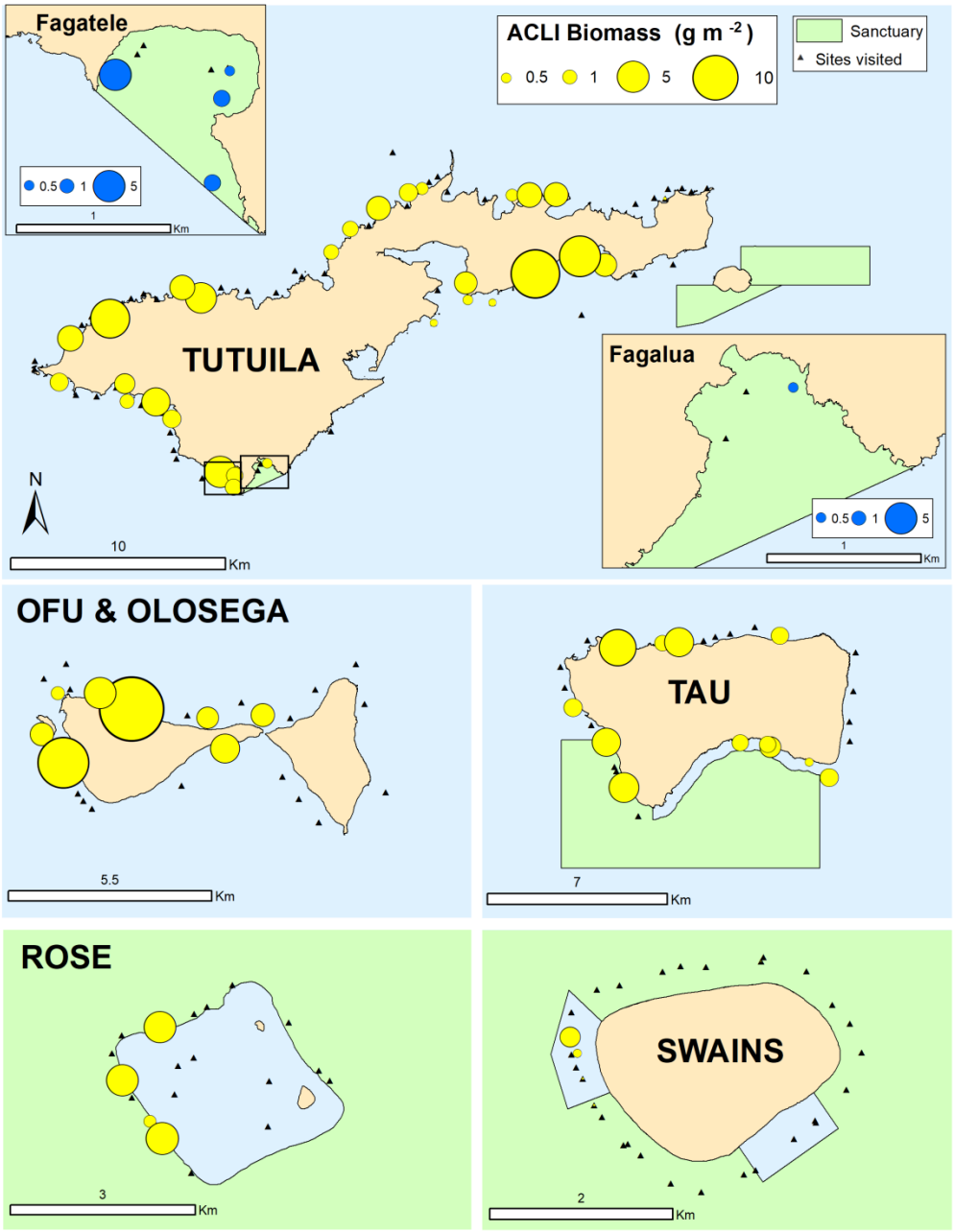

Figure 17. Site-level biomass density of the striped surgeonfish Acanthurus lineatus (ACLI) (g m^{-2}) for reporting units in American Samoa surveyed in 2018.

2018 Reporting Unit Estimates

The following section presents reporting unit-level mean estimates of (1) biomass density (g m^{-2}) of all fishes, the striped surgeonfish, *Acanthurus lineatus*, piscivores, and fishes >50 cm TL (Figure 18), and (2) species and generic richness of reef fishes (Figure 19). For these comparative bar graphs, site-level data

within each stratum were averaged and weighted in proportion to total stratum area. Weighted averages were then summed across strata to obtain mean estimates for each reporting unit listed in Table 3.

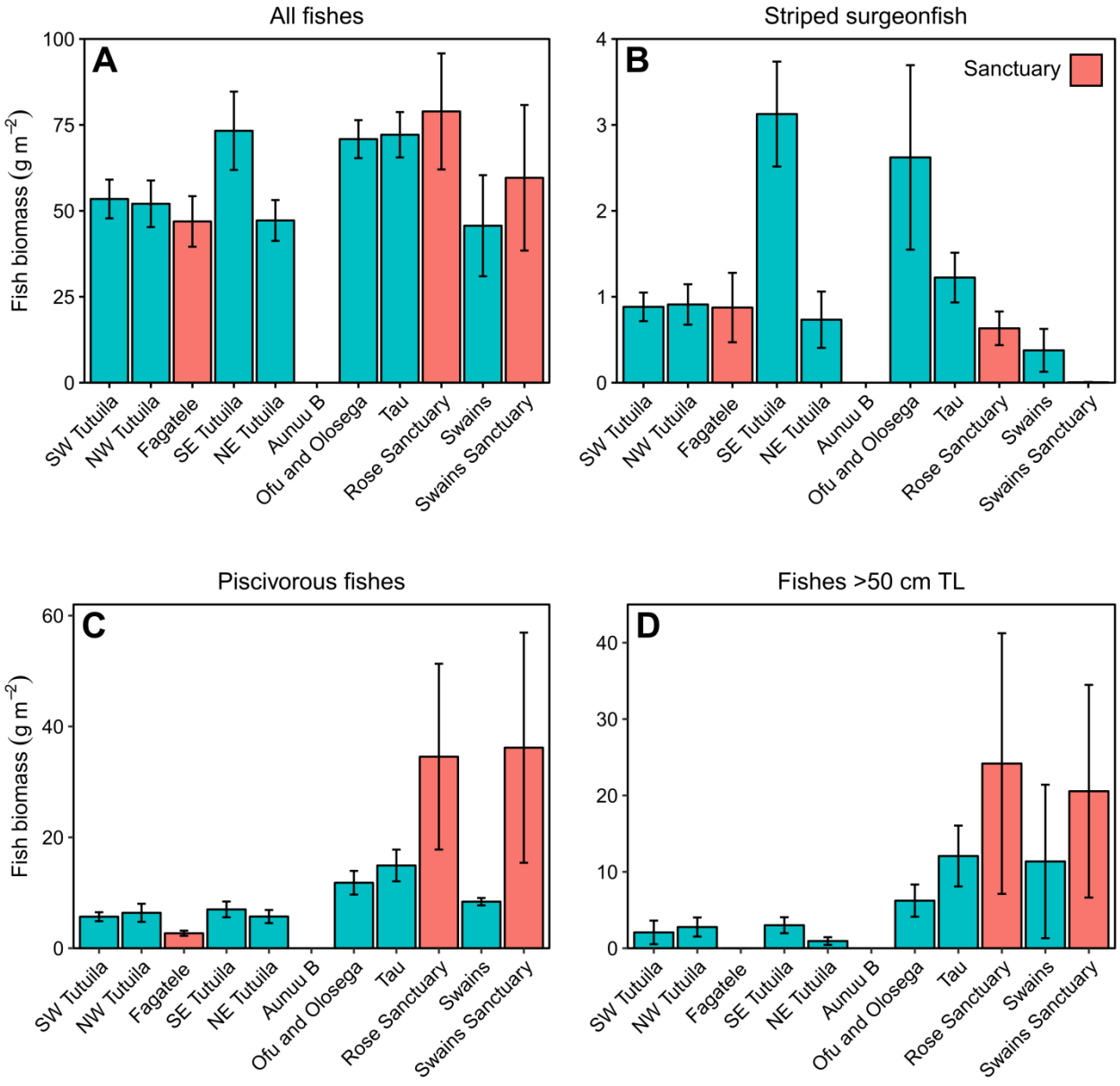

Figure 18. Mean biomass density (g m^{-2}) of: (A) all fishes; (B) striped surgeonfish,* Acanthurus lineatus*; (C) piscivorous fishes; and (D) fishes >50 cm TL for reporting units in American Samoa surveyed in 2018. Note the varying ranges of y-axes among plots.

Sanctuary status across reporting units did not appear to result in greater overall fish biomass in 2018 (Figure 18A). Rose and Swains Sanctuary management areas had the greatest biomass of large, piscivorous fishes; however, the variances of such estimates were also notably large (Figure 18C–D). Among reporting units, mean biomass of *Acanthurus lineatus* was relatively larger at SE Tutuila and Ofu and Olosega, although the variance was also large at Ofu and Olosega (Figure 18B). Species and generic richness of fishes appeared similar across reporting units, with the exception of relatively lower richness at Swains Island and in Rose Sanctuary (Figure 19).

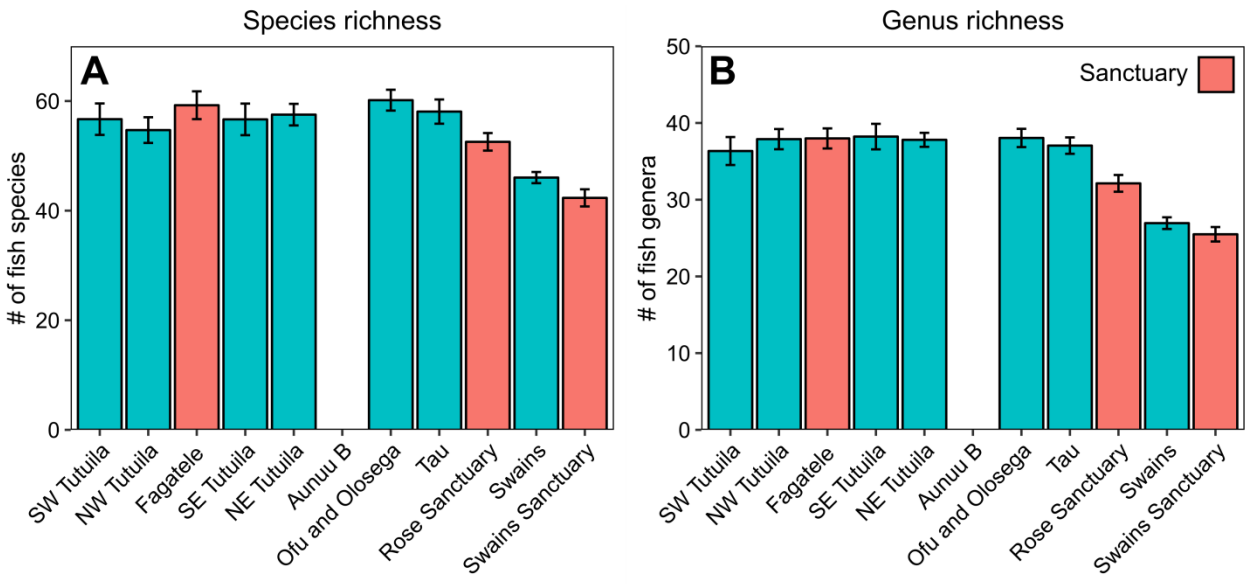

Figure 19. Mean species (A) and generic (B) richness of fishes for reporting units in American Samoa surveyed in 2018. Note the varying ranges of y-axes among plots.

Temporal Comparisons

The following section illustrates mean reporting unit-level estimates of biomass density (g m^{-2}) of all fishes, the striped surgeonfish, *Acanthurus lineatus*, piscivores, and fishes >50 cm TL (Figure 20); and reef fish species and generic richness (Figure 21) across survey years (2015, 2016, and 2018). Statistical temporal comparisons (based on the 95% confidence interval of the difference between survey year means; i.e., 2015 and 2018) for each reporting unit are presented in Table 7 and Table 8. Despite a highly limited survey effort in 2018 (due to weather conditions) compared to 2015, some general spatial patterns are described below.

Biomass of all fishes surveyed significantly increased between 2015 and 2018 at Fagatele and Rose Sanctuary management areas, as well as Ta‘u, and SE Tutuila. The remaining reporting units did not significantly differ in fish biomass between those survey years (Figure 20A and Table 7). Substantial increases in the biomass of *Acanthurus lineatus* between 2015 and 2018 were recorded at NW Tutuila, SE Tutuila, and Ofu and Olosega; however, observed biomass was also highly variable at those reporting units (Figure 20B). Reporting units in which large and piscivorous fishes were observed in relatively high levels of mean biomass also had large variance (Figure 20C, D), likely due to the patchiness of occurrence of such species that may also be intermittently observed in large schools.

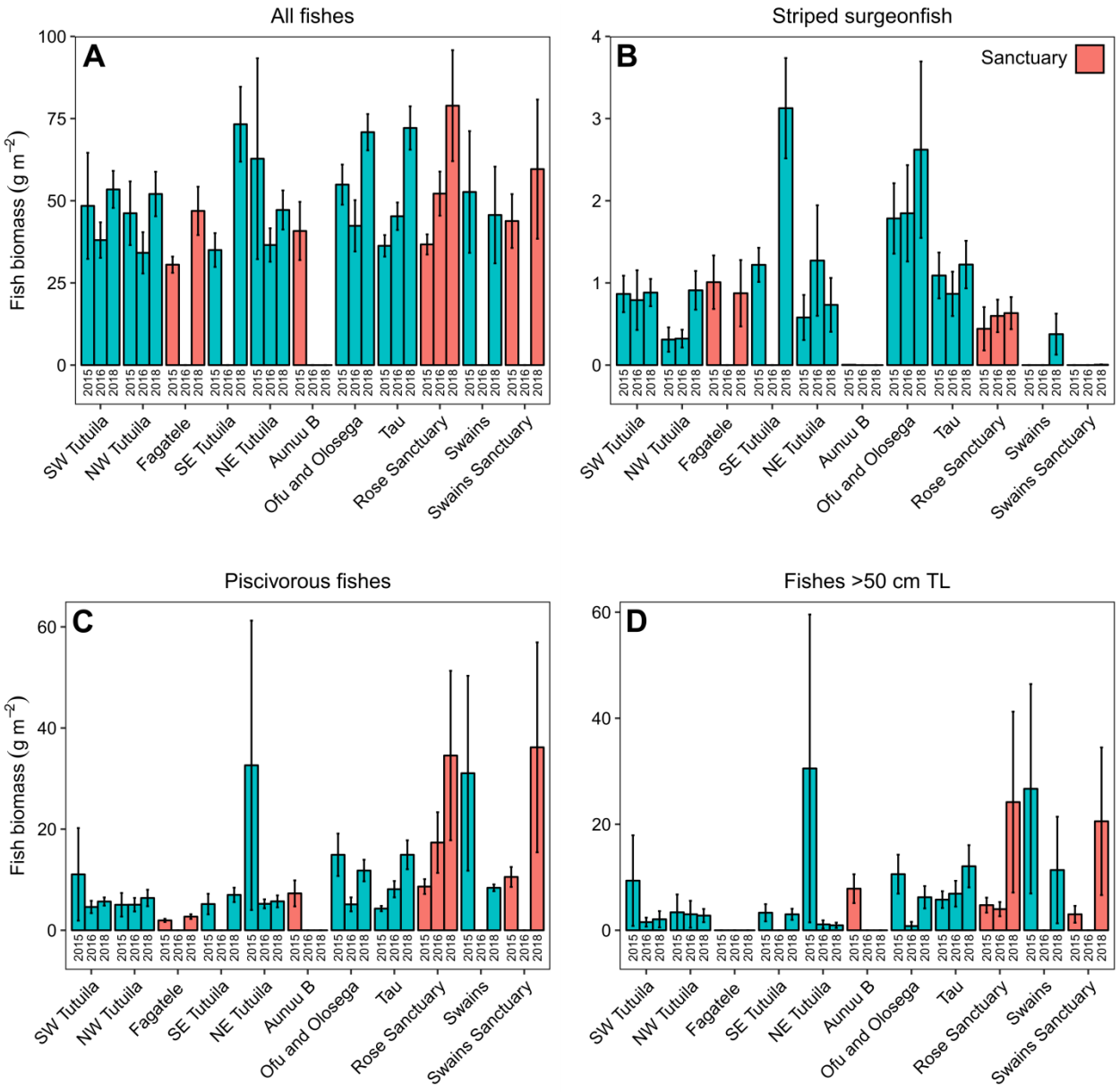

Figure 20. Biomass density (g m^{-2}) of: (A) all fishes; (B) striped surgeonfish,* Acanthurus lineatus*; (C) piscivorous fishes; (D) and fishes >50 cm TL for reporting units in American Samoa surveyed in 2015, 2016, and 2018. Note the varying ranges of y-axes among plots.

Species and genus richness of fishes appeared to increase between 2015 and 2018 in all surveyed reporting units (Figure 21), and indeed, species richness significantly increased over three years in all reporting units except for Swains Sanctuary (Table 8). Importantly, these increasing trends are very likely driven by sampling biases among teams of divers between 2015 and 2018, especially since this increasing trend was consistent across all reporting units. Therefore, it is unclear in which instances increases in species and genus richness reflect a true broadening in diversity of fish communities.

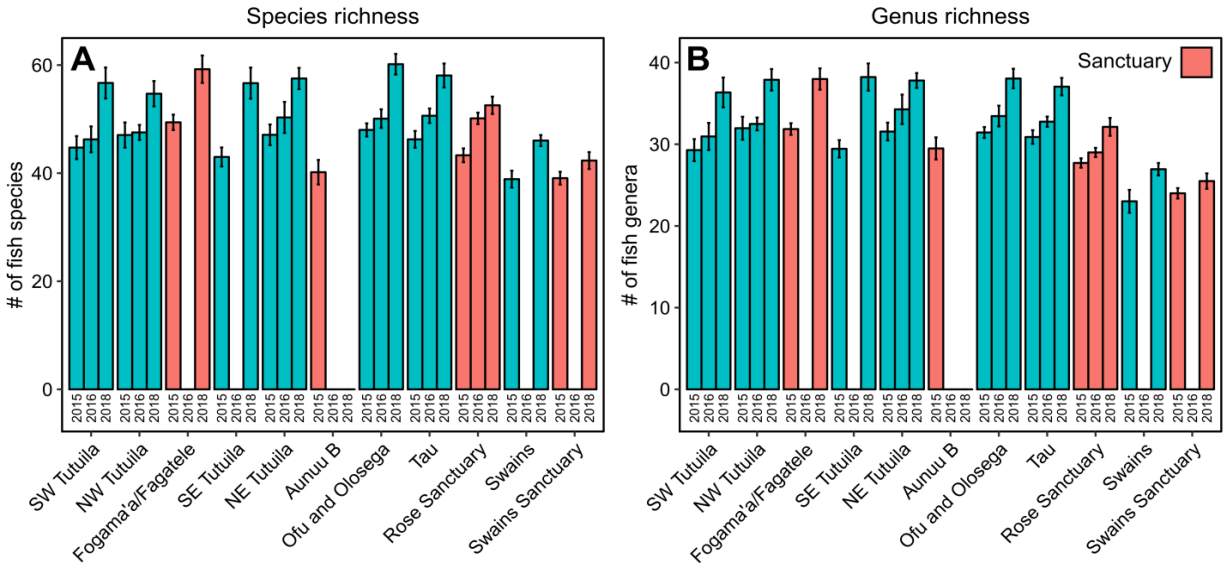

Figure 21. Species and genus richness of fishes (panels A and B, respectively) for reporting units in American Samoa surveyed in 2015, 2016, and 2018. Note the varying ranges of y-axes among plots.

Table 7. Statistical temporal comparison based on the 95% confidence interval of the difference between survey year means for total fish biomass at each reporting unit in American Samoa surveyed in 2015 and 2018. Significant differences are indicated with – or + to represent a decrease or increase in biomass, respectively.

TOTAL FISH BIOMASS	# of sites		Difference in means	Significant (α = 0.05)
Reporting unit	2015	2018		
SW Tutuila	15	18	5.0000	
NW Tutuila	18	23	5.8509	
Fagatele Sanctuary	27	8	16.3595	+
SE Tutuila	47	12	38.2770	+
NE Tutuila	27	20	15.5878	
Aunuʻu B	27	0	NA	NA
Ofu and Olosega	52	25	15.9481	
Taʻu	43	23	35.8470	+
Rose Sanctuary	37	16	42.2126	+
Swains	9	10	7.0096	
Swains Sanctuary	23	20	15.7844	

Table 8. Statistical temporal comparison based on the 95% confidence interval of the difference between survey year means for fish species richness at each reporting unit in American Samoa surveyed in 2015 and 2018. Significant differences are indicated with – or + to represent a decrease or increase in richness, respectively.

FISH SPECIES RICHNESS Reporting unit	# of sites 2015	 2018	Difference in means	Significant (α = 0.05)
SW Tutuila	15	18	11.9601	+
NW Tutuila	18	23	7.6450	+
Fagatele Sanctuary	27	8	9.8318	+
SE Tutuila	47	12	13.6591	+
NE Tutuila	27	20	10.4222	+
Aunu'u B	27	0	NA	NA
Ofu and Olosega	52	25	12.1635	+
Tau	43	23	11.8196	+
Rose Sanctuary	37	16	42.21255	+
Swains	9	10	7.1402	+
Swains Sanctuary	23	20	3.2586	

2018 Ocean and Climate Change

2018 Site-level Data

The following section displays site-level bubble maps, which illustrate the spatial distribution and depth of subsurface temperature recorders, Calcification Accretion Units, and dissolved inorganic carbon (DIC) water samples to estimate Omega aragonite. A concatenated time series of in-situ water temperature is also included. A summary table displaying site-level DIC water chemistry data is presented in Appendix 5.

A total of 37 temperature loggers were recovered (Figure 22), 85 water samples for carbonate chemistry collected (Figure 23), and 102 CAU units recovered (Figure 24) between June 28 and August 16, 2018.

Sea Surface Temperature

The timing and magnitude of temperature patterns in the Territory are similar across islands and Sanctuary management areas (Figure 25). A strong seasonal cycle is evident, with the warmest temperatures occurring during summer months (Dec–Mar) and cooler temperatures observed in the winter (July–September). From the period of temperature data collection, 2010 through 2015, temperatures across all islands rarely exceeded the bleaching threshold —i.e., 1°C above the maximum monthly mean; and if exceeded, it was over a very narrow time period. In 2015–2017, however, summer temperatures exceeded the bleaching threshold for several months during each year. These sharp and repeated ocean temperature rises during the 2015–2016 El Niño caused prolonged thermal stress and subsequent coral bleaching, which was recorded by the coral demographic surveys in March–April 2015. During this warming event, Swains Island experienced the greatest thermal anomalies, with water temperatures of almost 31°C and consequently, widespread levels of coral bleaching (NOAA 2016). By the summer of 2018, the ocean warming event had receded and temperatures were mild, well within the typical range.

Carbonate Chemistry

Omega aragonite values in American Samoa are traditionally the highest measured among the 48 islands and atolls periodically visited by NOAA's Pacific RAMP. Within the islands of American Samoa there is little temporal variation; omega aragonite values were very similar between survey years 2015 and 2018. Rose Atoll exhibited the highest omega aragonite levels while Tutuila had the lowest (Figure 23). Fagatele and Fagalua Sanctuary management areas have lower omega aragonite values than most of the forereef sampling locations. In small, sheltered embayments like Fagatele and Fagalua, with limited water circulation and longer residence times, biological activity (e.g., calcification and respiration) can draw omega aragonite.

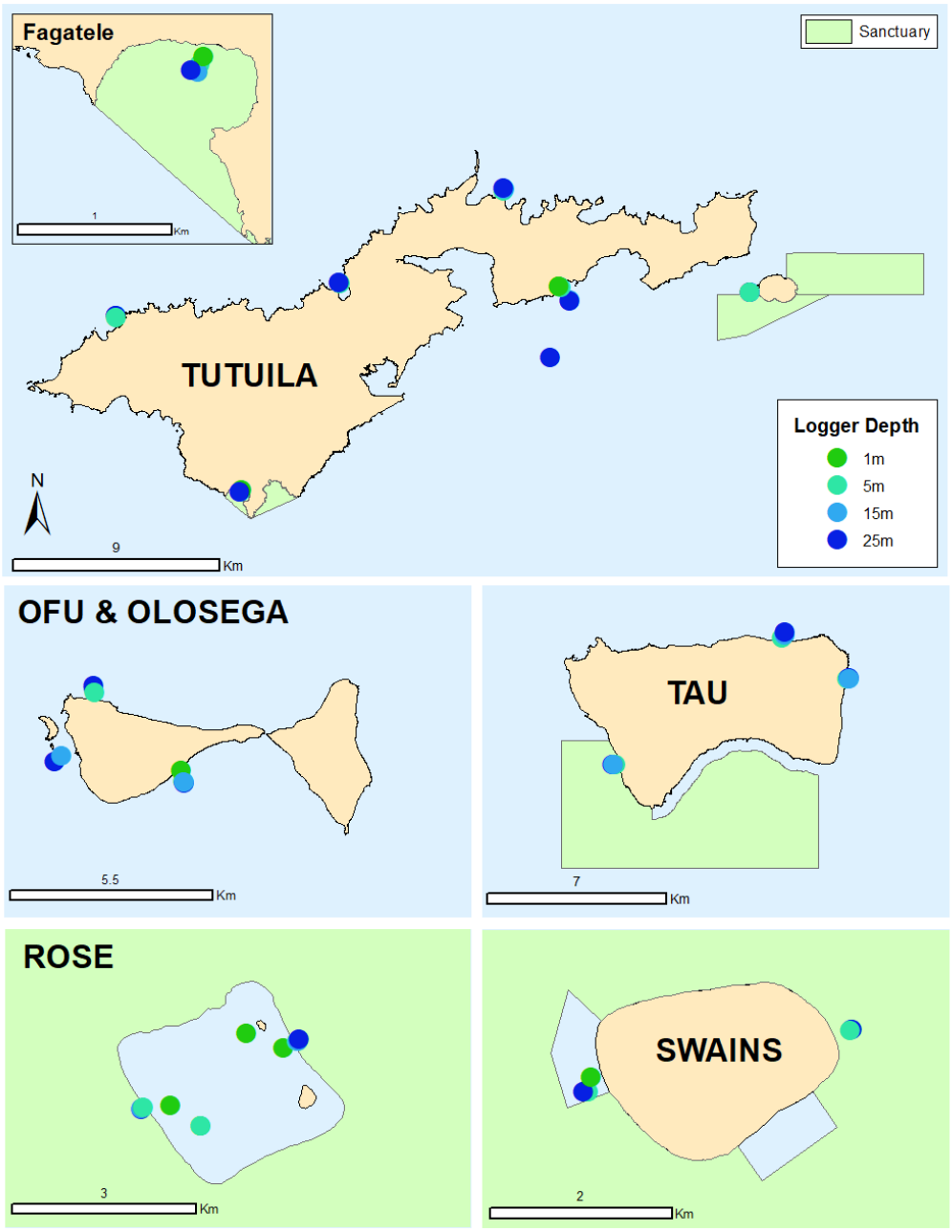

Figure 22. Spatial distribution and depth of subsurface temperature loggers maintained in American Samoa.

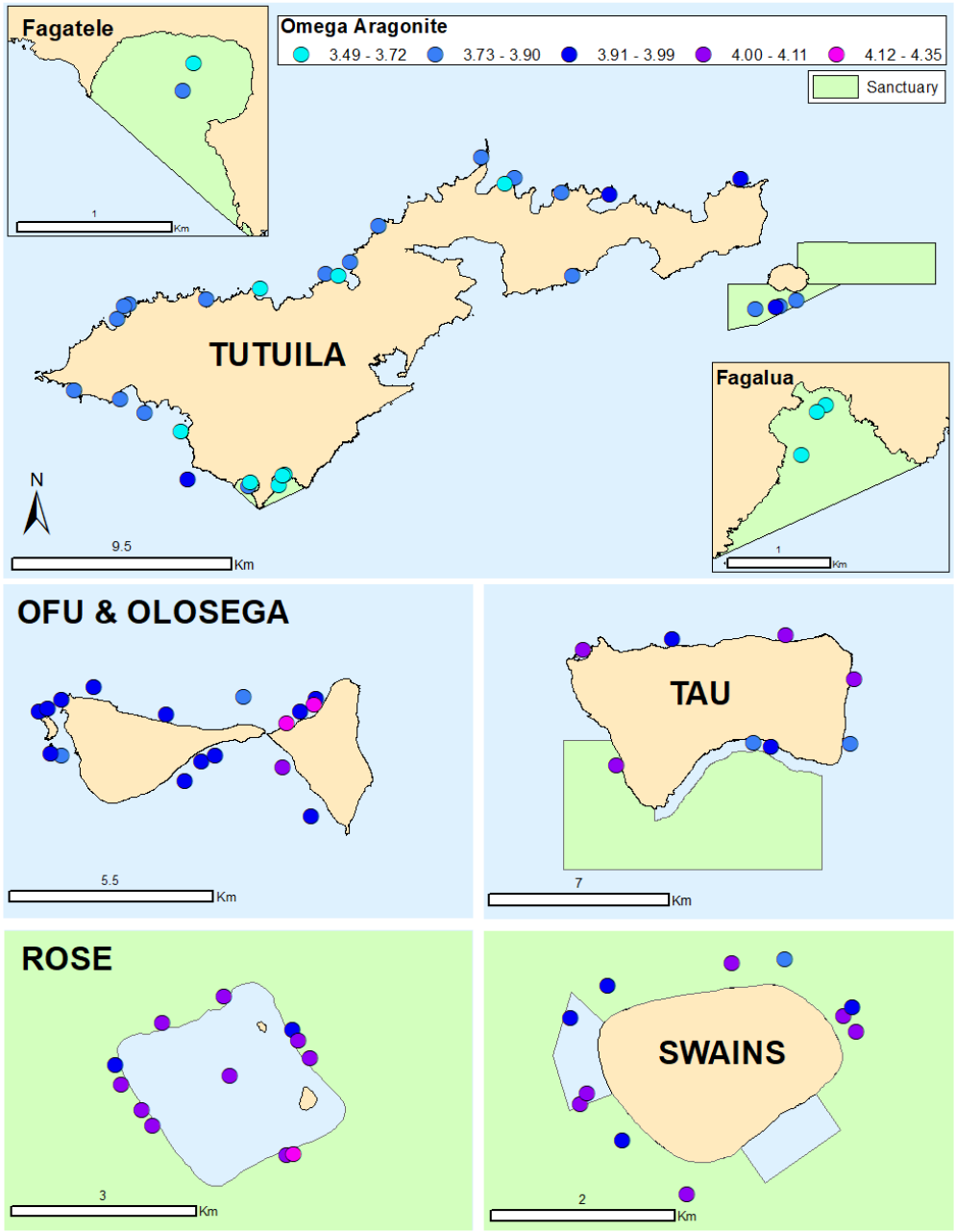

Figure 23. Spatial distribution and locations of DIC water samples for carbonate chemistry analyses collected around American Samoa.

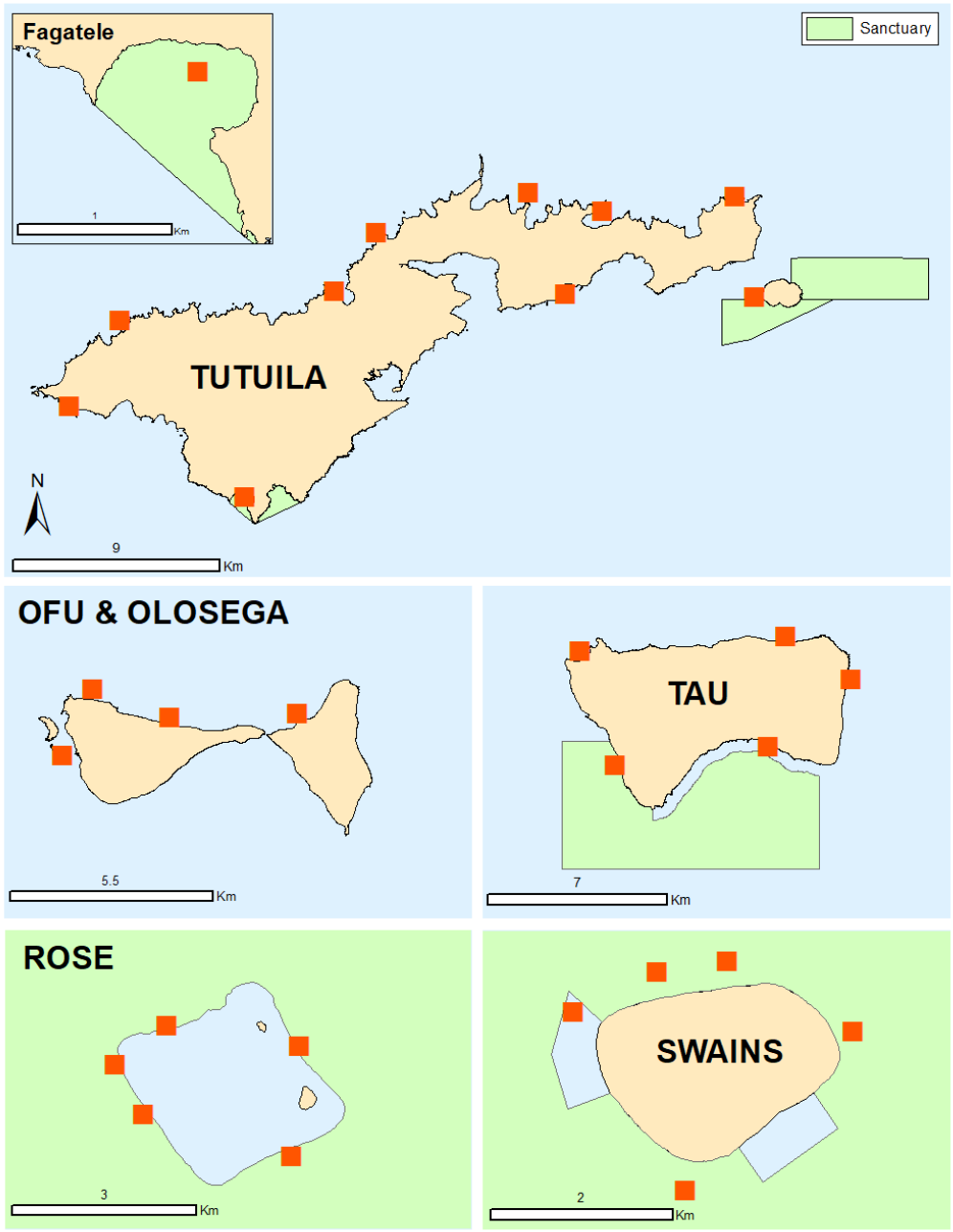

Figure 24. Spatial distribution and locations of Calcification Accretion Units recovered around American Samoa.

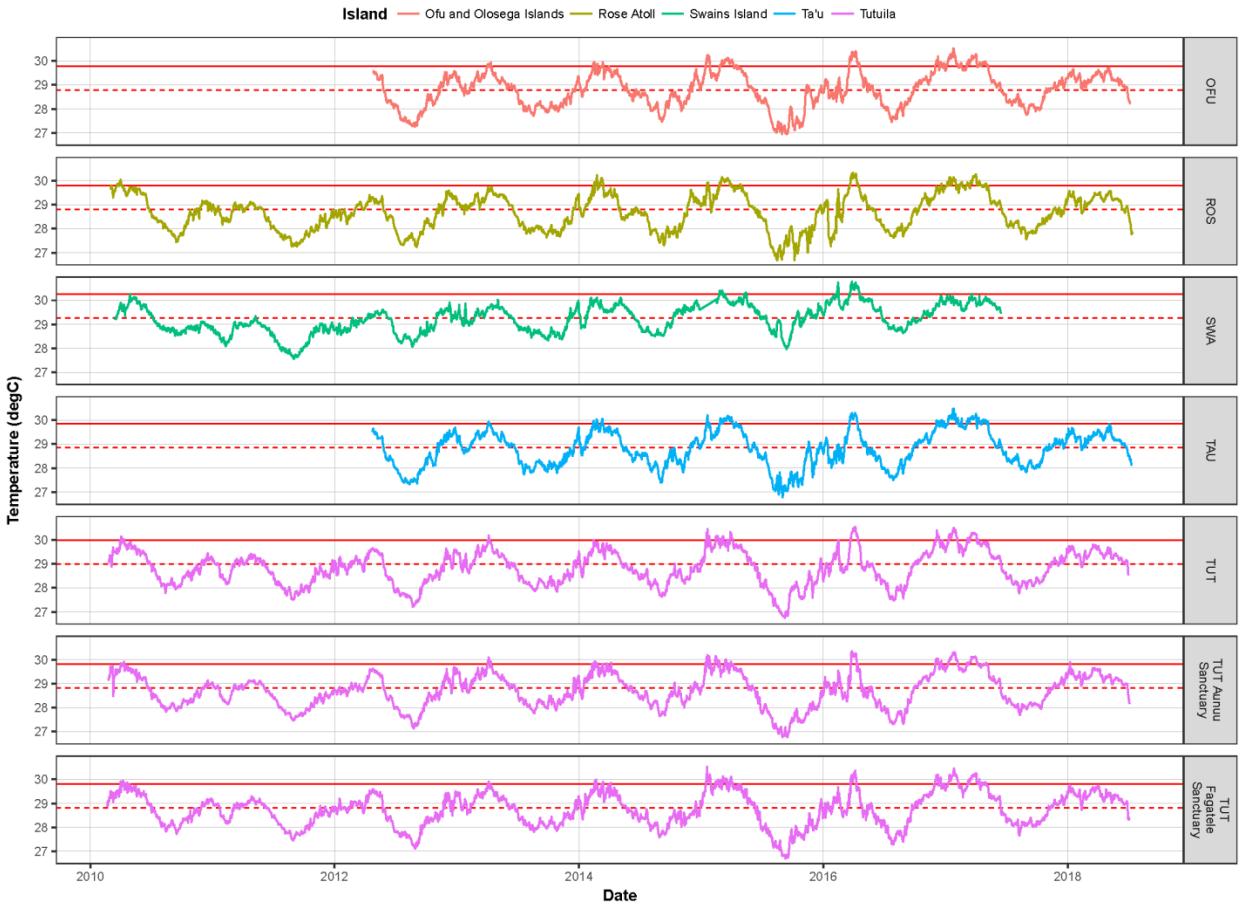

Figure 25. Time series of representative subsurface temperature recorders at 15-m depth maintained in American Samoa between 2010 and 2018. Red lines indicate: in-situ adjusted maximum monthly mean temperature (dashed); and in-situ adjusted bleaching threshold (solid). Bleaching threshold is defined as 1°C above the maximum monthly mean.

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Appendices

Appendix 1: List of coral genera recorded within the coral population surveys in 2018.

Genus	Genus code	Genus	Genus code
Acanthastrea	ACAS	*Leptoria*	LEPS
Acropora	ACSP	*Leptoseris*	LESP
Alveopora	ALSP	*Lobophyllia*	LOBS
Astreopora	ASSP	*Merulina*	MESP
Astrea	ASTP	*Millepora*	MISP
Caulastrea	CASP	*Montipora*	MOSP
Coeloseris	COES	*Mycedium*	MYSP
Coscinaraea	COSP	*Oulophyllia*	OUSP
Ctenactis	CTSP	*Oxypora*	OXSP
Cycloseris	CYPS	*Pachyseris*	PACS
Cyphastrea	CYSP	*Pavona*	PAVS
Diploastrea	DISP	*Phymastrea*	PHYM
Echinophyllia	ECHL	*Platygyra*	PLSP
Echinopora	ECHP	*Plesiastrea*	PLES
Euphyllia	EUSP	*Pocillopora*	POCS
Favia	FASP	*Porites*	POSP
Favites	FAVS	*Psammocora*	PSSP
Fungia	FUSP	*Sandalolitha*	SASP
Galaxea	GASP	*Scapophyllia*	SCAS
Gardineroseris	GARS	*Stylocoeniella*	STSP
Goniastrea	GONS	*Stylophora*	STYS
Goniopora	GOSP	*Symphyllia*	SYSP
Halomitra	HASP	*Tubastrea*	TUSP
Heliopora	HESP	*Turbinaria*	TURS
Herpolitha	HERS		
Hydnophora	HYSP		
Isopora	ISSP		
Leptastrea	LEPT		

Appendix 2. Site-level percent benthic cover estimates of hard coral (CORAL), coralline algae (CCA), encrusting macroalgae (EMA), Halimeda (HALI), sessile invertebrate (I), fleshy macroalgae (MA), mobile fauna (MF), soft coral (SC), sediment (SEDI), and turfalgae (TURF), tape/wand (TW), and unclassified (UC) based on analysis of benthic images collected on surveys in 2018. Table is sorted by SITE ID (OFU = Ofu & Olosega, ROS = Rose, SWA = Swains, TAU = Ta'u, TUT = Tutuila).

Site	Year	Reporting unit	Latitude	Longitude	Reef zone	Depth bin	CORAL	CCA	EMA	HAL	I	MA	SC	SED	TURF	TW	UC
OFU-00883	2018	Ofu & Olosega	-14.1814	-169.6524	Forereef	Deep	0.17	0.12	0.27	0.03	0.00	0.00	0.01	0.02	0.37	0.00	0.05
OFU-00886	2018	Ofu & Olosega	-14.1852	-169.6763	Forereef	Mid	0.11	0.40	0.15	0.12	0.00	0.00	0.05	0.01	0.17	0.01	0.03
OFU-00891	2018	Ofu & Olosega	-14.1830	-169.6027	Forereef	Deep	0.18	0.13	0.09	0.00	0.00	0.00	0.02	0.01	0.58	0.00	0.03
OFU-00893	2018	Ofu & Olosega	-14.1650	-169.6460	Forereef	Deep	0.12	0.24	0.21	0.05	0.01	0.01	0.05	0.01	0.29	0.01	0.02
OFU-00895	2018	Ofu & Olosega	-14.1553	-169.6858	Forereef	Deep	0.07	0.10	0.19	0.01	0.01	0.00	0.01	0.02	0.58	0.00	0.03
OFU-00902	2018	Ofu & Olosega	-14.1904	-169.6190	Forereef	Deep	0.34	0.21	0.24	0.04	0.00	0.00	0.01	0.00	0.17	0.00	0.03
OFU-00912	2018	Ofu & Olosega	-14.1616	-169.6078	Forereef	Mid	0.21	0.35	0.13	0.00	0.00	0.00	0.04	0.03	0.24	0.02	0.06
OFU-00929	2018	Ofu & Olosega	-14.1690	-169.6864	Forereef	Mid	0.25	0.40	0.11	0.02	0.00	0.00	0.03	0.00	0.19	0.00	0.13
OFU-00931	2018	Ofu & Olosega	-14.1650	-169.6259	Forereef	Mid	0.23	0.27	0.29	0.01	0.00	0.01	0.04	0.01	0.13	0.01	0.09
OFU-00935	2018	Ofu & Olosega	-14.1793	-169.6279	Forereef	Mid	0.54	0.19	0.20	0.00	0.00	0.00	0.04	0.00	0.03	0.00	0.03
OFU-00937	2018	Ofu & Olosega	-14.1590	-169.6824	Forereef	Mid	0.32	0.27	0.18	0.00	0.00	0.00	0.05	0.02	0.16	0.00	0.06
OFU-00943	2018	Ofu & Olosega	-14.1833	-169.6776	Forereef	Mid	0.33	0.21	0.24	0.00	0.00	0.00	0.00	0.01	0.21	0.01	0.03
OFU-00944	2018	Ofu & Olosega	-14.1847	-169.6238	Forereef	Mid	0.27	0.24	0.22	0.01	0.00	0.00	0.01	0.00	0.24	0.01	0.01
OFU-00951	2018	Ofu & Olosega	-14.1580	-169.6795	Forereef	Mid	0.38	0.23	0.17	0.00	0.00	0.00	0.01	0.00	0.21	0.00	0.02
OFU-00957	2018	Ofu & Olosega	-14.1870	-169.6742	Forereef	Mid	0.37	0.20	0.32	0.01	0.00	0.00	0.03	0.00	0.07	0.01	0.04
OFU-00973	2018	Ofu & Olosega	-14.1725	-169.6417	Forereef	Shallow	0.62	0.11	0.22	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.03
OFU-00974	2018	Ofu & Olosega	-14.1628	-169.6645	Forereef	Shallow	0.21	0.10	0.09	0.01	0.00	0.00	0.00	0.01	0.59	0.00	0.02
OFU-00977	2018	Ofu & Olosega	-14.1612	-169.6378	Forereef	Mid	0.24	0.18	0.16	0.00	0.00	0.00	0.00	0.00	0.41	0.01	0.04
OFU-00982	2018	Ofu & Olosega	-14.1612	-169.6829	Forereef	Shallow	0.22	0.18	0.04	0.00	0.00	0.00	0.01	0.03	0.51	0.00	0.02
OFU-00985	2018	Ofu & Olosega	-14.1610	-169.6383	Forereef	Deep	0.15	0.16	0.25	0.00	0.00	0.00	0.03	0.02	0.38	0.00	0.05
OFU-00985	2018	Ofu & Olosega	-14.1610	-169.6383	Forereef	Deep	0.15	0.16	0.25	0.00	0.00	0.00	0.03	0.02	0.38	0.00	0.05
OFU-00987	2018	Ofu & Olosega	-14.1867	-169.6640	Forereef	Deep	0.22	0.26	0.23	0.05	0.01	0.00	0.03	0.01	0.20	0.00	0.02
OFU-00988	2018	Ofu & Olosega	-14.1752	-169.6457	Forereef	Deep	0.09	0.08	0.21	0.05	0.00	0.01	0.00	0.04	0.51	0.00	0.03
OFU-00995	2018	Ofu & Olosega	-14.1644	-169.6558	Forereef	Deep	0.26	0.13	0.26	0.04	0.00	0.01	0.02	0.04	0.24	0.00	0.09
OFU-01000	2018	Ofu & Olosega	-14.1607	-169.6203	Forereef	Deep	0.06	0.33	0.10	0.01	0.00	0.00	0.04	0.06	0.40	0.00	0.06
OFU-01004	2018	Ofu & Olosega	-14.1726	-169.6420	Forereef	Mid	0.56	0.08	0.29	0.01	0.00	0.01	0.01	0.00	0.04	0.00	0.02
OFU-01010	2018	Ofu & Olosega	-14.1884	-169.6211	Forereef	Mid	0.25	0.23	0.23	0.00	0.01	0.00	0.01	0.00	0.27	0.00	0.01
OFU-01012	2018	Ofu & Olosega	-14.1651	-169.6491	Forereef	Mid	0.26	0.22	0.08	0.00	0.00	0.00	0.03	0.00	0.40	0.00	0.03
OFU-01013	2018	Ofu & Olosega	-14.1631	-169.6851	Forereef	Mid	0.20	0.31	0.03	0.00	0.00	0.00	0.01	0.00	0.44	0.00	0.05
OFU-01014	2018	Ofu & Olosega	-14.1781	-169.6501	Forereef	Mid	0.58	0.11	0.21	0.02	0.00	0.00	0.02	0.00	0.06	0.00	0.03
OFU-01024	2018	Ofu & Olosega	-14.1767	-169.6284	Forereef	Mid	0.20	0.38	0.23	0.00	0.00	0.00	0.04	0.00	0.16	0.00	0.06
OFU-01031	2018	Ofu & Olosega	-14.1662	-169.6275	Forereef	Shallow	0.30	0.29	0.09	0.00	0.00	0.00	0.02	0.00	0.30	0.00	0.03
OFU-01033	2018	Ofu & Olosega	-14.1622	-169.6205	Forereef	Shallow	0.09	0.14	0.03	0.00	0.00	0.00	0.00	0.01	0.73	0.00	0.03
OFU-01034	2018	Ofu & Olosega	-14.1640	-169.6599	Forereef	Shallow	0.37	0.12	0.38	0.00	0.00	0.00	0.01	0.00	0.12	0.00	0.05
OFU-01045	2018	Ofu & Olosega	-14.1741	-169.6443	Forereef	Mid	0.32	0.16	0.30	0.05	0.00	0.01	0.02	0.00	0.14	0.00	0.01
OFU-01047	2018	Ofu & Olosega	-14.1607	-169.6680	Forereef	Deep	0.08	0.38	0.07	0.00	0.00	0.00	0.04	0.04	0.38	0.00	0.10
OFU-01049	2018	Ofu & Olosega	-14.1761	-169.6480	Forereef	Deep	0.05	0.14	0.21	0.04	0.00	0.00	0.02	0.05	0.48	0.00	0.03
OFU-01051	2018	Ofu & Olosega	-14.1635	-169.6874	Forereef	Mid	0.42	0.18	0.21	0.00	0.00	0.00	0.04	0.00	0.14	0.00	0.05
OFU-01054	2018	Ofu & Olosega	-14.1736	-169.6845	Forereef	Mid	0.22	0.23	0.24	0.00	0.00	0.00	0.01	0.00	0.30	0.00	0.01
ROS-00933	2018	ROS_SANCTUARY	-14.5361	-168.1471	Forereef	Deep	0.15	0.26	0.10	0.08	0.00	0.01	0.16	0.00	0.24	0.00	0.08
ROS-00936	2018	ROS_SANCTUARY	-14.5348	-168.1609	Forereef	Deep	0.29	0.12	0.10	0.07	0.00	0.01	0.02	0.00	0.38	0.00	0.06

Site	Year	Reporting unit	Latitude	Longitude	Reef zone	Depth bin	CORAL	CCA	EMA	HAL	I	MA	SC	SED	TURF	TW	UC
ROS-00948	2018	ROS_SANCTUARY	-14.5406	-168.1729	Forereef	Mid	0.63	0.11	0.18	0.00	0.00	0.01	0.01	0.00	0.06	0.00	0.10
ROS-00952	2018	ROS_SANCTUARY	-14.5379	-168.1715	Forereef	Mid	0.68	0.11	0.06	0.01	0.00	0.00	0.11	0.00	0.04	0.00	0.12
ROS-00967	2018	ROS_SANCTUARY	-14.5362	-168.1642	Forereef	Mid	0.39	0.12	0.16	0.05	0.00	0.00	0.05	0.00	0.23	0.04	0.09
ROS-00968	2018	ROS_SANCTUARY	-14.5306	-168.1553	Forereef	Mid	0.65	0.11	0.13	0.03	0.01	0.00	0.01	0.00	0.06	0.00	0.11
ROS-00972	2018	ROS_SANCTUARY	-14.5458	-168.1708	Forereef	Mid	0.52	0.13	0.18	0.10	0.00	0.00	0.02	0.00	0.05	0.00	0.12
ROS-00974	2018	ROS_SANCTUARY	-14.5505	-168.1674	Forereef	Mid	0.44	0.12	0.24	0.01	0.00	0.00	0.05	0.00	0.15	0.00	0.29
ROS-00977	2018	ROS_SANCTUARY	-14.5446	-168.1411	Forereef	Mid	0.23	0.38	0.10	0.03	0.01	0.01	0.08	0.01	0.16	0.00	0.11
ROS-00979	2018	ROS_SANCTUARY	-14.5338	-168.1591	Forereef	Mid	0.49	0.10	0.14	0.03	0.00	0.00	0.05	0.00	0.19	0.00	0.10
ROS-00995	2018	ROS_SANCTUARY	-14.5580	-168.1613	Forereef	Shallow	0.60	0.18	0.08	0.01	0.00	0.00	0.09	0.00	0.03	0.00	0.10
ROS-00998	2018	ROS_SANCTUARY	-14.5445	-168.1714	Forereef	Shallow	0.56	0.10	0.21	0.00	0.00	0.00	0.09	0.00	0.03	0.00	0.09
ROS-00999	2018	ROS_SANCTUARY	-14.5530	-168.1655	Forereef	Shallow	0.75	0.12	0.07	0.00	0.00	0.00	0.01	0.00	0.04	0.00	0.12
ROS-01045	2018	ROS_SANCTUARY	-14.5353	-168.1616	Forereef	Deep	0.44	0.16	0.10	0.03	0.00	0.00	0.01	0.00	0.25	0.00	0.07
ROS-01047	2018	ROS_SANCTUARY	-14.5370	-168.1680	Forereef	Deep	0.31	0.38	0.05	0.00	0.00	0.00	0.02	0.00	0.24	0.00	0.05
ROS-01048	2018	ROS_SANCTUARY	-14.5417	-168.1439	Forereef	Deep	0.36	0.25	0.20	0.00	0.00	0.09	0.01	0.00	0.07	0.00	0.12
ROS-01053	2018	ROS_SANCTUARY	-14.5323	-168.1577	Forereef	Mid	0.37	0.09	0.19	0.01	0.00	0.00	0.03	0.00	0.30	0.00	0.06
ROS-01056	2018	ROS_SANCTUARY	-14.5550	-168.1475	Forereef	Mid	0.49	0.09	0.27	0.01	0.00	0.05	0.02	0.00	0.07	0.00	0.10
ROS-01062	2018	ROS_SANCTUARY	-14.5418	-168.1726	Forereef	Mid	0.44	0.24	0.18	0.03	0.00	0.01	0.03	0.00	0.06	0.00	0.15
ROS-01067	2018	ROS_SANCTUARY	-14.5370	-168.1470	Forereef	Mid	0.43	0.18	0.18	0.01	0.01	0.06	0.01	0.01	0.11	0.01	0.06
ROS-01070	2018	ROS_SANCTUARY	-14.5461	-168.1707	Forereef	Deep	0.46	0.13	0.18	0.14	0.00	0.01	0.02	0.00	0.06	0.00	0.17
ROS-01071	2018	ROS_SANCTUARY	-14.5437	-168.1718	Forereef	Mid	0.63	0.11	0.12	0.02	0.00	0.01	0.07	0.00	0.04	0.00	0.13
ROS-01076	2018	ROS_SANCTUARY	-14.5391	-168.1457	Forereef	Mid	0.41	0.20	0.25	0.00	0.00	0.06	0.02	0.00	0.05	0.00	0.06
ROS-01077	2018	ROS_SANCTUARY	-14.5340	-168.1586	Forereef	Shallow	0.61	0.06	0.13	0.00	0.00	0.00	0.05	0.00	0.15	0.00	0.10
ROS-01080	2018	ROS_SANCTUARY	-14.5378	-168.1708	Forereef	Shallow	0.58	0.08	0.04	0.00	0.00	0.00	0.12	0.00	0.17	0.00	0.05
ROS-01101	2018	ROS_SANCTUARY	-14.5362	-168.1639	Forereef	Mid	0.64	0.11	0.13	0.01	0.00	0.00	0.04	0.00	0.06	0.00	0.10
ROS-01105	2018	ROS_SANCTUARY	-14.5373	-168.1686	Forereef	Mid	0.63	0.13	0.05	0.02	0.00	0.00	0.10	0.00	0.07	0.00	0.08
ROS-01108	2018	ROS_SANCTUARY	-14.5442	-168.1715	Forereef	Mid	0.57	0.14	0.07	0.04	0.00	0.00	0.15	0.00	0.03	0.00	0.07
ROS-05001	2018	ROS_SANCTUARY	-14.5507	-168.1670	Forereef	Shallow	0.09	0.07	0.23	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.19
SWA-00711	2018	SWA_SANCTUARY	-11.0638	-171.0873	Forereef	Deep	0.12	0.46	0.27	0.00	0.00	0.01	0.00	0.00	0.13	0.00	0.08
SWA-00721	2018	SWA_SANCTUARY	-11.0500	-171.0668	Forereef	Shallow	0.29	0.46	0.07	0.00	0.00	0.04	0.00	0.00	0.13	0.00	0.11
SWA-00722	2018	SWA_SANCTUARY	-11.0676	-171.0827	Forereef	Mid	0.04	0.48	0.41	0.00	0.00	0.01	0.01	0.01	0.04	0.00	0.12
SWA-00728	2018	SWA_SANCTUARY	-11.0467	-171.0835	Forereef	Mid	0.42	0.09	0.18	0.00	0.00	0.09	0.02	0.01	0.18	0.00	0.09
SWA-00731	2018	SWA_SANCTUARY	-11.0467	-171.0693	Forereef	Mid	0.62	0.12	0.11	0.00	0.00	0.06	0.02	0.00	0.07	0.00	0.13
SWA-00740	2018	SWA_SANCTUARY	-11.0648	-171.0856	Forereef	Shallow	0.22	0.42	0.08	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.15
SWA-00751	2018	SWA_SANCTUARY	-11.0463	-171.0792	Forereef	Shallow	0.33	0.31	0.06	0.00	0.00	0.03	0.00	0.00	0.26	0.00	0.04
SWA-00753	2018	SWA_SANCTUARY	-11.0599	-171.0902	Forereef	Shallow	0.04	0.77	0.08	0.00	0.00	0.01	0.02	0.00	0.08	0.00	0.09
SWA-00766	2018	SWA_SANCTUARY	-11.0515	-171.0655	Forereef	Mid	0.19	0.21	0.22	0.00	0.00	0.16	0.02	0.00	0.20	0.00	0.14
SWA-00775	2018	SWA_SANCTUARY	-11.0453	-171.0722	Forereef	Deep	0.42	0.08	0.19	0.00	0.00	0.11	0.03	0.01	0.17	0.00	0.08
SWA-00780	2018	SWA_SANCTUARY	-11.0459	-171.0779	Forereef	Mid	0.56	0.10	0.10	0.00	0.00	0.09	0.01	0.00	0.13	0.00	0.10
SWA-00788	2018	SWA_SANCTUARY	-11.0467	-171.0811	Forereef	Shallow	0.12	0.72	0.08	0.00	0.01	0.03	0.00	0.00	0.04	0.00	0.09
SWA-00789	2018	SWA_SANCTUARY	-11.0485	-171.0888	Forereef	Shallow	0.17	0.57	0.15	0.01	0.00	0.02	0.00	0.00	0.08	0.00	0.15
SWA-00795	2018	SWA_SANCTUARY	-11.0659	-171.0849	Forereef	Mid	0.16	0.34	0.29	0.00	0.00	0.01	0.03	0.01	0.16	0.00	0.11
SWA-00800	2018	SWA_SANCTUARY	-11.0634	-171.0871	Forereef	Shallow	0.11	0.52	0.22	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.16
TAU-00890	2018	TAU_OPEN	-14.2493	-169.4185	Forereef	Deep	0.30	0.27	0.23	0.05	0.01	0.00	0.01	0.00	0.13	0.00	0.04
TAU-00894	2018	TAU_OPEN	-14.2127	-169.4657	Forereef	Deep	0.09	0.25	0.10	0.06	0.02	0.00	0.01	0.04	0.42	0.02	0.02
TAU-00900	2018	TAU_SANCTUARY	-14.2497	-169.5039	Forereef	Shallow	0.35	0.21	0.12	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.03
TAU-00906	2018	TAU_OPEN	-14.2139	-169.5106	Forereef	Deep	0.01	0.07	0.07	0.01	0.00	0.00	0.00	0.05	0.79	0.00	0.00

Site	Year	Reporting unit	Latitude	Longitude	Reef zone	Depth bin	CORAL	CCA	EMA	HAL	I	MA	SC	SED	TURF	TW	UC
TAU-00919	2018	TAU_OPEN	-14.2131	-169.5042	Forereef	Deep	0.08	0.30	0.11	0.00	0.00	0.00	0.21	0.02	0.28	0.00	0.02
TAU-00923	2018	TAU_SANCTUARY	-14.2584	-169.5011	Forereef	Deep	0.15	0.13	0.17	0.07	0.00	0.00	0.04	0.01	0.42	0.00	0.01
TAU-00938	2018	TAU_OPEN	-14.2504	-169.4474	Forereef	Mid	0.32	0.30	0.25	0.00	0.01	0.00	0.01	0.00	0.12	0.00	0.00
TAU-00941	2018	TAU_OPEN	-14.2567	-169.4329	Forereef	Mid	0.28	0.27	0.25	0.00	0.00	0.00	0.01	0.00	0.17	0.00	0.04
TAU-00945	2018	TAU_SANCTUARY	-14.2756	-169.4927	Forereef	Mid	0.17	0.03	0.25	0.00	0.00	0.00	0.01	0.00	0.54	0.00	0.00
TAU-00947	2018	TAU_SANCTUARY	-14.2599	-169.5005	Forereef	Mid	0.11	0.11	0.09	0.00	0.00	0.00	0.00	0.03	0.65	0.00	0.01
TAU-00951	2018	TAU_OPEN	-14.2123	-169.4431	Forereef	Mid	0.25	0.28	0.18	0.00	0.00	0.00	0.04	0.02	0.23	0.00	0.05
TAU-00952	2018	TAU_OPEN	-14.2515	-169.4463	Forereef	Mid	0.20	0.27	0.27	0.00	0.01	0.00	0.03	0.00	0.22	0.00	0.02
TAU-00958	2018	TAU_OPEN	-14.2437	-169.5092	Forereef	Mid	0.13	0.21	0.17	0.01	0.00	0.00	0.01	0.01	0.46	0.00	0.03
TAU-00961	2018	TAU_OPEN	-14.2182	-169.4166	Forereef	Deep	0.25	0.16	0.28	0.03	0.01	0.01	0.01	0.00	0.25	0.00	0.10
TAU-00975	2018	TAU_OPEN	-14.2498	-169.4569	Forereef	Mid	0.35	0.27	0.25	0.00	0.01	0.00	0.03	0.00	0.10	0.00	0.01
TAU-00979	2018	TAU_OPEN	-14.2424	-169.4187	Forereef	Mid	0.36	0.28	0.21	0.02	0.00	0.00	0.01	0.00	0.11	0.00	0.05
TAU-00983	2018	TAU_OPEN	-14.2305	-169.5186	Forereef	Mid	0.03	0.31	0.04	0.00	0.00	0.00	0.01	0.00	0.60	0.00	0.01
TAU-00987	2018	TAU_OPEN	-14.2115	-169.4606	Forereef	Mid	0.08	0.61	0.02	0.00	0.00	0.00	0.02	0.00	0.27	0.00	0.03
TAU-00992	2018	TAU_OPEN	-14.2149	-169.4842	Forereef	Mid	0.35	0.33	0.16	0.00	0.00	0.00	0.02	0.02	0.12	0.01	0.03
TAU-01000	2018	TAU_OPEN	-14.2196	-169.5177	Forereef	Deep	0.07	0.07	0.09	0.00	0.00	0.00	0.01	0.00	0.76	0.00	0.02
TAU-01007	2018	TAU_SANCTUARY	-14.2656	-169.4977	Forereef	Shallow	0.37	0.23	0.13	0.00	0.00	0.00	0.02	0.00	0.25	0.00	0.00
TAU-01009	2018	TAU_OPEN	-14.2116	-169.4423	Forereef	Deep	0.23	0.20	0.20	0.01	0.00	0.00	0.01	0.07	0.26	0.00	0.04
TAU-01011	2018	TAU_OPEN	-14.2099	-169.4303	Forereef	Deep	0.27	0.27	0.18	0.01	0.00	0.00	0.02	0.01	0.23	0.00	0.07
TAU-01016	2018	TAU_OPEN	-14.2244	-169.5197	Forereef	Shallow	0.05	0.02	0.02	0.10	0.00	0.00	0.00	0.00	0.81	0.00	0.02
TAU-01019	2018	TAU_OPEN	-14.2147	-169.4783	Forereef	Shallow	0.22	0.15	0.19	0.00	0.00	0.01	0.01	0.00	0.41	0.00	0.06
TAU-01021	2018	TAU_OPEN	-14.2558	-169.4200	Forereef	Mid	0.54	0.19	0.15	0.00	0.00	0.00	0.02	0.00	0.10	0.00	0.02
TAU-01022	2018	TAU_OPEN	-14.2165	-169.5000	Forereef	Shallow	0.18	0.34	0.11	0.00	0.00	0.00	0.01	0.00	0.36	0.01	0.01
TAU-01032	2018	TAU_OPEN	-14.2144	-169.4881	Forereef	Mid	0.11	0.44	0.13	0.00	0.00	0.00	0.01	0.00	0.30	0.00	0.01
TAU-01034	2018	TAU_OPEN	-14.2148	-169.5022	Forereef	Mid	0.09	0.19	0.23	0.00	0.00	0.00	0.03	0.01	0.46	0.00	0.02
TAU-01036	2018	TAU_OPEN	-14.2487	-169.4190	Forereef	Mid	0.49	0.19	0.20	0.00	0.01	0.00	0.03	0.00	0.08	0.00	0.05
TAU-01056	2018	TAU_SANCTUARY	-14.2651	-169.4990	Forereef	Deep	0.11	0.08	0.28	0.00	0.00	0.00	0.01	0.03	0.49	0.00	0.03
TAU-01062	2018	TAU_SANCTUARY	-14.2755	-169.4922	Forereef	Mid	0.14	0.05	0.23	0.00	0.00	0.00	0.00	0.00	0.57	0.00	0.02
TAU-01065	2018	TAU_SANCTUARY	-14.2634	-169.4999	Forereef	Mid	0.16	0.08	0.21	0.00	0.00	0.00	0.00	0.01	0.53	0.00	0.02
TAU-01071	2018	TAU_SANCTUARY	-14.2633	-169.4990	Forereef	Shallow	0.40	0.16	0.12	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.04
TAU-01074	2018	TAU_SANCTUARY	-14.2677	-169.4963	Forereef	Shallow	0.31	0.25	0.10	0.00	0.00	0.00	0.00	0.00	0.34	0.00	0.04
TAU-01077	2018	TAU_OPEN	-14.2346	-169.4189	Forereef	Mid	0.48	0.14	0.23	0.00	0.01	0.00	0.01	0.00	0.13	0.00	0.01
TAU-01080	2018	TAU_OPEN	-14.2282	-169.5187	Forereef	Mid	0.08	0.56	0.12	0.00	0.01	0.00	0.04	0.01	0.19	0.00	0.02
TUT-02553	2018	TUT_SW_OPEN	-14.3364	-170.8011	Forereef	Deep	0.23	0.27	0.15	0.01	0.01	0.00	0.03	0.01	0.30	0.00	0.03
TUT-02564	2018	TUT_SW_OPEN	-14.3398	-170.7921	Forereef	Deep	0.13	0.32	0.14	0.01	0.00	0.00	0.03	0.03	0.34	0.00	0.01
TUT-02581	2018	TUT_SW_OPEN	-14.3553	-170.7875	Forereef	Mid	0.21	0.15	0.17	0.01	0.00	0.00	0.01	0.14	0.31	0.00	0.02
TUT-02591	2018	TUT_SW_OPEN	-14.3328	-170.8198	Forereef	Mid	0.41	0.25	0.20	0.00	0.00	0.01	0.04	0.00	0.10	0.00	0.06
TUT-02606	2018	TUT_SW_OPEN	-14.3349	-170.8071	Forereef	Mid	0.43	0.15	0.27	0.01	0.00	0.05	0.03	0.00	0.06	0.00	0.01
TUT-02630	2018	TUT_SW_OPEN	-14.3479	-170.7890	Forereef	Mid	0.13	0.22	0.16	0.00	0.00	0.01	0.03	0.10	0.34	0.01	0.03
TUT-02636	2018	TUT_SW_OPEN	-14.3276	-170.8081	Forereef	Shallow	0.17	0.12	0.04	0.00	0.00	0.00	0.01	0.00	0.65	0.00	0.02
TUT-02639	2018	TUT_SW_OPEN	-14.3351	-170.7950	Forereef	Shallow	0.42	0.39	0.11	0.00	0.00	0.01	0.03	0.00	0.04	0.00	0.03
TUT-02662	2018	TUT_SW_OPEN	-14.3268	-170.8356	Forereef	Shallow	0.49	0.19	0.06	0.00	0.00	0.01	0.00	0.00	0.25	0.00	0.06
TUT-02771	2018	TUT_FAGALUA	-14.3608	-170.7484	Forereef	Mid	0.36	0.05	0.51	0.01	0.00	0.00	0.01	0.00	0.06	0.00	0.00
TUT-02791	2018	TUT_FAGATELE	-14.3641	-170.7616	Forereef	Shallow	0.28	0.42	0.08	0.00	0.00	0.00	0.10	0.00	0.12	0.00	0.08
TUT-02794	2018	TUT_FAGALUA	-14.3638	-170.7523	Forereef	Deep	0.25	0.08	0.17	0.00	0.00	0.00	0.02	0.04	0.44	0.00	0.02
TUT-02796	2018	TUT_FAGALUA	-14.3610	-170.7512	Forereef	Mid	0.42	0.17	0.22	0.00	0.00	0.00	0.08	0.00	0.10	0.00	0.01

Site	Year	Reporting unit	Latitude	Longitude	Reef zone	Depth bin	CORAL	CCA	EMA	HAL	I	MA	SC	SED	TURF	TW	UC
TUT-02803	2018	TUT_NE_OPEN	-14.2929	-170.5498	Forereef	Deep	0.39	0.04	0.35	0.01	0.00	0.00	0.00	0.00	0.20	0.00	0.04
TUT-02806	2018	TUT_NE_OPEN	-14.2930	-170.5525	Forereef	Deep	0.22	0.09	0.35	0.15	0.00	0.00	0.02	0.00	0.17	0.00	0.05
TUT-02808	2018	TUT_SE_OPEN	-14.2965	-170.5661	Forereef	Mid	0.05	0.09	0.09	0.06	0.00	0.00	0.00	0.01	0.70	0.00	0.04
TUT-02812	2018	TUT_SE_OPEN	-14.2950	-170.5582	Forereef	Mid	0.13	0.23	0.09	0.00	0.00	0.00	0.01	0.01	0.54	0.00	0.02
TUT-02838	2018	TUT_FAGATELE	-14.3633	-170.7669	Forereef	Deep	0.07	0.09	0.17	0.01	0.00	0.01	0.01	0.10	0.54	0.00	0.03
TUT-02843	2018	TUT_FAGATELE	-14.3645	-170.7682	Forereef	Deep	0.47	0.09	0.26	0.00	0.00	0.00	0.01	0.00	0.16	0.00	0.02
TUT-02850	2018	TUT_FAGALUA	-14.3643	-170.7521	Forereef	Deep	0.20	0.04	0.35	0.01	0.00	0.00	0.00	0.01	0.40	0.00	0.01
TUT-02852	2018	TUT_FAGALUA	-14.3608	-170.7504	Forereef	Deep	0.28	0.09	0.35	0.00	0.01	0.00	0.07	0.01	0.20	0.00	0.00
TUT-02854	2018	TUT_FAGALUA	-14.3653	-170.7525	Forereef	Mid	0.39	0.06	0.47	0.00	0.00	0.00	0.03	0.00	0.06	0.00	0.00
TUT-02855	2018	TUT_FAGALUA	-14.3601	-170.7493	Forereef	Mid	0.41	0.14	0.36	0.00	0.00	0.01	0.02	0.00	0.05	0.00	0.01
TUT-02860	2018	TUT_FAGATELE	-14.3628	-170.7665	Forereef	Mid	0.31	0.15	0.35	0.00	0.00	0.00	0.00	0.01	0.18	0.00	0.01
TUT-02871	2018	TUT_FAGATELE	-14.3651	-170.7635	Forereef	Mid	0.24	0.19	0.38	0.01	0.00	0.01	0.03	0.00	0.13	0.00	0.01
TUT-02871	2018	TUT_FAGATELE	-14.3651	-170.7635	Forereef	Mid	0.24	0.19	0.38	0.01	0.00	0.01	0.03	0.00	0.13	0.00	0.01
TUT-02872	2018	TUT_FAGATELE	-14.3643	-170.7615	Forereef	Shallow	0.49	0.24	0.16	0.00	0.00	0.00	0.05	0.01	0.06	0.01	0.00
TUT-02874	2018	TUT_FAGATELE	-14.3619	-170.7649	Forereef	Mid	0.38	0.18	0.26	0.00	0.01	0.01	0.02	0.00	0.15	0.00	0.01
TUT-02883	2018	TUT_FAGATELE	-14.3631	-170.7622	Forereef	Shallow	0.33	0.49	0.08	0.00	0.00	0.00	0.03	0.00	0.08	0.00	0.08
TUT-02889	2018	TUT_FAGATELE	-14.3642	-170.7602	Forereef	Shallow	0.49	0.22	0.13	0.00	0.00	0.01	0.01	0.00	0.12	0.00	0.05
TUT-02897	2018	TUT_NE_OPEN	-14.2371	-170.6732	Forereef	Deep	0.22	0.04	0.09	0.00	0.08	0.00	0.01	0.02	0.53	0.00	0.01
TUT-02903	2018	TUT_NE_OPEN	-14.2501	-170.6572	Forereef	Mid	0.26	0.33	0.11	0.00	0.00	0.01	0.05	0.01	0.23	0.00	0.02
TUT-02904	2018	TUT_NE_OPEN	-14.2560	-170.6511	Forereef	Mid	0.14	0.24	0.16	0.03	0.00	0.02	0.02	0.04	0.36	0.00	0.03
TUT-02905	2018	TUT_NE_OPEN	-14.2504	-170.6213	Forereef	Mid	0.24	0.49	0.15	0.00	0.00	0.00	0.01	0.00	0.11	0.00	0.02
TUT-02906	2018	TUT_NW_OPEN	-14.3107	-170.8358	Forereef	Deep	0.24	0.21	0.35	0.00	0.02	0.00	0.02	0.00	0.15	0.00	0.01
TUT-02907	2018	TUT_NW_OPEN	-14.2884	-170.7689	Forereef	Mid	0.21	0.12	0.40	0.01	0.00	0.02	0.00	0.00	0.24	0.00	0.01
TUT-02908	2018	TUT_NW_OPEN	-14.2779	-170.7234	Forereef	Shallow	0.26	0.14	0.13	0.00	0.00	0.00	0.01	0.00	0.46	0.00	0.03
TUT-02909	2018	TUT_NE_OPEN	-14.2457	-170.6835	Forereef	Mid	0.06	0.08	0.27	0.00	0.00	0.04	0.02	0.00	0.53	0.00	0.00
TUT-02916	2018	TUT_NE_OPEN	-14.2483	-170.6704	Forereef	Shallow	0.20	0.23	0.10	0.00	0.00	0.04	0.04	0.03	0.36	0.00	0.06
TUT-02924	2018	TUT_NE_OPEN	-14.2520	-170.5941	Forereef	Deep	0.41	0.13	0.29	0.00	0.00	0.01	0.00	0.02	0.13	0.00	0.00
TUT-02926	2018	TUT_NE_OPEN	-14.2429	-170.6806	Forereef	Deep	0.31	0.04	0.19	0.00	0.00	0.00	0.02	0.03	0.41	0.00	0.03
TUT-02927	2018	TUT_NE_OPEN	-14.2469	-170.6643	Forereef	Mid	0.40	0.19	0.28	0.02	0.01	0.01	0.02	0.00	0.07	0.00	0.03
TUT-02929	2018	TUT_NE_OPEN	-14.2386	-170.6694	Forereef	Mid	0.26	0.34	0.27	0.00	0.00	0.00	0.06	0.00	0.07	0.00	0.06
TUT-02932	2018	TUT_NE_OPEN	-14.2304	-170.6958	Forereef	Deep	0.03	0.00	0.03	0.01	0.00	0.00	0.00	0.22	0.71	0.00	0.00
TUT-02933	2018	TUT_NE_OPEN	-14.2459	-170.5805	Forereef	Mid	0.41	0.05	0.34	0.00	0.00	0.00	0.01	0.01	0.18	0.00	0.00
TUT-02934	2018	TUT_NE_OPEN	-14.2485	-170.6459	Forereef	Deep	0.12	0.10	0.12	0.00	0.00	0.00	0.02	0.03	0.61	0.01	0.02
TUT-02935	2018	TUT_NW_OPEN	-14.2634	-170.7134	Forereef	Deep	0.15	0.15	0.22	0.00	0.00	0.00	0.01	0.01	0.47	0.00	0.00
TUT-02937	2018	TUT_NW_OPEN	-14.2884	-170.7591	Forereef	Deep	0.04	0.16	0.18	0.01	0.01	0.01	0.01	0.03	0.55	0.00	0.02
TUT-02938	2018	TUT_NW_OPEN	-14.2995	-170.8153	Forereef	Mid	0.20	0.23	0.34	0.00	0.00	0.00	0.01	0.00	0.21	0.00	0.02
TUT-02942	2018	TUT_NW_OPEN	-14.2823	-170.7339	Forereef	Deep	0.22	0.06	0.36	0.01	0.00	0.03	0.02	0.01	0.29	0.00	0.05
TUT-02943	2018	TUT_NE_OPEN	-14.2456	-170.5642	Forereef	Mid	0.28	0.03	0.49	0.00	0.00	0.00	0.01	0.00	0.19	0.00	0.01
TUT-02944	2018	TUT_NW_OPEN	-14.2908	-170.7467	Forereef	Deep	0.17	0.14	0.43	0.00	0.00	0.02	0.02	0.01	0.21	0.00	0.01
TUT-02945	2018	TUT_NE_OPEN	-14.2529	-170.6898	Forereef	Mid	0.36	0.04	0.02	0.00	0.02	0.00	0.01	0.06	0.48	0.00	0.01
TUT-02948	2018	TUT_NW_OPEN	-14.2931	-170.8090	Forereef	Shallow	0.17	0.20	0.23	0.00	0.00	0.00	0.01	0.00	0.39	0.00	0.01
TUT-02949	2018	TUT_NE_OPEN	-14.2611	-170.7059	Forereef	Shallow	0.40	0.06	0.11	0.00	0.00	0.00	0.04	0.00	0.38	0.00	0.05
TUT-02952	2018	TUT_NW_OPEN	-14.2920	-170.7923	Forereef	Shallow	0.11	0.32	0.06	0.00	0.00	0.00	0.02	0.00	0.49	0.00	0.01
TUT-02954	2018	TUT_NW_OPEN	-14.2908	-170.7888	Forereef	Shallow	0.07	0.04	0.16	0.00	0.00	0.00	0.01	0.00	0.71	0.00	0.01
TUT-02957	2018	TUT_NE_OPEN	-14.2500	-170.5816	Forereef	Mid	0.11	0.01	0.19	0.00	0.00	0.00	0.00	0.02	0.67	0.01	0.00
TUT-02959	2018	TUT_NE_OPEN	-14.2481	-170.6275	Forereef	Mid	0.43	0.24	0.22	0.00	0.00	0.00	0.02	0.00	0.09	0.00	0.02

Site	Year	Reporting unit	Latitude	Longitude	Reef zone	Depth bin	CORAL	CCA	EMA	HAL	I	MA	SC	SED	TURF	TW	UC
TUT-02960	2018	TUT_NE_OPEN	-14.2473	-170.6894	Forereef	Mid	0.07	0.06	0.18	0.00	0.00	0.00	0.00	0.00	0.69	0.01	0.00
TUT-02962	2018	TUT_NE_OPEN	-14.2455	-170.5746	Forereef	Mid	0.41	0.12	0.15	0.00	0.00	0.00	0.04	0.01	0.27	0.01	0.01
TUT-02965	2018	TUT_NW_OPEN	-14.2626	-170.7135	Forereef	Mid	0.10	0.03	0.14	0.00	0.00	0.00	0.01	0.02	0.69	0.00	0.01
TUT-02977	2018	TUT_NE_OPEN	-14.2483	-170.6385	Forereef	Mid	0.15	0.16	0.56	0.00	0.00	0.00	0.01	0.00	0.11	0.00	0.02
TUT-02978	2018	TUT_SE_OPEN	-14.2929	-170.6602	Forereef	Mid	0.04	0.40	0.51	0.00	0.00	0.02	0.03	0.00	0.00	0.00	0.02
TUT-02979	2018	TUT_NE_OPEN	-14.2470	-170.5707	Forereef	Mid	0.18	0.32	0.14	0.00	0.01	0.00	0.03	0.02	0.31	0.00	0.02
TUT-02985	2018	TUT_NE_OPEN	-14.2496	-170.5863	Forereef	Mid	0.52	0.06	0.34	0.00	0.00	0.01	0.00	0.00	0.07	0.00	0.00
TUT-03006	2018	TUT_SW_OPEN	-14.3603	-170.7864	Forereef	Deep	0.28	0.27	0.20	0.00	0.00	0.00	0.01	0.00	0.23	0.00	0.06
TUT-03007	2018	TUT_NE_OPEN	-14.2470	-170.6729	Forereef	Shallow	0.41	0.15	0.16	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.09
TUT-03022	2018	TUT_NE_OPEN	-14.2538	-170.7018	Forereef	Shallow	0.04	0.19	0.33	0.00	0.00	0.01	0.01	0.00	0.43	0.00	0.01
TUT-03023	2018	TUT_SW_OPEN	-14.3269	-170.8338	Forereef	Shallow	0.43	0.31	0.07	0.00	0.00	0.00	0.03	0.00	0.15	0.00	0.10
TUT-03026	2018	TUT_SW_OPEN	-14.3307	-170.8141	Forereef	Shallow	0.33	0.35	0.08	0.00	0.00	0.00	0.05	0.00	0.18	0.00	0.14
TUT-03038	2018	TUT_NW_OPEN	-14.2887	-170.7566	Forereef	Deep	0.26	0.06	0.40	0.03	0.00	0.03	0.00	0.00	0.22	0.00	0.02
TUT-03040	2018	TUT_NW_OPEN	-14.2893	-170.7447	Forereef	Deep	0.14	0.10	0.52	0.00	0.00	0.04	0.00	0.00	0.20	0.00	0.03
TUT-03043	2018	TUT_NE_OPEN	-14.2508	-170.6422	Forereef	Deep	0.10	0.25	0.15	0.00	0.01	0.01	0.01	0.04	0.43	0.00	0.03
TUT-03049	2018	TUT_NW_OPEN	-14.2812	-170.7243	Forereef	Mid	0.22	0.15	0.29	0.02	0.00	0.02	0.01	0.01	0.28	0.00	0.01
TUT-03050	2018	TUT_NW_OPEN	-14.2801	-170.7368	Forereef	Deep	0.15	0.03	0.35	0.00	0.00	0.00	0.00	0.02	0.44	0.01	0.02
TUT-03063	2018	TUT_NW_OPEN	-14.2993	-170.8220	Forereef	Deep	0.30	0.05	0.36	0.02	0.01	0.01	0.01	0.00	0.24	0.00	0.01
TUT-03070	2018	TUT_NW_OPEN	-14.2959	-170.8121	Forereef	Deep	0.18	0.21	0.12	0.00	0.00	0.00	0.01	0.00	0.48	0.00	0.02
TUT-03071	2018	TUT_NW_OPEN	-14.3180	-170.8457	Forereef	Deep	0.04	0.04	0.08	0.01	0.00	0.00	0.00	0.01	0.82	0.00	0.01
TUT-03072	2018	TUT_NW_OPEN	-14.3029	-170.8260	Forereef	Mid	0.12	0.37	0.09	0.00	0.00	0.00	0.01	0.01	0.39	0.00	0.00
TUT-03074	2018	TUT_NW_OPEN	-14.2920	-170.7946	Forereef	Mid	0.05	0.26	0.08	0.00	0.00	0.00	0.01	0.00	0.61	0.00	0.04
TUT-03080	2018	TUT_NW_OPEN	-14.3092	-170.8341	Forereef	Mid	0.03	0.51	0.07	0.00	0.01	0.00	0.00	0.00	0.37	0.00	0.01
TUT-03086	2018	TUT_NW_OPEN	-14.2939	-170.8093	Forereef	Mid	0.07	0.30	0.19	0.00	0.01	0.00	0.01	0.00	0.42	0.00	0.01
TUT-03087	2018	TUT_NW_OPEN	-14.2871	-170.7677	Forereef	Mid	0.11	0.05	0.34	0.00	0.00	0.01	0.00	0.02	0.47	0.00	0.01
TUT-03108	2018	TUT_NW_OPEN	-14.2872	-170.7840	Forereef	Shallow	0.14	0.04	0.69	0.00	0.00	0.07	0.00	0.00	0.06	0.00	0.00
TUT-03113	2018	TUT_NW_OPEN	-14.2918	-170.8053	Forereef	Mid	0.31	0.15	0.20	0.00	0.00	0.00	0.01	0.00	0.31	0.00	0.05
TUT-03114	2018	TUT_NW_OPEN	-14.2949	-170.8108	Forereef	Mid	0.27	0.27	0.18	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.01
TUT-03118	2018	TUT_NW_OPEN	-14.2826	-170.7339	Forereef	Mid	0.28	0.03	0.61	0.00	0.00	0.00	0.01	0.00	0.06	0.01	0.02
TUT-03119	2018	TUT_NW_OPEN	-14.2898	-170.8002	Forereef	Mid	0.03	0.26	0.10	0.00	0.00	0.00	0.00	0.00	0.60	0.01	0.00
TUT-03125	2018	TUT_NW_OPEN	-14.2915	-170.7761	Forereef	Shallow	0.13	0.03	0.70	0.00	0.00	0.07	0.01	0.00	0.05	0.00	0.01
TUT-03135	2018	TUT_NW_OPEN	-14.3002	-170.8141	Forereef	Shallow	0.17	0.05	0.24	0.00	0.00	0.00	0.01	0.00	0.53	0.00	0.02
TUT-03143	2018	TUT_NW_OPEN	-14.3214	-170.8458	Forereef	Mid	0.09	0.12	0.14	0.00	0.00	0.00	0.00	0.03	0.62	0.00	0.01
TUT-03144	2018	TUT_NW_OPEN	-14.3084	-170.8308	Forereef	Shallow	0.17	0.22	0.09	0.00	0.00	0.00	0.01	0.01	0.50	0.00	0.07
TUT-03163	2018	TUT_SE_OPEN	-14.2882	-170.6770	Forereef	Deep	0.26	0.09	0.11	0.00	0.00	0.00	0.02	0.03	0.49	0.00	0.01
TUT-03182	2018	TUT_SE_OPEN	-14.2936	-170.6540	Forereef	Mid	0.13	0.36	0.34	0.00	0.00	0.01	0.13	0.00	0.02	0.00	0.04
TUT-03193	2018	TUT_SE_OPEN	-14.3020	-170.6787	Forereef	Mid	0.05	0.25	0.57	0.00	0.00	0.10	0.01	0.00	0.02	0.00	0.00
TUT-03210	2018	TUT_SE_OPEN	-14.2924	-170.6644	Forereef	Mid	0.05	0.21	0.72	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00
TUT-03262	2018	TUT_SE_OPEN	-14.2854	-170.6652	Forereef	Mid	0.08	0.15	0.46	0.00	0.00	0.00	0.00	0.00	0.30	0.01	0.00
TUT-05000	2018	TUT_NW_OPEN	-14.2877	-170.7819	Forereef	Deep	0.12	0.02	0.31	0.00	0.00	0.01	0.00	0.01	0.53	0.00	0.01
TUT-05001	2018	TUT_NW_OPEN	-14.2921	-170.7798	Forereef	Mid	0.03	0.19	0.07	0.01	0.01	0.00	0.01	0.06	0.63	0.00	0.02
TUT-05003	2018	TUT_NE_OPEN	-14.2837	-170.5631	Forereef	Deep	0.20	0.14	0.18	0.00	0.00	0.00	0.01	0.03	0.44	0.00	0.01
TUT-05004	2018	TUT_NE_OPEN	-14.2810	-170.5615	Forereef	Mid	0.25	0.19	0.14	0.00	0.00	0.00	0.01	0.03	0.38	0.00	0.02
TUT-05005	2018	TUT_NE_OPEN	-14.2768	-170.5576	Forereef	Mid	0.26	0.19	0.20	0.00	0.00	0.00	0.02	0.03	0.30	0.00	0.01

Appendix 3. Mean (± 1 SE) coral population estimates of adult and juvenile density, colony partial mortality, and prevalence of disease and bleaching for select genera and total scleractinians, from surveys conducted in 2018. Old Mort: old mortality; Rec Mort: recent mortality; Acute DZ; acute diseases; Chronic DZ; chronic diseases; and BLE: bleaching. ACSP: Acropora sp., MOSP: Montipora sp., POCS: Pocillopora sp., POSP: Porites sp., and SSSS: all coral genera combined.

Island	Year	Reporting unit	Depth bin	Genus code	Adult density	SE	Juvenile density	SE	Old Mort	SE	Rec Mort	SE	Acute DZ	SE	Chronic DZ	SE	BLE	SE
Ofu & Olosega	2018	Ofu & Olosega	Deep	ACSP	0.67	0.21	0.39	0.33	2.15	2.15	0.16	0.14	3.31	3.30	0.00	0.00	0.00	0.00
Ofu & Olosega	2018	Ofu & Olosega	Deep	MOSP	1.92	0.70	0.67	0.33	8.59	1.67	1.20	0.54	1.73	1.09	0.00	0.00	0.00	0.00
Ofu & Olosega	2018	Ofu & Olosega	Deep	POCS	0.59	0.15	0.22	0.16	4.93	2.64	0.44	0.33	0.00	0.00	0.00	0.00	0.00	0.00
Ofu & Olosega	2018	Ofu & Olosega	Deep	POSP	0.95	0.26	0.17	0.11	12.62	3.27	1.85	0.74	1.75	1.75	0.00	0.00	0.00	0.00
Ofu & Olosega	2018	Ofu & Olosega	Deep	SSSS	14.44	3.79	5.56	2.24	8.70	1.70	0.59	0.12	0.62	0.33	0.27	0.17	0.00	0.00
Ofu & Olosega	2018	Ofu & Olosega	Mid	ACSP	1.71	0.38	0.33	0.15	5.05	2.02	0.48	0.27	1.94	1.27	0.00	0.00	0.00	0.00
Ofu & Olosega	2018	Ofu & Olosega	Mid	MOSP	5.26	0.98	2.14	0.53	10.72	2.34	1.20	0.33	0.54	0.54	0.00	0.00	0.00	0.00
Ofu & Olosega	2018	Ofu & Olosega	Mid	POCS	0.88	0.21	0.00	0.00	10.41	2.94	0.48	0.20	3.24	2.09	0.00	0.00	3.24	2.09
Ofu & Olosega	2018	Ofu & Olosega	Mid	POSP	0.41	0.16	0.19	0.14	16.55	1.57	0.83	0.35	4.88	4.12	0.00	0.00	0.00	0.00
Ofu & Olosega	2018	Ofu & Olosega	Mid	SSSS	18.11	1.55	4.95	0.48	10.85	0.93	0.56	0.16	0.66	0.22	0.00	0.00	0.16	0.10
Ofu & Olosega	2018	Ofu & Olosega	Shallow	ACSP	0.38	0.02	0.00	0.00	3.63	1.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ofu & Olosega	2018	Ofu & Olosega	Shallow	MOSP	5.88	1.37	3.17	1.72	15.02	2.45	1.31	0.68	0.43	0.42	0.00	0.00	0.00	0.00
Ofu & Olosega	2018	Ofu & Olosega	Shallow	POCS	1.08	0.29	1.00	0.23	15.09	8.12	0.46	0.25	0.00	0.00	0.00	0.00	0.00	0.00
Ofu & Olosega	2018	Ofu & Olosega	Shallow	POSP	0.83	0.07	0.42	0.16	11.60	3.89	1.16	0.81	0.00	0.00	0.00	0.00	0.00	0.00
Ofu & Olosega	2018	Ofu & Olosega	Shallow	SSSS	15.60	0.70	5.92	2.23	12.03	2.28	0.74	0.18	0.16	0.16	0.00	0.00	0.16	0.16
Rose	2018	ROS_SANCTUARY	Deep	ACSP	0.67	0.34	0.33	0.19	8.75	3.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rose	2018	ROS_SANCTUARY	Deep	MOSP	2.37	0.78	1.11	0.54	1.63	0.80	0.46	0.39	0.00	0.00	0.00	0.00	0.00	0.00
Rose	2018	ROS_SANCTUARY	Deep	POCS	2.70	0.84	0.56	0.39	9.00	4.09	1.83	1.46	0.00	0.00	0.00	0.00	4.53	2.81
Rose	2018	ROS_SANCTUARY	Deep	POSP	0.39	0.15	0.33	0.33	1.83	1.79	1.33	1.30	0.00	0.00	0.00	0.00	0.00	0.00
Rose	2018	ROS_SANCTUARY	Deep	SSSS	18.18	6.75	4.00	1.81	6.63	1.24	0.72	0.56	0.37	0.36	0.00	0.00	0.67	0.42
Rose	2018	ROS_SANCTUARY	Mid	ACSP	1.12	0.56	0.21	0.14	7.52	5.15	0.08	0.05	1.12	1.11	0.00	0.00	0.00	0.00
Rose	2018	ROS_SANCTUARY	Mid	MOSP	3.08	0.38	0.67	0.22	6.03	0.84	0.33	0.12	0.41	0.40	0.00	0.00	0.00	0.00
Rose	2018	ROS_SANCTUARY	Mid	POCS	2.65	0.61	1.42	0.32	5.82	1.44	1.10	0.59	1.41	0.98	0.00	0.00	5.18	4.10
Rose	2018	ROS_SANCTUARY	Mid	POSP	1.28	0.40	0.96	0.50	7.12	1.72	0.65	0.30	0.00	0.00	0.00	0.00	0.00	0.00
Rose	2018	ROS_SANCTUARY	Mid	SSSS	14.50	1.96	5.33	1.19	7.45	0.94	0.36	0.13	0.63	0.27	0.00	0.00	1.03	0.83
Rose	2018	ROS_SANCTUARY	Shallow	ACSP	0.00	0.00	0.00	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rose	2018	ROS_SANCTUARY	Shallow	MOSP	2.00	0.83	0.56	0.29	5.78	2.96	1.58	1.10	1.67	1.63	0.00	0.00	0.00	0.00
Rose	2018	ROS_SANCTUARY	Shallow	POCS	1.57	0.76	0.44	0.11	15.50	7.74	2.63	1.48	6.38	3.61	0.00	0.00	0.00	0.00
Rose	2018	ROS_SANCTUARY	Shallow	POSP	0.50	0.25	0.78	0.47	5.36	4.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rose	2018	ROS_SANCTUARY	Shallow	SSSS	5.37	0.96	1.89	0.76	9.20	0.84	0.67	0.09	2.48	1.22	0.00	0.00	0.00	0.00
Swains	2018	SWA_SANCTUARY	Mid	ACSP	0.00	0.00	0.00	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Swains	2018	SWA_SANCTUARY	Mid	MOSP	10.07	0.92	3.56	1.34	11.31	3.45	1.87	0.27	0.00	0.00	0.00	0.00	1.99	1.14
Swains	2018	SWA_SANCTUARY	Mid	POCS	2.07	0.83	0.22	0.22	8.91	6.39	0.47	0.28	1.61	1.60	0.00	0.00	12.90	4.23
Swains	2018	SWA_SANCTUARY	Mid	POSP	0.20	0.20	0.00	0.00	14.83	NA	3.00	NA	0.00	NA	0.00	NA	0.00	NA
Swains	2018	SWA_SANCTUARY	Mid	SSSS	13.80	1.34	3.78	1.17	10.58	3.07	1.45	0.25	0.24	0.24	0.00	0.00	3.62	1.49
Swains	2018	SWA_SANCTUARY	Shallow	ACSP	0.00	0.00	0.00	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Swains	2018	SWA_SANCTUARY	Shallow	MOSP	4.73	1.86	1.44	1.28	10.90	2.33	1.43	0.03	0.00	0.00	0.70	0.70	0.70	0.70
Swains	2018	SWA_SANCTUARY	Shallow	POCS	2.40	0.58	0.22	0.22	28.97	5.74	0.54	0.32	0.00	0.00	0.00	0.00	11.11	6.03
Swains	2018	SWA_SANCTUARY	Shallow	POSP	0.33	0.33	0.33	0.19	12.00	NA	0.00	NA	0.00	NA	0.00	NA	0.00	NA
Swains	2018	SWA_SANCTUARY	Shallow	SSSS	8.10	2.02	2.00	1.17	15.37	2.67	0.96	0.17	0.00	0.00	0.41	0.41	3.70	1.88

Island	Year	Reporting unit	Depth bin	Genus code	Adult density	SE	Juvenile density	SE	Old Mort	SE	Rec Mort	SE	Acute DZ	SE	Chronic DZ	SE	BLE	SE
Tau	2018	TAU_OPEN	Deep	ACSP	0.84	0.37	0.44	0.29	0.00	0.00	0.38	0.38	0.00	0.00	0.00	0.00	0.00	0.00
Tau	2018	TAU_OPEN	Deep	MOSP	3.28	1.59	2.89	1.42	18.28	11.62	0.33	0.21	3.13	3.12	0.00	0.00	0.00	0.00
Tau	2018	TAU_OPEN	Deep	POCS	0.62	0.33	0.00	0.00	3.33	3.33	16.67	16.63	0.00	0.00	0.00	0.00	0.00	0.00
Tau	2018	TAU_OPEN	Deep	POSP	0.36	0.11	0.67	0.67	8.75	4.72	0.25	0.25	0.00	0.00	0.00	0.00	0.00	0.00
Tau	2018	TAU_OPEN	Deep	SSSS	19.53	8.75	19.11	2.98	15.89	7.23	0.69	0.55	0.53	0.52	0.23	0.23	0.00	0.00
Tau	2018	TAU_OPEN	Mid	ACSP	0.89	0.34	0.44	0.27	1.17	1.16	0.17	0.17	1.88	1.87	0.00	0.00	0.00	0.00
Tau	2018	TAU_OPEN	Mid	MOSP	3.61	1.43	1.78	0.68	8.74	2.70	0.37	0.14	0.00	0.00	0.00	0.00	0.00	0.00
Tau	2018	TAU_OPEN	Mid	POCS	0.67	0.22	0.33	0.17	7.01	2.37	0.41	0.25	0.00	0.00	0.00	0.00	0.00	0.00
Tau	2018	TAU_OPEN	Mid	POSP	1.38	0.65	0.33	0.12	5.20	1.62	0.10	0.09	1.20	1.20	0.00	0.00	0.00	0.00
Tau	2018	TAU_OPEN	Mid	SSSS	14.77	1.40	5.17	1.37	10.13	0.59	0.21	0.06	0.23	0.23	0.49	0.24	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Deep	ACSP	0.25	0.05	0.17	0.16	6.67	6.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Deep	MOSP	6.05	0.61	4.67	1.26	2.08	0.19	0.74	0.22	0.00	0.00	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Deep	POCS	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Deep	POSP	0.35	0.05	0.17	0.16	0.83	0.79	1.00	0.94	0.00	0.00	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Deep	SSSS	11.60	0.85	8.67	0.63	4.90	0.42	0.81	0.11	0.00	0.00	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Mid	ACSP	1.95	0.15	0.33	0.13	9.80	3.73	0.55	0.27	8.97	5.54	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Mid	MOSP	7.85	0.59	4.17	0.60	4.92	1.25	1.45	0.34	1.27	0.88	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Mid	POCS	0.53	0.08	0.58	0.38	4.60	3.72	0.87	0.70	4.76	4.64	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Mid	POSP	0.18	0.14	0.17	0.16	5.00	3.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Mid	SSSS	13.18	0.80	6.42	0.96	6.54	1.61	1.02	0.25	2.28	1.32	0.19	0.19	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Shallow	ACSP	2.05	1.02	0.00	0.00	16.89	7.39	1.20	0.78	12.20	11.87	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Shallow	MOSP	3.90	2.24	2.83	2.11	5.94	1.82	2.18	1.35	0.00	0.00	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Shallow	POCS	1.05	0.24	1.33	0.00	25.10	7.81	0.31	0.30	4.76	4.63	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Shallow	POSP	0.40	0.19	0.33	0.32	4.58	4.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_FAGALUA_FAGATELE	Shallow	SSSS	18.90	11.39	6.17	4.06	10.68	0.12	0.67	0.24	1.59	1.03	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_NE_OPEN	Deep	ACSP	0.58	0.07	0.07	0.07	8.83	5.12	0.08	0.07	0.00	0.00	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_NE_OPEN	Deep	MOSP	4.56	1.05	3.93	2.04	6.43	1.23	1.11	0.21	0.44	0.44	0.44	0.44	0.00	0.00
Tutuila	2018	TUT_NE_OPEN	Deep	POCS	0.50	0.18	0.07	0.07	20.31	10.35	0.82	0.25	12.00	4.89	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_NE_OPEN	Deep	POSP	0.14	0.07	0.13	0.08	12.78	3.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_NE_OPEN	Deep	SSSS	10.24	1.14	5.80	2.26	8.60	1.07	0.64	0.19	0.78	0.19	0.39	0.24	0.20	0.19
Tutuila	2018	TUT_NE_OPEN	Mid	ACSP	1.55	0.66	0.00	0.00	6.29	2.63	0.17	0.06	3.87	1.44	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_NE_OPEN	Mid	MOSP	8.70	1.57	2.33	0.71	7.28	1.19	1.03	0.20	2.87	1.38	0.19	0.19	0.19	0.19
Tutuila	2018	TUT_NE_OPEN	Mid	POCS	0.52	0.16	0.17	0.07	3.23	1.81	0.60	0.49	0.00	0.00	0.00	0.00	3.23	3.22
Tutuila	2018	TUT_NE_OPEN	Mid	POSP	1.02	0.39	0.56	0.25	5.24	1.44	0.19	0.13	1.97	1.79	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_NE_OPEN	Mid	SSSS	17.03	2.10	3.94	1.12	9.03	0.67	0.63	0.12	1.96	0.88	0.59	0.48	0.29	0.20
Tutuila	2018	TUT_NW_OPEN	Deep	ACSP	0.44	0.20	0.06	0.06	1.02	0.57	0.20	0.18	0.00	0.00	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_NW_OPEN	Deep	MOSP	2.57	1.11	0.94	0.36	9.82	4.29	0.39	0.15	2.59	2.58	1.73	1.72	0.65	0.65
Tutuila	2018	TUT_NW_OPEN	Deep	POCS	0.28	0.19	0.00	0.00	7.97	2.82	3.42	2.35	11.76	9.58	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_NW_OPEN	Deep	POSP	0.96	0.55	0.72	0.53	8.83	2.52	1.58	0.73	1.74	1.74	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_NW_OPEN	Deep	SSSS	6.67	2.08	2.67	0.94	8.91	1.67	0.53	0.13	1.58	1.30	0.67	0.66	0.25	0.25
Tutuila	2018	TUT_NW_OPEN	Mid	ACSP	0.43	0.26	0.00	0.00	5.33	4.35	0.50	0.41	0.00	0.00	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_NW_OPEN	Mid	MOSP	5.87	2.49	3.22	1.97	7.16	3.81	0.49	0.25	0.57	0.57	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_NW_OPEN	Mid	POCS	0.27	0.09	0.22	0.22	5.14	2.63	0.00	0.00	0.00	0.00	0.00	0.00	12.50	12.48
Tutuila	2018	TUT_NW_OPEN	Mid	POSP	1.00	0.50	1.00	0.51	14.11	3.65	0.39	0.25	0.00	0.00	3.33	3.33	0.00	0.00
Tutuila	2018	TUT_NW_OPEN	Mid	SSSS	13.17	4.88	6.11	3.19	10.56	3.10	0.30	0.10	0.25	0.25	1.52	0.76	0.25	0.25

Island	Year	Reporting unit	Depth bin	Genus code	Adult density	SE	Juvenile density	SE	Old Mort	SE	Rec Mort	SE	Acute DZ	SE	Chronic DZ	SE	BLE	SE
Tutuila	2018	TUT_NW_OPEN	Shallow	ACSP	0.38	0.06	0.08	0.08	14.81	7.23	0.19	0.19	0.00	0.00	6.67	6.64	0.00	0.00
Tutuila	2018	TUT_NW_OPEN	Shallow	MOSP	6.15	1.49	2.25	1.04	17.41	2.99	0.41	0.30	0.81	0.47	0.00	0.00	0.41	0.40
Tutuila	2018	TUT_NW_OPEN	Shallow	POCS	0.65	0.36	0.08	0.08	19.03	10.38	5.92	4.70	0.00	0.00	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_NW_OPEN	Shallow	POSP	0.70	0.23	0.25	0.25	16.08	5.61	0.11	0.09	3.57	3.56	0.00	0.00	0.00	0.00
Tutuila	2018	TUT_NW_OPEN	Shallow	SSSS	11.95	2.65	4.33	1.68	18.00	1.33	0.45	0.27	0.63	0.21	0.21	0.21	0.84	0.83

Appendix 4. Site-level biomass densities (g m^2) for: total fish, Acanthurus lineatus, piscivores, and for three different size classes (0–20 cm, 20–50 cm, and >50 cm) from surveys conducted in 2018; species and generic richness (Richness_S, G) are also presented. Table is sorted by SITE ID (OFU = Ofu & Olosega, ROS = Rose, SWA = Swains, TAU = Ta'u, TUT = Tutuila).

SITE	Date	Reef zone	Depth bin	Latitude	Longitude	Depth (m)	Total Biomass	ACLI	Piscivore	size_0_20	size_20_50	size_50_plus	Richness_S	Richness_G
OFU-00883	7/7/18	Forereef	Deep	-14.1814	-169.6524	22.7	41.68	0.00	17.22	21.62	10.40	9.66	62	41
OFU-00886	7/10/18	Forereef	Mid	-14.1852	-169.6763	25	38.66	0.00	4.05	29.67	8.99	0.00	53	31
OFU-00891	7/9/18	Forereef	Deep	-14.1830	-169.6027	24.65	27.48	0.00	5.42	22.68	4.81	0.00	55	36
OFU-00892	7/10/18	Forereef	Deep	-14.1518	-169.6805	25.2	64.77	0.00	10.86	30.06	32.20	2.51	71	47
OFU-00893	7/9/18	Forereef	Deep	-14.1650	-169.6460	22.35	49.90	2.38	14.86	26.65	23.24	0.00	70	37
OFU-00895	7/10/18	Forereef	Deep	-14.1553	-169.6858	25.7	33.65	0.00	7.94	22.91	10.74	0.00	51	38
OFU-00896	7/9/18	Forereef	Deep	-14.1581	-169.6199	21.8	91.82	0.00	17.98	38.05	53.77	0.00	60	35
OFU-00902	7/7/18	Forereef	Deep	-14.1904	-169.6190	28.35	41.59	0.00	9.70	24.76	16.83	0.00	53	30
OFU-00904	7/9/18	Forereef	Deep	-14.1519	-169.6099	17.85	36.48	0.00	5.47	21.20	15.28	0.00	53	40
OFU-00912	7/9/18	Forereef	Mid	-14.1616	-169.6078	14.15	103.17	0.00	15.43	29.62	73.55	0.00	64	41
OFU-00919	7/10/18	Forereef	Mid	-14.1589	-169.6722	8.15	66.28	5.01	2.10	36.13	30.15	0.00	48	30
OFU-00929	7/10/18	Forereef	Mid	-14.1690	-169.6864	9.3	116.34	2.72	11.70	59.54	27.83	28.97	63	42
OFU-00931	7/9/18	Forereef	Mid	-14.1650	-169.6259	10.05	122.77	0.00	64.87	45.59	29.06	48.12	71	43
OFU-00935	7/7/18	Forereef	Mid	-14.1793	-169.6279	7.85	59.59	0.00	5.06	48.28	11.30	0.00	56	36
OFU-00937	7/10/18	Forereef	Mid	-14.1590	-169.6824	12.05	137.96	0.89	12.28	54.58	57.54	25.83	75	47
OFU-00943	7/10/18	Forereef	Mid	-14.1833	-169.6776	12.4	68.11	0.00	21.21	37.16	19.28	11.67	65	38
OFU-00944	7/7/18	Forereef	Mid	-14.1847	-169.6238	15.15	62.35	0.00	8.87	32.53	29.82	0.00	64	41
OFU-00951	7/10/18	Forereef	Mid	-14.1580	-169.6795	9.75	58.24	0.00	10.37	32.44	25.79	0.00	41	28
OFU-00955	7/9/18	Forereef	Mid	-14.1643	-169.6509	9.35	46.97	0.00	10.79	30.12	16.85	0.00	65	38
OFU-00957	7/10/18	Forereef	Mid	-14.1870	-169.6742	14.15	140.39	0.00	12.83	41.91	72.78	25.70	66	37
OFU-00973	7/7/18	Forereef	Shallow	-14.1725	-169.6417	4	70.08	4.07	5.31	30.77	39.30	0.00	52	32
OFU-00974	7/9/18	Forereef	Shallow	-14.1628	-169.6645	5.9	66.12	20.19	5.33	42.13	16.14	7.85	48	32
OFU-00977	7/9/18	Forereef	Mid	-14.1612	-169.6378	12.65	77.45	0.00	14.34	41.96	27.29	8.19	66	43
OFU-00981	7/9/18	Forereef	Shallow	-14.1643	-169.6326	4.25	84.65	2.69	6.27	41.82	42.83	0.00	72	46
OFU-00985	7/10/18	Forereef	Deep	-14.1758	-169.6811	2.7	91.60	12.55	4.99	59.40	32.21	0.00	64	43
ROS-00924	7/14/18	Backreef	Mid	-14.5424	-168.1633	11.2	47.96	0.00	22.31	13.38	16.81	17.77	40	30
ROS-00929	7/15/18	Backreef	Shallow	-14.5412	-168.1610	2.55	41.88	0.00	5.07	18.73	23.14	0.00	50	32
ROS-00931	7/14/18	Backreef	Shallow	-14.5512	-168.1502	1.2	11.32	0.00	7.24	4.08	7.24	0.00	38	26
ROS-00932	7/15/18	Backreef	Shallow	-14.5466	-168.1638	2.2	2.05	0.00	0.00	2.05	0.00	0.00	8	8
ROS-00933	7/14/18	Forereef	Deep	-14.5361	-168.1471	20.55	43.88	0.00	10.25	22.99	19.60	1.28	52	34
ROS-00936	7/13/18	Forereef	Deep	-14.5348	-168.1609	22.55	72.00	0.00	39.31	25.91	28.04	18.05	61	35
ROS-00944	7/14/18	Forereef	Deep	-14.5470	-168.1700	23.9	25.47	0.00	4.26	17.65	7.82	0.00	46	27
ROS-00948	7/15/18	Forereef	Mid	-14.5406	-168.1729	16.95	61.74	0.00	26.00	32.10	17.36	12.29	55	34
ROS-00952	7/14/18	Forereef	Mid	-14.5379	-168.1715	10.7	36.36	0.00	6.75	26.27	10.09	0.00	45	27
ROS-00955	7/15/18	Forereef	Mid	-14.5431	-168.1427	17	45.61	0.00	12.64	27.33	18.27	0.00	50	31
ROS-00967	7/13/18	Forereef	Mid	-14.5362	-168.1642	17.85	81.80	0.00	41.21	36.87	29.53	15.40	60	35
ROS-00968	7/15/18	Forereef	Mid	-14.5306	-168.1553	11.45	265.57	0.00	227.79	31.21	13.56	220.80	52	33
ROS-00972	7/15/18	Forereef	Mid	-14.5458	-168.1708	16.65	46.54	0.00	10.40	34.67	11.87	0.00	56	33
ROS-00974	7/14/18	Forereef	Mid	-14.5505	-168.1674	12	107.86	0.75	10.81	37.05	70.81	0.00	56	33
ROS-00977	7/15/18	Forereef	Mid	-14.5446	-168.1411	17.1	73.46	0.00	23.54	28.86	35.44	9.16	64	41
ROS-00979	7/14/18	Forereef	Mid	-14.5338	-168.1591	12.1	50.56	0.00	6.97	22.16	28.40	0.00	48	28
ROS-00993	7/15/18	Forereef	Shallow	-14.5367	-168.1659	5.2	123.94	4.85	60.56	33.16	22.98	67.80	46	28

SITE	Date	Reef zone	Depth bin	Latitude	Longitude	Depth (m)	Total Biomass	ACLI	Piscivore	size_0_20	size_20_50	size_50_plus	Richness_S	Richness_G
ROS-00995	7/14/18	Forereef	Shallow	-14.5580	-168.1613	4.1	39.79	0.00	4.00	25.32	14.48	0.00	35	22
ROS-00998	7/15/18	Forereef	Shallow	-14.5445	-168.1714	5.35	63.38	4.83	5.66	30.98	32.39	0.00	49	33
ROS-00999	7/15/18	Forereef	Shallow	-14.5530	-168.1655	4.6	80.90	5.25	14.29	47.06	23.77	10.07	52	34
ROS-01005	7/14/18	Lagoon	Mid	-14.5447	-168.1500	14.75	207.26	0.00	7.93	93.33	89.31	24.62	53	34
SWA-00676	6/19/18	Forereef	Deep	-11.0507	-171.0924	25.8	56.72	0.00	7.17	17.94	15.32	23.47	52	33
SWA-00677	6/19/18	Forereef	Deep	-11.0663	-171.0743	23.5	62.15	0.00	14.58	10.08	24.15	27.92	49	27
SWA-00678	6/21/18	Forereef	Deep	-11.0549	-171.0924	25.6	107.66	0.00	55.61	15.56	27.54	64.56	51	32
SWA-00683	6/21/18	Forereef	Deep	-11.0616	-171.0684	24.9	61.73	0.00	39.01	12.51	28.52	20.71	51	28
SWA-00684	6/20/18	Forereef	Mid	-11.0632	-171.0705	7.7	37.58	0.00	9.46	19.65	9.92	8.00	37	25
SWA-00687	6/19/18	Forereef	Mid	-11.0561	-171.0920	15.05	54.99	0.00	16.18	17.45	37.54	0.00	52	30
SWA-00689	6/21/18	Forereef	Mid	-11.0532	-171.0925	11.3	31.49	2.01	9.80	17.70	13.79	0.00	53	29
SWA-00700	6/21/18	Forereef	Shallow	-11.0573	-171.0913	2	32.02	0.02	8.33	24.68	7.34	0.00	44	28
SWA-00703	6/20/18	Forereef	Shallow	-11.0614	-171.0685	4.65	24.00	0.00	7.10	14.49	9.52	0.00	46	25
SWA-00706	6/19/18	Forereef	Shallow	-11.0548	-171.0919	10.25	80.66	0.32	6.05	32.28	12.04	36.33	47	27
SWA-00711	6/19/18	Forereef	Deep	-11.0638	-171.0873	26.2	43.34	0.00	10.82	16.48	26.86	0.00	48	30
SWA-00712	6/20/18	Forereef	Deep	-11.0462	-171.0817	27.15	133.25	0.00	95.51	16.33	80.43	36.50	57	33
SWA-00713	6/20/18	Forereef	Deep	-11.0519	-171.0651	22.25	162.68	0.00	125.75	13.86	29.40	119.41	54	31
SWA-00717	6/20/18	Forereef	Deep	-11.0453	-171.0736	23.15	50.85	0.00	32.44	17.83	16.07	16.96	48	31
SWA-00721	6/21/18	Forereef	Shallow	-11.0500	-171.0668	3.7	59.63	0.00	22.33	29.50	30.14	0.00	37	25
SWA-00722	6/19/18	Forereef	Mid	-11.0676	-171.0827	10.1	23.57	0.00	11.55	14.58	8.99	0.00	39	22
SWA-00723	6/20/18	Forereef	Mid	-11.0547	-171.0639	10.35	18.87	0.00	9.73	6.75	12.12	0.00	38	23
SWA-00724	6/19/18	Forereef	Mid	-11.0611	-171.0894	12.3	21.78	0.00	8.86	15.47	6.31	0.00	44	27
SWA-00728	6/20/18	Forereef	Mid	-11.0467	-171.0835	15.75	39.72	0.00	9.01	20.85	10.86	8.00	56	37
SWA-00731	6/20/18	Forereef	Mid	-11.0467	-171.0693	10.85	628.14	0.00	608.19	11.31	215.10	401.73	42	27
SWA-00732	6/21/18	Forereef	Mid	-11.0485	-171.0899	17.2	36.45	0.00	10.65	12.20	13.77	10.48	53	29
SWA-00733	6/21/18	Forereef	Mid	-11.0684	-171.0797	14	26.22	0.00	19.74	8.79	4.38	13.06	36	23
SWA-00739	6/21/18	Forereef	Shallow	-11.0457	-171.0738	3.7	22.64	0.01	2.76	19.47	3.16	0.00	43	23
SWA-00740	6/19/18	Forereef	Shallow	-11.0648	-171.0856	4.15	42.24	0.00	6.07	27.94	14.30	0.00	46	25
SWA-00741	6/20/18	Forereef	Shallow	-11.0637	-171.0869	5.4	15.13	0.00	3.82	13.89	1.24	0.00	40	25
SWA-00747	6/20/18	Forereef	Shallow	-11.0481	-171.0877	3.4	39.52	0.00	9.46	26.13	13.39	0.00	35	20
SWA-00750	6/19/18	Forereef	Shallow	-11.0667	-171.0755	4.25	31.71	0.00	6.22	21.44	10.28	0.00	38	23
SWA-00751	6/20/18	Forereef	Shallow	-11.0463	-171.0792	6.15	46.66	0.00	16.40	30.79	7.65	8.21	45	27
SWA-00753	6/19/18	Forereef	Shallow	-11.0599	-171.0902	2.25	66.36	0.02	36.83	26.75	10.13	29.48	52	32
SWA-00757	6/20/18	Forereef	Shallow	-11.0583	-171.0654	5.85	14.56	0.00	7.89	7.63	6.94	0.00	33	21
TAU-00890	7/16/18	Forereef	Deep	-14.2493	-169.4185	19.4	156.52	0.00	6.79	24.94	50.78	80.79	65	42
TAU-00894	7/12/18	Forereef	Deep	-14.2127	-169.4657	21.5	49.66	0.00	17.94	22.24	27.42	0.00	53	36
TAU-00897	7/16/18	Forereef	Deep	-14.2318	-169.4174	21.15	53.25	0.00	12.12	24.08	29.17	0.00	64	41
TAU-00900	7/11/18	Forereef	Shallow	-14.2497	-169.5039	3.95	65.89	4.01	4.55	42.09	23.80	0.00	53	36
TAU-00906	7/11/18	Forereef	Deep	-14.2139	-169.5106	25	128.81	0.00	47.77	34.78	47.13	46.90	60	42
TAU-00910	7/11/18	Forereef	Deep	-14.2233	-169.5200	26.6	60.87	0.00	4.44	42.26	18.60	0.00	60	40
TAU-00919	7/12/18	Forereef	Deep	-14.2131	-169.5042	25.95	124.24	0.00	23.39	34.42	66.84	22.97	71	41
TAU-00923	7/11/18	Forereef	Deep	-14.2584	-169.5011	20.5	55.67	0.00	11.88	23.73	31.94	0.00	74	53
TAU-00938	7/16/18	Forereef	Mid	-14.2504	-169.4474	7.75	42.77	1.32	8.64	29.67	13.10	0.00	54	32
TAU-00941	7/16/18	Forereef	Mid	-14.2567	-169.4329	12.8	94.01	0.37	55.72	26.35	16.91	50.74	65	38
TAU-00943	7/12/18	Forereef	Mid	-14.2140	-169.4699	14.2	77.37	0.00	21.19	29.26	38.79	9.33	66	38
TAU-00945	7/11/18	Forereef	Mid	-14.2756	-169.4927	15.7	34.38	0.00	0.88	27.39	6.99	0.00	44	32

SITE	Date	Reef zone	Depth bin	Latitude	Longitude	Depth (m)	Total Biomass	ACLI	Piscivore	size_0_20	size_20_50	size_50_plus	Richness_S	Richness_G
TAU-00947	7/11/18	Forereef	Mid	-14.2599	-169.5005	15.8	40.58	0.00	3.96	26.79	13.79	0.00	58	35
TAU-00950	7/16/18	Forereef	Mid	-14.2621	-169.4258	14.1	69.89	1.65	4.51	28.43	41.45	0.00	49	34
TAU-00951	7/12/18	Forereef	Mid	-14.2123	-169.4431	12.7	44.28	1.54	10.93	33.63	10.66	0.00	70	40
TAU-00952	7/16/18	Forereef	Mid	-14.2515	-169.4463	11.3	71.53	2.10	18.72	31.94	39.58	0.00	70	42
TAU-00958	7/11/18	Forereef	Mid	-14.2437	-169.5092	17.2	102.31	0.00	17.88	42.59	54.70	5.02	77	46
TAU-00961	7/16/18	Forereef	Deep	-14.2182	-169.4166	23.65	114.27	0.00	49.32	42.26	24.48	47.53	65	39
TAU-00975	7/16/18	Forereef	Mid	-14.2498	-169.4569	11.65	122.29	1.31	8.08	36.82	42.42	43.06	64	42
TAU-00979	7/16/18	Forereef	Mid	-14.2424	-169.4187	16.3	45.69	0.00	14.78	25.50	18.38	1.81	70	40
TAU-00983	7/11/18	Forereef	Mid	-14.2305	-169.5186	9.4	44.84	0.00	2.60	17.09	19.43	8.32	42	34
TAU-00987	7/12/18	Forereef	Mid	-14.2115	-169.4606	9.05	38.64	0.00	6.80	23.14	15.50	0.00	43	33
TAU-00992	7/12/18	Forereef	Mid	-14.2149	-169.4842	9.4	120.07	1.19	22.55	37.99	82.08	0.00	74	48
TAU-00993	7/12/18	Forereef	Mid	-14.2093	-169.4519	13.6	51.31	0.00	5.53	33.42	17.89	0.00	58	41
TAU-01003	7/11/18	Forereef	Shallow	-14.2376	-169.5156	5.4	18.34	1.58	0.56	17.02	1.32	0.00	28	18
TAU-01007	7/11/18	Forereef	Shallow	-14.2656	-169.4977	4.75	35.15	4.38	4.32	29.17	5.98	0.00	38	26
TAU-01019	7/12/18	Forereef	Shallow	-14.2147	-169.4783	3.6	59.88	4.09	1.34	44.05	15.83	0.00	47	32
TAU-01022	7/12/18	Forereef	Shallow	-14.2165	-169.5000	5.45	32.88	6.68	2.35	21.81	11.07	0.00	34	22
TUT-02552	7/17/18	Forereef	Deep	-14.3670	-170.7755	20.85	63.91	0.00	5.83	44.29	19.63	0.00	64	42
TUT-02553	7/4/18	Forereef	Deep	-14.3364	-170.8011	23.7	32.51	0.00	4.36	25.85	6.67	0.00	57	39
TUT-02558	7/17/18	Forereef	Deep	-14.3322	-170.8285	19.7	95.68	0.00	14.44	31.42	42.61	21.65	69	45
TUT-02564	7/4/18	Forereef	Deep	-14.3398	-170.7921	25.7	40.96	0.00	12.01	24.73	9.73	6.50	40.5	28
TUT-02581	7/4/18	Forereef	Mid	-14.3553	-170.7875	15.7	59.27	0.00	7.68	39.75	19.52	0.00	56	38
TUT-02589	7/17/18	Forereef	Mid	-14.3290	-170.8116	10.3	14.69	0.00	2.66	10.50	4.19	0.00	36	23
TUT-02591	7/4/18	Forereef	Mid	-14.3328	-170.8198	10.15	60.50	0.00	11.00	30.61	29.89	0.00	67	42
TUT-02606	7/4/18	Forereef	Mid	-14.3349	-170.8071	13.45	48.61	0.95	4.76	36.59	12.02	0.00	65	40
TUT-02607	7/17/18	Forereef	Mid	-14.3436	-170.7892	11.5	37.89	0.00	4.14	23.71	14.18	0.00	56	35
TUT-02628	7/17/18	Forereef	Mid	-14.3588	-170.7864	11.15	60.54	0.00	2.30	44.20	16.34	0.00	59	40
TUT-02630	7/4/18	Forereef	Mid	-14.3479	-170.7890	17.05	29.11	0.00	4.21	21.30	7.81	0.00	65	44
TUT-02636	7/4/18	Forereef	Shallow	-14.3276	-170.8081	1.5	21.28	1.92	0.27	18.42	2.86	0.00	38	20
TUT-02639	7/4/18	Forereef	Shallow	-14.3351	-170.7950	3.25	41.04	3.84	1.67	35.16	5.88	0.00	55	31
TUT-02652	7/17/18	Forereef	Shallow	-14.3421	-170.7883	3.35	62.81	1.60	3.17	21.46	41.34	0.00	68	42
TUT-02662	7/4/18	Forereef	Shallow	-14.3268	-170.8356	5.6	58.45	1.71	2.93	48.01	10.44	0.00	44	31
TUT-02771	7/6/18	Forereef	Mid	-14.3608	-170.7484	14.4	84.08	0.51	9.31	61.89	22.20	0.00	73	43
TUT-02791	7/6/18	Forereef	Shallow	-14.3641	-170.7616	3.8	45.12	0.00	0.99	39.00	6.12	0.00	62	35
TUT-02794	7/6/18	Forereef	Deep	-14.3638	-170.7523	20.35	81.30	0.00	7.47	25.86	55.43	0.00	61	40
TUT-02796	7/6/18	Forereef	Mid	-14.3610	-170.7512	11.1	52.73	0.00	2.75	48.61	4.13	0.00	59	39
TUT-02838	7/6/18	Forereef	Deep	-14.3633	-170.7669	26.55	62.10	0.00	7.14	22.40	39.71	0.00	62	38
TUT-02843	7/6/18	Forereef	Deep	-14.3645	-170.7682	22.05	72.41	4.80	1.23	36.88	35.53	0.00	54	38
TUT-02846	7/6/18	Forereef	Mid	-14.3642	-170.7626	11.95	20.35	0.00	3.08	15.01	5.34	0.00	63	44
TUT-02860	7/6/18	Forereef	Mid	-14.3628	-170.7665	17.05	63.99	0.00	4.68	32.50	31.49	0.00	55	40
TUT-02870	7/17/18	Forereef	Mid	-14.3708	-170.7625	16.75	70.46	1.38	3.02	34.28	36.18	0.00	69	43
TUT-02871	7/6/18	Forereef	Mid	-14.3659	-170.7619	3.95	30.65	1.42	2.57	25.62	5.03	0.00	58	37
TUT-02872	7/6/18	Forereef	Shallow	-14.3643	-170.7615	5.25	31.58	0.52	0.27	27.78	3.79	0.00	49	28
TUT-02903	7/3/18	Forereef	Mid	-14.2501	-170.6572	20.3	19.96	0.00	3.79	14.95	5.02	0.00	56	40
TUT-02909	6/29/18	Forereef	Mid	-14.2457	-170.6835	4.45	15.10	0.77	7.59	6.70	1.12	7.28	46	33
TUT-02924	7/5/18	Forereef	Deep	-14.2520	-170.5941	23.15	81.88	0.00	13.80	40.31	41.57	0.00	59	37
TUT-02926	6/29/18	Forereef	Deep	-14.2429	-170.6806	18	60.14	0.00	4.96	25.71	34.43	0.00	67	44

SITE	Date	Reef zone	Depth bin	Latitude	Longitude	Depth (m)	Total Biomass	ACLI	Piscivore	size_0_20	size_20_50	size_50_plus	Richness_S	Richness_G
TUT-02932	6/29/18	Forereef	Deep	-14.2304	-170.6958	29.35	25.75	0.00	0.55	10.46	15.29	0.00	51	36
TUT-02933	7/5/18	Forereef	Mid	-14.2459	-170.5805	12.8	62.31	0.00	3.81	47.02	15.29	0.00	53	38
TUT-02934	7/3/18	Forereef	Deep	-14.2485	-170.6459	24.45	38.18	0.78	3.20	21.32	16.87	0.00	62	38
TUT-02943	7/5/18	Forereef	Mid	-14.2456	-170.5642	16.1	14.07	0.00	2.45	12.86	1.21	0.00	42	29
TUT-02945	6/29/18	Forereef	Mid	-14.2529	-170.6898	15.1	27.62	0.00	10.00	11.99	15.63	0.00	54	41
TUT-02949	6/29/18	Forereef	Shallow	-14.2611	-170.7059	14.75	25.39	0.00	3.68	20.05	5.34	0.00	65	37
TUT-02957	7/5/18	Forereef	Mid	-14.2500	-170.5816	9.8	26.20	0.06	4.65	19.61	6.59	0.00	46	30
TUT-02959	7/3/18	Forereef	Mid	-14.2481	-170.6275	9.75	98.04	2.95	21.11	34.06	53.26	10.72	64	39
TUT-02960	6/30/18	Forereef	Mid	-14.2473	-170.6894	15.9	96.31	1.70	10.62	51.61	34.58	10.13	72	49
TUT-02962	7/5/18	Forereef	Mid	-14.2455	-170.5746	16.75	52.33	0.00	7.66	38.65	13.68	0.00	63	39
TUT-02965	6/30/18	Forereef	Mid	-14.2626	-170.7135	16	72.94	1.19	4.96	37.57	34.57	0.81	71	50
TUT-02977	7/3/18	Forereef	Mid	-14.2483	-170.6385	12.1	112.39	3.13	3.96	67.09	45.29	0.00	62	40
TUT-02979	7/5/18	Forereef	Mid	-14.2470	-170.5707	10.05	67.31	0.00	4.87	54.36	12.95	0.00	65	43
TUT-02985	7/5/18	Forereef	Mid	-14.2496	-170.5863	7.5	59.86	0.00	10.60	38.71	21.16	0.00	67	41
TUT-03007	7/3/18	Forereef	Shallow	-14.2470	-170.6729	3.65	22.36	0.00	0.68	22.36	0.00	0.00	48	35
TUT-03017	6/29/18	Forereef	Mid	-14.2407	-170.6771	9.25	38.98	0.00	2.74	30.78	8.20	0.00	54	34
TUT-03022	6/29/18	Forereef	Shallow	-14.2538	-170.7018	5.25	39.55	2.83	4.38	26.80	12.75	0.00	51	35
TUT-03038	7/2/18	Forereef	Deep	-14.2887	-170.7566	22.45	70.19	0.00	23.90	20.36	38.97	10.87	55	38
TUT-03040	7/2/18	Forereef	Deep	-14.2893	-170.7447	18.85	102.65	0.00	9.69	25.79	61.58	15.28	69	42
TUT-03049	7/2/18	Forereef	Mid	-14.2812	-170.7243	15.4	33.00	0.00	4.30	17.81	15.19	0.00	55	35
TUT-03050	6/30/18	Forereef	Deep	-14.2801	-170.7368	25.6	80.62	0.00	3.89	31.50	36.31	12.80	49	37
TUT-03063	7/1/18	Forereef	Deep	-14.2993	-170.8220	24.4	99.36	0.00	20.08	54.31	45.05	0.00	64	44
TUT-03070	7/1/18	Forereef	Deep	-14.2959	-170.8121	22.15	28.40	0.00	5.08	15.17	13.23	0.00	53	36
TUT-03071	7/1/18	Forereef	Deep	-14.3180	-170.8457	28.65	24.02	0.00	1.37	14.75	9.26	0.00	57	40
TUT-03072	7/1/18	Forereef	Mid	-14.3029	-170.8260	10.1	17.76	0.00	0.04	10.01	7.74	0.00	28	22
TUT-03074	7/2/18	Forereef	Mid	-14.2920	-170.7946	7.25	37.97	0.00	3.39	23.22	14.75	0.00	54	41
TUT-03080	7/1/18	Forereef	Mid	-14.3092	-170.8341	15.1	30.95	0.00	8.46	18.25	12.70	0.00	52	35
TUT-03086	7/1/18	Forereef	Mid	-14.2939	-170.8093	10.75	29.15	0.00	2.51	19.86	9.29	0.00	51	37
TUT-03087	7/2/18	Forereef	Mid	-14.2871	-170.7677	17.25	37.10	0.00	2.76	25.69	11.41	0.00	64	44
TUT-03108	7/2/18	Forereef	Shallow	-14.2872	-170.7840	5.05	17.43	3.14	2.36	13.14	4.29	0.00	41	33
TUT-03113	7/2/18	Forereef	Mid	-14.2918	-170.8053	9.05	73.17	0.00	4.73	44.22	28.96	0.00	76	51
TUT-03114	7/1/18	Forereef	Mid	-14.2949	-170.8108	9.8	48.46	0.00	6.94	30.53	17.93	0.00	72	46
TUT-03118	6/30/18	Forereef	Mid	-14.2826	-170.7339	6.7	81.21	0.00	4.17	39.84	41.37	0.00	64	43
TUT-03119	7/2/18	Forereef	Mid	-14.2898	-170.8002	12.05	34.34	0.00	1.34	20.56	13.78	0.00	40	28
TUT-03125	7/2/18	Forereef	Shallow	-14.2915	-170.7761	3.85	20.61	4.61	1.49	14.17	6.44	0.00	41	32
TUT-03129	7/2/18	Forereef	Shallow	-14.2722	-170.7215	4.45	15.03	1.07	1.16	10.87	4.16	0.00	30	22
TUT-03135	7/1/18	Forereef	Shallow	-14.3002	-170.8141	4.2	63.63	7.46	6.73	37.78	25.85	0.00	62	45
TUT-03143	7/4/18	Forereef	Mid	-14.3214	-170.8458	6.8	20.23	0.00	1.09	15.15	5.08	0.00	43	32
TUT-03144	7/1/18	Forereef	Shallow	-14.3084	-170.8308	4.35	66.85	3.28	0.37	35.57	31.28	0.00	59	35
TUT-03163	6/28/18	Forereef	Deep	-14.2882	-170.6770	21	15.21	0.00	1.40	11.55	3.66	0.00	35	27
TUT-03168	7/18/18	Forereef	Deep	-14.2818	-170.5947	22.25	32.80	0.00	6.67	19.56	13.24	0.00	66	43
TUT-03171	7/18/18	Forereef	Deep	-14.2775	-170.5785	26.3	96.86	0.00	13.67	23.65	71.81	1.40	65	45
TUT-03182	6/28/18	Forereef	Mid	-14.2936	-170.6540	10.95	87.67	0.26	12.17	47.70	30.64	9.33	61	37
TUT-03187	7/18/18	Forereef	Mid	-14.2985	-170.6168	14.15	42.77	0.00	11.04	23.14	11.79	7.83	49	38
TUT-03193	6/28/18	Forereef	Mid	-14.3020	-170.6787	15.2	59.28	0.26	1.86	40.15	12.67	6.46	52	35
TUT-03201	7/17/18	Forereef	Mid	-14.3475	-170.7217	9.6	78.63	0.00	14.14	51.16	27.48	0.00	64	45

SITE	Date	Reef zone	Depth bin	Latitude	Longitude	Depth (m)	Total Biomass	ACLI	Piscivore	size_0_20	size_20_50	size_50_plus	Richness_S	Richness_G
TUT-03210	6/28/18	Forereef	Mid	-14.2924	-170.6644	14.55	133.59	0.51	15.10	90.40	29.03	14.15	38	28
TUT-03238	7/18/18	Forereef	Shallow	-14.2777	-170.6070	1.05	42.01	2.70	0.53	37.47	4.54	0.00	60	41
TUT-03256	7/18/18	Forereef	Shallow	-14.2740	-170.6173	4.15	98.96	8.13	2.44	32.63	66.33	0.00	59	37
TUT-03262	6/28/18	Forereef	Mid	-14.2854	-170.6652	13.55	42.81	2.56	3.28	32.70	10.12	0.00	55	37
TUT-03276	7/18/18	Forereef	Shallow	-14.2815	-170.6361	2.85	121.66	11.48	6.68	48.03	73.63	0.00	68	43

Appendix 5. Site-level seawater carbonate chemistry data from samples collected in 2018. DIC: dissolved inorganic carbon (μm/kg); TA: total alkalinity (μm/kg); pCO2: partial CO2 pressure (μatm); Ω Aragonite: aragonite saturation state; Salinity (PSU); Temp: Temperature (°C); Pressure (decibar).

CTD Cast ID	Year	Latitude	Longitude	Depth (m)	DIC	TA	pH	pCO2	Ω Aragonite	Salinity	Temp	Pressure
HA1801_AmSamoa_Swains_SN4282_001	2018	-11.0633	-171.0877	0.9	1948.7	2291.8	8.04170	393.87107	3.95034	34.99672	30.04570	1.00612
HA1801_AmSamoa_Swains_SN4282_002	2018	-11.0597	-171.0918	0.9	1946	2298.5	8.06274	372.25280	4.03697	35.03700	29.50660	1.00615
HA1801_AmSamoa_Swains_SN4818_001	2018	-11.0586	-171.0911	0.9	1955.4	2304.3	8.05863	378.10162	4.00207	34.99437	29.38152	1.00549
HA1801_AmSamoa_Swains_SN4818_002	2018	-11.0526	-171.0647	0.9	1955.8	2309.3	8.06374	373.15336	4.05332	35.02867	29.42840	1.00551
HA1801_AmSamoa_Swains_SN4818_003	2018	-11.0458	-171.0769	0.9	1945.7	2299.6	8.06417	370.80005	4.05239	35.05040	29.53117	1.00554
HA1801_AmSamoa_Swains_SN4282_003	2018	-11.0454	-171.0717	0.9	1961.1	2298.5	8.04537	392.72156	3.88288	34.82831	29.27139	1.00613
HA1801_AmSamoa_Swains_SN4282_004	2018	-11.0481	-171.0891	0.9	1958.3	2302.2	8.04867	388.45305	3.94907	35.04397	29.50892	1.00614
HA1801_AmSamoa_Swains_SN4282_005	2018	-11.0510	-171.0659	0.9	1942.3	2295.1	8.06607	368.51608	4.03991	34.95273	29.42512	1.00610
HA1801_AmSamoa_Swains_SN4282_006	2018	-11.0501	-171.0650	0.9	1946.1	2294.4	8.05774	377.00300	3.98587	35.07469	29.42147	1.00610
HA1801_AmSamoa_Swains_SN4818_004	2018	-11.0512	-171.0928	0.9	1960.1	2307	8.05495	382.48159	3.97897	35.05136	29.34187	1.00554
HA1801_AmSamoa_Swains_SN4818_005	2018	-11.0685	-171.0813	0.9	1958.6	2307	8.05909	378.18101	3.99448	35.01034	29.25524	1.00550
HA1801_AmSamoa_Swains_SN3029_001	2018	-11.0561	-170.9427	0.9	1961.2	2310.9	8.05977	378.24303	4.01832	34.91753	29.37713	2.01111
HA1801_AmSamoa_Swains_SN3029_001	2018	-11.0561	-170.9427	0.9	1960.5	2314	8.06118	376.59065	4.06066	35.00948	29.56060	2.01111
HA1801_AmSamoa_Swains_SN3029_002	2018	-11.0611	-171.2164	0.9	1958.3	2305.1	8.05808	379.41056	3.98417	34.86849	29.29610	2.01110
HA1801_AmSamoa_Swains_SN3029_002	2018	-11.0611	-171.2164	0.9	1959.3	2299.1	8.04317	394.32770	3.90780	34.97368	29.53858	2.01110
HA1801_AmSamoa_TUT_SN4818_001	2018	-14.2831	-170.6378	0.9	1939.5	2278	8.05597	377.82515	3.87195	34.81430	28.91952	1.00613
HA1801_AmSamoa_TUT_SN4818_002	2018	-14.2448	-170.6601	0.9	1953.8	2292.8	8.05323	383.03922	3.88116	34.92524	28.89615	1.00615
HA1801_AmSamoa_TUT_SN4282_001	2018	-14.2370	-170.6732	0.9	1952.5	2292.2	8.05943	377.11154	3.89387	34.72248	28.73536	1.00618
HA1801_AmSamoa_TUT_SN4282_002	2018	-14.2474	-170.6640	0.9	1959	2279.2	8.02725	410.55406	3.67518	34.89139	28.79580	1.00615
HA1801_AmSamoa_TUT_SN4282_003	2018	-14.2637	-170.7133	0.9	1953.3	2290.5	8.05806	378.55769	3.86338	34.71102	28.59179	1.00615
HA1801_AmSamoa_TUT_SN4282_004	2018	-14.2777	-170.7241	0.9	1953.8	2288.8	8.05372	382.62573	3.83276	34.83091	28.56583	1.00613
HA1801_AmSamoa_TUT_SN4282_005	2018	-14.2999	-170.8148	0.9	1953	2290.5	8.05618	379.72919	3.85215	34.97202	28.52815	1.00615
HA1801_AmSamoa_TUT_SN4282_006	2018	-14.2943	-170.8102	0.9	1952.9	2291.3	8.05896	377.18091	3.86574	34.88371	28.50316	1.00616
HA1801_AmSamoa_TUT_SN4818_003	2018	-14.2948	-170.8122	0.9	1953.7	2294.6	8.06172	374.71332	3.89580	34.87505	28.55321	1.00631
HA1801_AmSamoa_TUT_SN4282_007	2018	-14.2824	-170.7336	0.9	1957.4	2289.1	8.05845	378.87907	3.79471	34.64028	28.05821	1.00608
HA1801_AmSamoa_TUT_SN4282_008	2018	-14.2879	-170.7593	0.9	1955.2	2273.5	8.03412	402.43511	3.64050	34.83491	28.23875	1.00608
HA1801_AmSamoa_TUT_SN4282_009	2018	-14.2922	-170.7803	0.9	1934.8	2269	8.06005	372.87824	3.80979	34.74466	28.35156	1.00602
HA1801_AmSamoa_TUT_SN4818_004	2018	-14.2831	-170.7286	0.9	1954.9	2279.5	8.04493	391.52767	3.71186	34.76749	28.19462	1.00619
HA1801_AmSamoa_TUT_SN4282_010	2018	-14.2506	-170.6419	0.9	1965.2	2298.9	8.05262	384.61922	3.78829	35.30962	27.98798	1.00607
HA1801_AmSamoa_TUT_SN4818_005	2018	-14.2516	-170.6233	0.9	1961.6	2304	8.06263	374.78664	3.90190	35.09562	28.35955	1.00612
HA1801_AmSamoa_TUT_SN4818_006	2018	-14.2452	-170.5722	0.9	1966.4	2311.1	8.06461	373.60839	3.92597	35.17165	28.32431	1.00615
HA1801_AmSamoa_TUT_FLOWTHRU_001	2018	-14.1069	-170.8846	0.9	1944	2283.9	8.07164	363.75274	3.87784	34.64381	28.10315	1.00000
HA1801_AmSamoa_TUT_FLOWTHRU_002	2018	-14.1783	-170.6980	0.9	1991.7	2323.7	8.04210	400.86195	3.80016	35.21075	28.32305	1.00000
HA1801_AmSamoa_TUT_SN4282_011	2018	-14.3651	-170.7639	0.9	1963.9	2302.7	8.06014	377.59697	3.85985	35.07650	28.17899	1.00619
HA1801_AmSamoa_TUT_SN4282_012	2018	-14.3647	-170.7519	0.9	1961.9	2281.4	8.04714	390.37273	3.64409	34.74254	27.49399	1.00615
HA1801_AmSamoa_TUT_SN4282_013	2018	-14.3604	-170.7498	0.9	1974.9	2287	8.03055	408.93167	3.54964	35.16323	27.37535	1.00612
HA1801_AmSamoa_TUT_SN4282_014	2018	-14.3610	-170.7505	0.9	1952.6	2266.7	8.04391	392.33963	3.59038	34.48173	27.49720	1.00614
HA1801_AmSamoa_TUT_SN4818_007	2018	-14.3635	-170.7632	0.9	1977.6	2284.7	8.01733	424.35379	3.51832	34.95445	27.90267	1.00614
HA1801_AmSamoa_TUT_SN4818_008	2018	-14.3278	-170.8317	0.9	1965.9	2297.8	8.06064	377.81916	3.78478	34.81892	27.68780	1.00614
HA1801_AmSamoa_Ofu and Olosega_SN4818_001	2018	-14.1804	-169.6521	0.9	1961.1	2308.6	8.07133	366.28909	3.95419	35.11496	28.24253	1.00619
HA1801_AmSamoa_Ofu and Olosega_SN4282_001	2018	-14.1756	-169.6480	0.9	1949.3	2295.9	8.07242	363.04632	3.93530	35.11796	28.21560	1.00613
HA1801_AmSamoa_Ofu and Olosega_SN4282_002	2018	-14.1888	-169.6213	0.9	1962.4	2311.6	8.07367	364.22779	3.97073	35.15486	28.19573	1.00624

CTD Cast ID	Year	Latitude	Longitude	Depth (m)	DIC	TA	pH	pCO2	Ω Aragonite	Salinity	Temp	Pressure
HA1801_AmSamoa_Ofu and Olosega_SN4282_003	2018	-14.1769	-169.6281	0.9	1942.4	2295	8.08426	350.84390	3.99419	35.10208	28.07106	1.00616
HA1801_AmSamoa_Ofu and Olosega_SN4282_004	2018	-14.1742	-169.6447	0.9	1956.5	2304.9	8.07371	363.17351	3.96020	35.11796	28.21560	1.00613
HA1801_AmSamoa_TUT_FLOWTHRU_003	2018	-14.1371	-170.7083	0.9	1966.5	2317.1	8.07378	365.06599	3.99577	35.08988	28.32545	1.00000
HA1801_AmSamoa_TUT_FLOWTHRU_004	2018	-14.5298	-170.4637	0.9	1963.7	2311.9	8.07094	367.23363	3.96716	35.08988	28.32545	1.00000
HA1801_AmSamoa_Ofu and Olosega_SN4818_002	2018	-14.1575	-169.6742	0.9	1964	2312.8	8.07196	366.12671	3.96806	35.16657	28.24474	1.00618
HA1801_AmSamoa_Ofu and Olosega_SN4282_005	2018	-14.1604	-169.6202	0.9	1965.4	2312.8	8.06580	371.92993	3.94744	35.34543	28.36052	1.00615
HA1801_AmSamoa_Ofu and Olosega_SN4282_006	2018	-14.1599	-169.6378	0.9	1965.1	2294.5	8.04278	394.88606	3.75556	35.18480	28.33898	1.00608
HA1801_AmSamoa_Ofu and Olosega_SN4282_007	2018	-14.1663	-169.6272	0.9	1928.7	2313.9	8.12991	309.48178	4.35231	35.05264	28.12726	1.00614
HA1801_AmSamoa_Ofu and Olosega_SN4282_008	2018	-14.1619	-169.6207	0.9	1925.6	2295.5	8.10413	330.54633	4.18938	35.06107	28.53185	1.00617
HA1801_AmSamoa_Ofu and Olosega_SN4818_003	2018	-14.1742	-169.6820	0.9	1976.7	2316.3	8.05864	381.39290	3.87403	35.13522	28.16435	1.00613
HA1801_AmSamoa_Ofu and Olosega_SN4818_005	2018	-14.1641	-169.6565	0.9	1964.7	2309.2	8.06590	371.87710	3.91645	35.22702	28.19245	1.00612
HA1801_AmSamoa_Ofu and Olosega_SN4818_004	2018	-14.1636	-169.6241	0.9	1970.9	2316.8	8.06281	375.97222	3.93817	35.29496	28.40209	1.00615
HA1801_AmSamoa_Ofu and Olosega_SN4282_009	2018	-14.1635	-169.6874	0.9	1972.8	2322.9	8.07001	369.10310	3.97499	35.40715	28.19515	1.00613
HA1801_AmSamoa_Ofu and Olosega_SN4282_010	2018	-14.1737	-169.6846	0.9	1973.1	2321.4	8.06695	372.31882	3.96276	35.31564	28.30662	1.00613
HA1801_AmSamoa_Ofu and Olosega_SN4282_011	2018	-14.1628	-169.6854	0.9	1963.9	2313.8	8.07189	365.90472	3.97341	35.29871	28.24115	1.00619
HA1801_AmSamoa_Ofu and Olosega_SN4282_012	2018	-14.1606	-169.6821	0.9	1953.8	2304.8	8.07605	360.17421	3.97929	35.26757	28.20311	1.00616
HA1801_AmSamoa_TAU_SN4818_006	2018	-14.2576	-169.5010	0.9	1972.8	2324.4	8.07499	364.74323	3.99960	35.22825	28.15104	1.00611
HA1801_AmSamoa_TAU_SN4818_007	2018	-14.2121	-169.4418	0.9	1972.8	2328.3	8.07968	360.11776	4.03631	35.33416	28.10518	1.00611
HA1801_AmSamoa_TAU_SN4818_008	2018	-14.2173	-169.5127	0.9	1947.8	2310.8	8.09218	344.32817	4.10761	35.30676	28.25179	1.00617
HA1801_AmSamoa_TAU_SN4282_013	2018	-14.2134	-169.4817	0.9	1974	2323.8	8.07579	364.26775	3.97901	35.16472	27.97295	1.00610
HA1801_AmSamoa_Ofu and Olosega_FLTHRU_001	2018	-14.1027	-169.6897	0.9	1973.5	2323.8	8.07606	363.59396	3.97465	35.30953	27.88543	1.00000
HA1801_AmSamoa_TAU_SN3029_001	2018	-14.2125	-169.2803	0.9	1970.7	2321	8.07649	362.63924	3.97221	35.30953	27.88543	2.01095
HA1801_AmSamoa_TAU_FLOWTHRU_001	2018	-14.2627	-169.5824	0.9	1973.5	2317.7	8.07866	362.91093	3.94726	34.47803	27.85223	1.00000
HA1801_AmSamoa_TAU_SN3029_001	2018	-14.2125	-169.2803	0.9	1972.5	2322	8.08616	355.74793	4.00538	34.47803	27.85223	2.01095
HA1801_AmSamoa_Rose_SN4282_001	2018	-14.5412	-168.1443	0.9	1982.8	2342	8.08509	356.36015	4.06459	35.55268	27.78614	1.00616
HA1801_AmSamoa_Rose_SN4282_002	2018	-14.5371	-168.1469	0.9	1982	2332	8.07285	367.79355	3.96625	35.49284	27.82474	1.00613
HA1801_AmSamoa_Rose_SN4282_003	2018	-14.5552	-168.1478	0.9	1985	2338.6	8.07642	365.02205	4.01046	35.48109	27.89211	1.00614
HA1801_AmSamoa_Rose_SN4282_004	2018	-14.5510	-168.1672	0.9	1983	2340	8.08184	359.50476	4.04367	35.51295	27.83533	1.00614
HA1801_AmSamoa_Rose_SN4818_001	2018	-14.5487	-168.1689	0.9	1984.6	2339.6	8.07825	363.05500	4.02034	35.55820	27.83779	1.00610
HA1801_AmSamoa_Rose_SN4818_002	2018	-14.5423	-168.1727	0.9	1983.9	2331.9	8.06948	371.39145	3.94658	35.48377	27.85243	1.00615
HA1801_AmSamoa_Rose_SN4818_003	2018	-14.5361	-168.1658	0.9	1981.9	2334.4	8.07377	366.93733	3.99720	35.50605	27.98149	1.00612
HA1801_AmSamoa_Rose_SN4818_004	2018	-14.5438	-168.1560	0.9	1979.7	2334.5	8.07842	362.20336	4.02141	35.47622	27.93084	1.00611
HA1801_AmSamoa_Rose_SN4818_008	2018	-14.5323	-168.1568	0.9	1982.3	2337	8.08150	359.83401	4.01966	35.42329	27.73267	1.00614
HA1801_AmSamoa_Rose_SN4818_007	2018	-14.5451	-168.1718	0.9	1983.3	2337.9	8.08285	358.88200	4.02137	35.35499	27.68018	1.00613
HA1801_AmSamoa_Rose_SN4818_006	2018	-14.5551	-168.1468	0.9	1986.6	2350.7	8.09184	351.14498	4.13027	35.41735	27.84586	1.00615
HA1801_AmSamoa_Rose_SN4818_005	2018	-14.5387	-168.1460	0.9	1983.6	2338.4	8.07911	362.22499	4.02149	35.47999	27.83874	1.00614
HA1801_AmSamoa_TAU_SN4818_009	2018	-14.2275	-169.4180	0.9	1960.8	2312.3	8.07133	366.06052	3.99858	35.24490	28.50381	1.11149
HA1801_AmSamoa_TAU_SN4818_010	2018	-14.2512	-169.4468	0.9	1975.9	2320.2	8.06528	374.38698	3.91430	35.29613	28.03460	1.00611
HA1801_AmSamoa_TAU_SN4282_005	2018	-14.2503	-169.4193	0.9	1982.7	2314.8	8.04064	400.15935	3.78751	35.39864	28.37033	1.00615
HA1801_AmSamoa_TAU_SN4282_006	2018	-14.2497	-169.4531	0.9	2000.4	2332.2	8.04499	399.41523	3.79412	35.23739	27.99616	1.00610
HA1801_AmSamoa_TUT_SN7744_DS001	2018	-14.2946	-170.8120	15.2	1962	2314.2	8.07895	358.84361	3.99799	35.09638	28.14200	14.79189
HA1801_AmSamoa_TUT_SN7744_DS001	2018	-14.2946	-170.8120	15.2	1986.9	2292.3	8.00701	436.96371	3.49918	35.09928	28.17080	14.75289
HA1801_AmSamoa_TUT_SN7744_DS001	2018	-14.2946	-170.8120	15.2	1973.3	2299.5	8.04050	398.42333	3.71807	35.09256	28.14002	15.01189
HA1801_AmSamoa_TUT_SN7744_DS001	2018	-14.2946	-170.8120	15.2	1964.7	2311.9	8.07152	366.28387	3.94408	35.10246	28.14212	14.74356
HA1801_AmSamoa_TUT_SN7744_DS001	2018	-14.2946	-170.8120	15.2	1984.3	2299.3	8.02264	419.32927	3.60173	35.08307	28.12530	15.86767
HA1801_AmSamoa_TUT_SN7744_DS001	2018	-14.2946	-170.8120	15.2	1958.9	2303.5	8.06872	367.88019	3.91245	35.08729	28.16416	15.16667

CTD Cast ID	Year	Latitude	Longitude	Depth (m)	DIC	TA	pH	pCO2	Ω Aragonite	Salinity	Temp	Pressure
HA1801_AmSamoa_TUT_SN4282_015	2018	-14.3622	-170.7874	0.9	1965.4	2306.4	8.06909	370.05053	3.90153	34.69846	28.09192	1.00617
HA1801_AmSamoa_TUT_SN4282_016	2018	-14.3436	-170.7901	0.9	1971.2	2285.5	8.02212	417.89352	3.59866	35.04548	28.29508	1.00613
HA1801_AmSamoa_TUT_SN4282_017	2018	-14.3364	-170.8042	0.9	1945.4	2285.2	8.06036	373.80763	3.86160	35.13437	28.41376	1.00613
HA1801_AmSamoa_TUT_SN4282_018	2018	-14.3311	-170.8138	0.9	1958.8	2299.6	8.05521	381.18454	3.87956	35.26927	28.58864	1.00615
HA1801_AmSamoa_TUT_SN3029_003	2018	-14.5047	-170.7031	0.9	1962.6	2312.8	8.06946	370.96856	4.06651	34.13271	29.43082	2.01107
HA1801_AmSamoa_TUT_SN3029_003	2018	-14.5047	-170.7031	0.9	1964.9	2311.7	8.06437	376.31570	4.02957	34.13271	29.43082	2.01107
HA1801_AmSamoa_Rose_SN3029_002	2018	-14.3946	-168.1520	0.9	1986.6	2335.8	8.05763	387.43564	4.08685	34.08928	29.89675	2.01122
HA1801_AmSamoa_Rose_SN3029_002	2018	-14.3946	-168.1520	0.9	1986.8	2339.4	8.05859	386.37197	4.12626	34.17375	30.06890	2.01122
HA1801_AmSamoa_TUT_SN4282_019	2018	-14.2947	-170.5568	0.9	1973.4	2312.9	8.06076	378.54578	3.86535	35.17021	28.02068	1.00615
HA1801_AmSamoa_TUT_SN4282_020	2018	-14.2928	-170.5504	0.9	1972.8	2313.1	8.06223	376.60999	3.86303	35.30953	27.88543	2.01122
HA1801_AmSamoa_TUT_SN4282_021	2018	-14.2951	-170.5582	0.9	1971.2	2318	8.06987	369.37722	3.94672	35.17751	28.11086	1.00613
HA1801_AmSamoa_TUT_SN4282_022	2018	-14.2960	-170.5665	0.9	1970	2311.8	8.06083	377.79661	3.89094	35.22547	28.22173	1.00613