

# Assessing relative resilience potential of coral reefs to inform management in the Commonwealth of the Northern Mariana Islands

J Maynard, S McKagan, L Raymundo, S Johnson, G Ahmadi, L Johnston, P Houk, G Williams, M Kendall, S Heron, R van Hooijdonk, E Mcleod



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National Oceanic and Atmospheric Administration  
National Ocean Service  
Office for Coastal Management  
Coral Reef Conservation Program

October 2015



## NOAA Technical Memorandum CRCP 22



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Atmospheric Administration

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# Assessing relative resilience potential of coral reefs to inform management in the Commonwealth of the Northern Mariana Islands

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## *Executive Summary*

### **Assessing relative resilience potential of coral reefs to inform management in the Commonwealth of the Northern Mariana Islands**

J. Maynard\*, S. McKagan\*\*, L. Raymundo\*\*\*, S. Johnson, G. Ahmadia, L. Johnston, P. Houk, G. Williams, M. Kendall, S. F. Heron, R. van Hoodonk, E. Mcleod

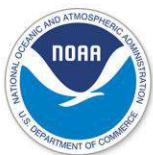
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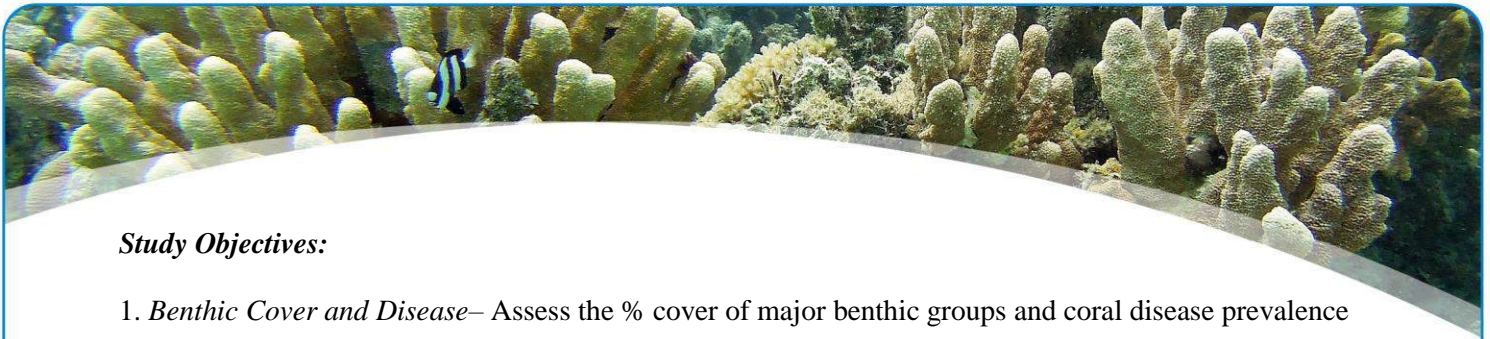
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**Project Background:** Coral reef managers face the challenge of reducing vulnerability to the effects of climate change by reducing other sources of stress to support the resilience of reef systems. Resilience-based management (RBM) has been developed to overcome the challenges of reducing vulnerability in this era of rapid change. RBM of coral reefs can include assessing spatial variation in resilience potential and then targeting and tailoring appropriate actions, which is the focus of the project reported on here.

In CNMI, undertaking resilience-based management became a priority following a bleaching event in 2000, which caused 60-70% coral mortality in some locations, and a less severe bleaching event in 2005 that coincided with an outbreak of crown-of-thorns starfish. Reef managers in CNMI became especially interested in identifying bleaching-vulnerable locations between 2009 and 2011. During these years the NOAA Coral Reef Watch tools suggested severe bleaching was possible. Fortunately, waters never warmed over reefs sufficiently to cause thermal bleaching between 2009 and 2011 due to high cloud cover and rainfall. This project then began in 2012 with surveys of 35 lagoon and forereef sites near Saipan, which was followed by identifying bleaching-vulnerable locations and ranking sites from highest to lowest relative resilience potential. In the process used for the resilience assessment, values for variables that are indicators of resilience processes ('resilience indicators' – e.g., herbivory and recruitment) are compared to the maximum value for that indicator among the survey sites. This means that in 2012 we could only compare the sites we surveyed near Saipan. The project reported on here sought to expand the surveys and analysis undertaken in 2012 so that coral reef sites near all of the populated islands in CNMI could be compared. In total, in May/June of 2014, 49 more sites were surveyed at the 30-foot contour near the islands of Tinian and Aguijan as well as near Rota. A large number of other changes and additions were made for this project that advance our work from 2012. The most important of these are that: anthropogenic stressors are examined separately to the resilience indicators, the assessments of resilience indicators and anthropogenic stressors are summarized within a decision-support framework that targets management actions to support site and system resilience, and connectivity simulations are used to interpret the resilience assessment results and further prioritize and target management actions.

#### *Assessing relative resilience of coral reefs in CNMI*





### **Study Objectives:**

1. *Benthic Cover and Disease*– Assess the % cover of major benthic groups and coral disease prevalence
2. *ESA-listed Coral Species* – Identify coral species listed as Threatened under the 2014 ESA listing
3. *Relative Resilience* – Assess resilience potential of forereef sites within and among the surveyed islands
4. *Resilience Drivers* – Determine primary drivers of differences in resilience potential
5. *Connectivity* – Assess the extent to which each surveyed island is a source and destination of larvae
6. *Assessing Anthropogenic Stressors and Identifying Management Targets* – Identify priority areas to target management actions that can support reef resilience
7. *Outreach and Engagement* – Ensure project results are accessible to local managers in CNMI, understood, and used to inform management decisions and planning

### **Summary Conclusions**

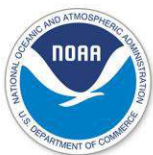
*Obj. 1 – Benthic Cover and Disease:* The average percent cover of live coral and macroalgae were similar in Saipan and Tinian/Aguijan; ~38% for live coral and ~7% for macroalgae. On average, coral cover was ~10% lower on Rota than in Saipan or Tinian/Aguijan (~28% versus ~38%) and macroalgae cover on Rota was twice that observed in Saipan or Tinian/Aguijan (~14% versus ~7%). The average coral cover at the forereef sites (all islands combined) is 35%, which is slightly greater than the current average coral cover in the Great Barrier Reef in Australia. Coral disease prevalence is low and typically ~3% in Tinian/Aguijan and Rota. The most commonly observed coral diseases are white syndromes and skeletal eroding band.

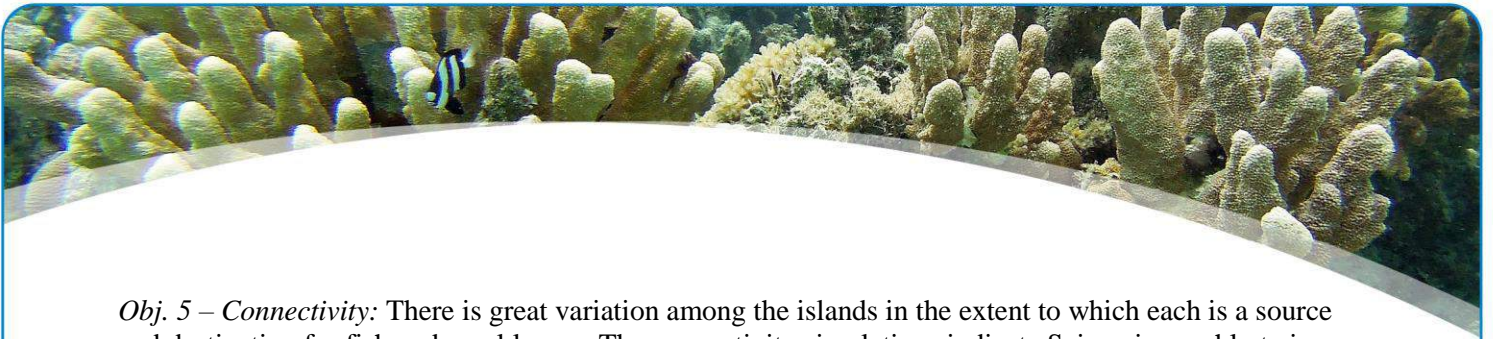
*Obj. 2 – ESA-listed Coral Species:* There are three coral species newly listed in 2014 as Threatened under the Endangered Species Act that are known to be present on reefs within CNMI: *Acropora globiceps*, *Acropora retusa*, and *Seriatopora aculeata*. We compiled complete coral species lists for all survey sites and only *A. globiceps* was observed during our surveys. *A. globiceps* was observed at one site in Saipan, at 13 of the 24 survey sites in Rota and at 12 of the 25 survey sites in Tinian/Aguijan. *A. globiceps* was also observed at 3 shallow (<4 m) sites in northeast Tinian (only shallow sites surveyed outside the Saipan lagoon), one of which is a planned focus of future military training activities (Unai Chulu).

*Obj. 3 - Relative Resilience:* Resilience potential varied greatly within and among islands with some sites having high and some having low relative resilience potential. Generally, sites closest to the main population centers and near cleared lands had lower relative resilience potential than sites more remote from population centers. Since anthropogenic stressors are examined separate to the ecological resilience assessment, these results strongly suggest human activities are impacting the resilience potential of coral reefs near population centers.

*Obj. 4 – Resilience Drivers:* Herbivore average functional group (AFG) biomass and coral recruitment are the indicators that most distinguish sites in the resilience assessment from one another. These influential indicators need to continue to be assessed during research and monitoring activities. The processes these indicators measure are inter-related since herbivores clear algae from the substrate upon which coral recruits can then settle. Consequently, both are positively affected by actions that conserve herbivorous fish.

*Assessing relative resilience of coral reefs in CNMI*





**Obj. 5 – Connectivity:** There is great variation among the islands in the extent to which each is a source and destination for fish and coral larvae. The connectivity simulations indicate Saipan is roughly twice as great a source as Tinian and 10x that of Rota. Tinian and Saipan are comparable destinations and each is roughly twice as great a destination as Rota. These results help explain the lower relative resilience potential of reefs in Rota. These results also strongly suggest that actions taken to support the resilience of reefs in Rota may not be sufficient to overcome the limitations for recovery potential in Rota due to Rota having poor connectivity with the other large islands in the Marianas chain. Therefore, actions to support resilience are likely to be more effective in the long-term if implemented in Saipan and Tinian/Aguijan.

**Obj. 6 - Assessing anthropogenic stressors and identifying management targets:** 55 of the 78 forereef survey sites met at least one of the 6 criteria we set to identify targets for management actions that can support site and system resilience. We identified targets for: conservation, land-based sources of pollution reduction, fishery management and enforcement, bleaching monitoring and supporting recovery, reef restoration/coral translocation, and tourism outreach and stewardship. The criteria for the data queries we set are an innovation in streamlining how the results of ecological resilience assessments can inform management actions. Managers in CNMI can use the connectivity results as well as our observations of the Threatened coral species *Acropora globiceps* to further prioritize from among the identified sites. For example, actions in Saipan and Tinian/Aguijan may be more effective so can be prioritized (as above) and efficiencies can be gained for managers by supporting resilience at sites that meet one or more of the set criteria and have resident *A. globiceps* colonies.

**Obj. 7 – Outreach and engagement:** The results of this project have already been shared through presentations to local managers in CNMI, as well as regionally and globally via recorded webinars. In all, a wealth of data and information were produced during this project that can inform management decision-making and planning in CNMI for years to come. In this sense, a part of the project is just starting in that efforts will be ongoing for the years ahead to maximize the value of the data and results for supporting the resilience of CNMI’s diverse coral reefs.

This project report: provides further background both to this project and ecological resilience assessments in reef areas, describes our methods for assessing the various resilience indicators and anthropogenic stressors, shares highlights of our results and progress towards each of the objectives, identifies next steps, and has an appendix with tables and map graphics that expand upon the content within the main report. This report includes Site Summaries; 1-page overviews for each of the 84 sites we surveyed of the field data, resilience assessment results and the results of the queries that identify targets for various types of management actions.

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## **Project Background**

Coral reef managers face the challenge of reducing vulnerability to the effects of climate change by reducing other sources of stress to support the resilience of reef systems (Anthony et al. 2014). Coral reef resilience is the capacity of a reef to resist or recover from degradation and maintain provision of ecosystem goods and services (Mumby et al. 2007). Resilience-based management (RBM) has been developed to overcome the challenges of reducing vulnerability in an era of rapid change (Bestelmeyer and Briske 2012). RBM involves the application of resilience theory and tools to deliver ecosystem-based management outcomes into the future (Chapin et al. 2009). RBM of coral reefs can include assessing spatial variation in resilience potential and then targeting and tailoring appropriate actions. Such assessments have been strongly recommended by coral reef ecology experts and leading conservation organizations (McClanahan et al. 2012; Graham et al. 2013, Anthony et al. 2014). However, there are few examples of assessments of resilience potential that have directly resulted in management actions (Maynard et al., 2010; Weeks & Jupiter, 2013).

In CNMI, undertaking resilience-based management became a priority following a bleaching event in 2000, which caused 60-70% coral mortality in some locations, and a less severe bleaching event in 2005 that coincided with an outbreak of crown-of-thorns starfish. Reef managers in CNMI became especially interested in identifying bleaching-vulnerable locations between 2009 and 2011. During these years the NOAA Coral Reef Watch tools suggested severe bleaching was possible. Fortunately, waters never warmed over reefs sufficiently to cause thermal bleaching between 2009 and 2011 due to high cloud cover and rainfall. This project then began in 2012, when the the CNMI Coral Reef Initiative (CRI) provided money to the local Bureau of Environmental and Coastal Quality to undertake a reef resilience study for the reefs near Saipan. 35 lagoon and forereef sites near Saipan were surveyed in 2012 and sites were ranked from highest to lowest relative resilience potential. The results of the resilience assessment were shared within a report that also included a range of suggestions for local managers to consider involving actions that would support the natural resilience of reefs in Saipan. The 2012 report is available on the NOAA CORIS website at this link: [http://www.fpir.noaa.gov/Library/HCD/CoRIS\\_204\\_Saipan\\_Resilience\\_Report\\_Maynard McKagan\\_2012.pdf](http://www.fpir.noaa.gov/Library/HCD/CoRIS_204_Saipan_Resilience_Report_Maynard_McKagan_2012.pdf). The resilience assessment is based on producing composite scores for resilience potential based on averaging values for variables that are indicators of resilience processes (e.g., recruitment and herbivore biomass). In the process used, values for each resilience indicator are compared to the maximum value for that indicator among the survey sites. This means that in 2012 we could only compare the sites we surveyed near Saipan.

This project sought to expand the surveys and analysis undertaken in 2012 so that coral reef sites near all of the populated islands in CNMI could be compared. In total, 49 more sites were surveyed at the 30-foot contour near the islands of Tinian and Aguijan as well as near Rota in May/June of 2014. These surveys followed the most extensive bleaching event documented in the Marianas Archipelago, which occurred in 2013 and affected 85% of nearshore coral taxa (Reynolds et al. 2014). In combination, the 2012 and 2014 surveys enabled our team to meet the initial objective set in the late 2000's of identifying bleaching vulnerable locations. We have

gone several steps further (see objectives list below) in that we have developed a decision-support framework for CNMI that identifies targets for different kinds of management actions. Prioritizing actions to the target sites we identify can help support the natural resilience of reefs in CNMI to future bleaching events and other disturbances.

All of the following are important differences between the methods and scope of this recent research effort and the results we reported on in 2012:

*Changes:*

- Lagoon sites in Saipan have been excluded from the main analysis and are reported on in the appended *Site Summaries*. This ensures all sites included in the analysis were surveyed at the same depth.
- Fish surveys no longer include 10 m stationary point counts (SPCs); all SPCs included here are 5 m in diameter.
- The resilience indicators are scaled based on perceived importance scores from a critical review of resilience indicators (McClanahan et al. 2012). Perceived importance was used instead of strength of scientific evidence because the availability of evidence for the indicators varies greatly due to the paucity of studies like that presented here.
- Relative classes for resilience potential (low, medium-low, medium-high, and high) were set using the variance in the results as measured by the standard deviation.
- Nutrients and sediments are combined here into a single proxy for land-based sources of pollution (LBSP).
- LBSP and fishing access are separated here from the analysis of relative resilience potential; this ensures indicators of resilience processes are separated from stressors that challenge resilience potential.
- The fishing access metric now includes distance from boat launch and shore access.

*New additions:*

- Queries of the indicators, final resilience scores and anthropogenic stressors are used here to identify targets for different types of management actions.
- A map is provided showing the locations where coral species currently listed as Threatened under the Endangered Species Act were observed.
- Connectivity simulations are used to examine larval connectivity among the islands of CNMI and Guam.
- Species lists were generated for fish as well as coral using swim surveys at the conclusion of each survey dive.
- Coral disease surveys were conducted at some of the survey sites (i.e., the sub-set of our survey sites for which our coral disease specialist was available).

## **Introduction to coral reef resilience assessments**

The simplest method of incorporating resilience into coral reef conservation planning that others have used (i.e., not the focus here) is representation and replication during the spatial planning of

marine protected areas (MPAs) and networks (Fernandes et al. 2005, Grimsditch & Salm 2006, Mcleod et al. 2009). Ensuring that a range of habitat types are represented and replicated within protected areas spreads risk and increases the likelihood that at least a few resilient areas will be protected and connected to support recovery (McLeod et al. 2009). Assessments of resilience potential, the approach used here, are more resource-intensive, but can provide important planning and management guidance to supplement a representation and replication approach. Resilience assessments can help to target a wide range of management initiatives to support reef resilience. Many of these actions may be more tractable or politically viable in many jurisdictions than MPAs are (e.g., quotas, gear restrictions, community management; MacNeil et al. 2015).

Assessing the resilience potential of coral reefs was first conceptually developed in Salm et al. (2001) and later in West and Salm (2003) in the wake of the 1998 coral bleaching event. These authors made the case that there are physical and ecological characteristics of coral reefs that provide some reefs with a greater likelihood of resisting and/or recovering from disturbances such as coral bleaching. These characteristics, which we have come to refer to as ‘resilience indicators’ (McClanahan et al. 2012), are variables that can be assessed or measured. Obura and Grimsditch (2009) were the first to develop an approach to assess the ecological resilience of coral reefs, which included recommending 61 resilience indicators. Their report identified a wide range of potentially important indicators but contained limited guidance on implementation and consequently has been challenging to apply. Maynard et al. (2010) then applied a resilience assessment framework in the southern Great Barrier Reef using a sub-set (30) of the indicators recommended within the IUCN (2009) report. That case study was the first to scale resilience indicators based on perceived relative importance and the first coral reef resilience assessment to inform a management decision; the designation of no-anchoring areas (Maynard et al. 2010, Beeden et al. 2014).

To prioritize resilience indicators to help make resilience assessments more feasible, McClanahan et al. (2012) surveyed reef scientists and managers to assess the perceived importance, strength of scientific evidence and feasibility of assessment/measurement of 31 resilience indicators. Within this review, eleven resilience indicators were prioritized for use in resilience assessments. The study results added to the body of evidence that while ecosystems are complex, they are “frequently controlled by just a few strong variables operating at a given scale”. This report presents the results of the first field-based implementation of the resilience assessment framework recommended within McClanahan et al. (2012). In doing so, we describe a detailed and adaptable process that can guide the implementation of ecological resilience assessments in coral reef areas.

## **Study Objectives**

This applied research project has a large scope that includes: assessments of benthic cover, identification of all coral and fish species, the resilience assessments, connectivity simulations, a management decision-support framework, and our ongoing efforts to share the project results and inform management actions and planning. Several of the objectives emerged from conversations with partners about how to create added value from the study, which highlights the

level of collaboration and flexibility that characterized this project. The 7 objectives are listed in a sequence that describes the progression of our work starting with our field surveys and concluding with our current outreach and engagement efforts. The objectives form the primary section sub-titles in the Materials and Methods, Results and Summary Conclusions sections.

Obj. 1. *Benthic Cover and Disease*– Assess the percentage cover of major benthic groups and assess coral disease prevalence

Obj. 2. *ESA-listed Coral Species* – Identify coral species listed as Threatened under the Endangered Species Act

Obj. 3. *Relative Resilience* – Assess the relative resilience potential of forereef sites within and among the surveyed islands

Obj. 4. *Resilience Drivers* – Determine the primary drivers of differences in resilience potential at the island and CNMI-wide scale

Obj. 5. *Connectivity* – Assess the extent to which each surveyed island is a source and destination of coral and fish larvae using connectivity simulations

Obj. 6. *Assessing Anthropogenic Stressors and Identifying Management Targets* – Identify priority areas to target management actions that can support reef resilience.

Obj. 7. *Outreach and Engagement* – Ensure project results are accessible to local managers in CNMI, understood and used to inform management decisions and planning.

## **Methods**

Field surveys were conducted at forereef sites (8-12 m) of the fringing reefs of the three main populated islands of the CNMI: Saipan (May 2012, n=28), Tinian and Aguijan, (May-June 2014, n=25), and Rota (May-June 2014, n=24, see Table S1 in the appendix for coordinates and Figure 2 for locations). The sites surveyed represent the full range of ecological settings and physical conditions as well as roughly even spatial coverage of the forereef around each of the islands (i.e., a survey site every 1-2 miles along the island coastlines). We also conducted field surveys at 7 sites within the Saipan lagoon and report on results from those surveys for objectives 1 and 2 (see pages 79-84 in the *Site Summaries* appendix). Methods used to meet all of the study objectives are described below.

### *Obj. 1. Benthic Cover and Disease*

Three 50 m point-intercept transects were laid sequentially with 2-10 m gaps along the same depth (8-10 m for reef sites) at all sites. At 50 cm intervals (100 per transect, 300 per site), the benthos was categorized as live coral, soft coral, dead coral, sand, rubble, pavement (bare hard substrate without crustose coralline algae (CCA)), macroalgae, turf algae, other invertebrates (i.e., sponges and sea stars), or CCA. The cover of each group was expressed as a percentage

number of points for each transect and then values for transects were averaged. Benthic cover results are summarized in a table and within pie charts in the *Site Summaries* appendix.

Coral disease surveys were conducted at a sub-set of the sites surveyed in Rota (16 of 24) and Tinian/Aguijan (10 of 25). All coral species were identified within three 20x1 m belt transects. The two longest lengths of each coral colony were measured and corals were assessed as healthy or diseased. Diseases were identified and included: white syndromes, skeletal eroding band, black band, growth anomalies or cyano-bacterial mat. Tables are used to summarize the results from the surveys of disease prevalence.

### *Obj. 2. ESA-listed coral species*

Twenty two species of coral are now protected under the Endangered Species Act. Twenty new corals were added in 2015 to the two corals listed as Threatened in 2006. Fifteen of the newly listed species occur in the Indo-Pacific and of these *Acropora globiceps*, *Acropora retusa*, and *Seriatopora aculeata* are known to occur in CNMI. All stony corals were identified to species during our field surveys (see coral diversity, in Table 1). Maps were produced to show where *A. globiceps* was observed during the 2012 and 2014 field surveys as this was the only coral of the three Threatened that we observed.

### *Obj. 3. Relative resilience*

6 of the 11 resilience indicators recommended in McClanahan et al. (2012) were included in the assessment: coral diversity, bleaching resistance, coral recruitment, macroalgae cover, herbivore AFG biomass, and temperature variability. Herbivore diversity was added due to the growing body of evidence that herbivore diversity is as important to coral reef and herbivorous fish community resilience as biomass (Green et al. 2009; Heenan and Williams 2013).

The remaining 5 of the 11 indicators recommended in McClanahan et al. 2012 are coral disease, nutrients (pollution), sedimentation, physical human impacts (anchor and fin damage) and fishing pressure. Coral disease was assessed at a sub-set of the survey sites (see related objective) so could not be included in the resilience assessment. Physical human impacts were not observed so are not described within this report. Proxies we developed to assess nutrients (pollution), sedimentation and fishing pressure, which we call fishing access, are described in the *Identifying Management Targets* section. These anthropogenic stressors challenge reef resilience (i.e., rather than being indicators of resilience processes), which is why they were excluded from the calculation of composite scores for resilience potential.

The resilience indicators were assessed in the field, excepting temperature variability, which was assessed using remote sensing. Methods for assessment or measurement of each of the resilience indicators are described in Table 1.

The resilience assessment compared sites among (inter-island analysis) and within (intra-island analysis) the surveyed islands. Once data were collected and compiled for each indicator, values for each variable were normalized to a uni-directional scale of 0-1 by: dividing by the maximum value for the variable among all 78 sites (inter-island analysis), and dividing by the maximum

value for the variable among sites surveyed at each island (intra-island analysis). To ensure that high scores always infer higher relative resilience potential, normalized scores were inverted for macroalgae cover. The normalized scores were then scaled based on differences in the perceived importance of each variable to resistance and recovery from Table 2 in McClanahan et al. (2012). Bleaching resistance had the highest perceived importance score of 15.57, which is 1.37x the value of the lowest perceived importance score for our variables of 11.43 for coral recruitment. Scaling multipliers are as follows: macroalgae cover – 1, bleaching resistance – 1.37, coral recruitment – 1, coral diversity – 1.08, temperature variability – 1.22, herbivore biomass – 1.02. The scaled scores are then averaged and are normalized again by dividing by the maximum value, which results in resilience potential scores ranging from 0-1 that are expressed as a percentage of the site with the greatest score. Sites are ranked from highest to lowest score. Relative classifications for resilience scores are as follows: high (final scores that are greater than 1 sd above average), medium-high (<avg+1sd and >avg), medium-low (<avg and >avg-1sd), and low (<avg-1sd). Resilience rankings and relative classifications, as well as scores for each resilience indicator, are all shown within tables and maps for both the inter- and intra-island analyses.

**Table 1.** Field-survey and desktop-based methods for resilience indicators used and for two anthropogenic stressors (denoted by \*).

Variable name (unit)	Methods
<b>Macroalgae cover (%)</b>	Average percent of points classified as fleshy macroalgae (>5 cm in height) on three 50-m point-intercept transects where points were classified at 50-cm intervals.
<i>Coral community</i>	<i>12-16 0.25 m<sup>2</sup> quadrats thrown in a stratified random manner ~10 m on left and right sides of the three 50-m transect tapes used to assess macroalgae cover (Starmer and Houk 2008). All stony corals were identified to species and the longest diameter and perpendicular diameter measured for all colonies that fell within the quadrat. Species were classified from 1-5 from low to high bleaching susceptibility. Susceptibility ratings (see Table S2) were produced using an expert focus group that reviewed the literature, as well as data from the only well documented bleaching event in Saipan (in 2001).</i>
<b>Bleaching resistance (%)</b>	Percent of the community made up of species considered to be resistant (rating ≤3, see Table S2).
<b>Coral recruitment (#/m<sup>2</sup>)</b>	Average density of corals with a geometric mean <5 cm within the assessed quadrats; we assess new recruits so exclude massive and encrusting colonies that commonly have parts of larger colonies that are <5 cm (e.g., <i>P. rus</i> ).
<b>Coral diversity (unitless)</b>	The inverse of Simpson’s index of diversity, which is based on the frequency each species was observed and the species richness. The resultant value ranges from 0-1 and assesses the probability two species selected at random from the sampled community will be different, so higher percentages equate to higher diversity. The formula for Simpspon’s index is $D = (\sum n(n-1))/(N(N-1))$ where, where n = the total number of organisms of a particular species, and N = the total number of organisms of all species observed.
<i>Herbivorous fish community</i>	<i>The fish community was assessed using three 3-minute 5-meter radius stationary point counts (SPC’s) performed along each of the 50 m transect lines (9 SPCs in total), which is in keeping with recommendations from a power analysis previously undertaken in the region (Houk and Starmer 2010). All herbivorous fish and all other fish larger than 8 cm in body length were identified to species, and their length was estimated to the nearest cm. The weight of each fish in grams was then calculated using standard weight-length relationships (WLRs). The coefficients used were sourced from NOAA’s Coral Reef Ecosystem Division (Weijerman et al. 2013). Species were classified as herbivores using IUCN classifications and were grouped as: 1) browsers, 2) grazers/detritivores, and 3) scrapers/excavators (Green et al. 2009).</i>

Variable name (unit)	Methods
<b>Herbivore AFG biomass (kg/ha)</b>	The 'herbivore average functional group (AFG) biomass' was calculated in kg/ha. The biomass of the 3 major herbivore functional groups (1) browsers, 2) grazers/detritivores, and 3) scrapers/excavators) was calculated first and then these values were normalized by dividing by the maximum value among (inter-island analysis) and within (intra-island analysis) the islands. These normalized values were then averaged and then re-normalised to produce the final <i>Herbivore AFG biomass (kg/ha)</i> value (assumes all groups are equally important). The herbivore AFG biomass is thus inclusive of herbivore diversity but not directly comparable to other 'total' herbivore biomass values that are typically reported.
<b>Temperature variability (unitless)</b>	Observed sea surface temperature (SST) data for the period 1982-2012 was obtained from NOAA Pathfinder Version 5.2 (4-km resolution, Casey et al. 2010). The final value used is the standard deviation (SD) of warm season temperatures with warm season defined as the three months that center on the month with the maximum monthly mean temperature for the 1982-2012 period (Heron et al. in review). High warm season temperature variability may reduce bleaching sensitivity so higher SD values may be associated with higher resilience.
<b>*Land-based sources of pollution (unitless)</b>	Geographic information system (GIS) layers were developed pertaining to watershed size, topography, land use (vegetation types are considered equal) and human population (landuse data from United States Forest Service, <a href="http://www.fs.usda.gov/r5">http://www.fs.usda.gov/r5</a> ). The proxy represented a measure of land-based influence to coastal water quality based on the coverage of barren land (no vegetation), urbanized areas, and human populations. Digital elevation models (i.e., topographic data) were used to define watershed boundaries and flow patterns for surface discharge, and then each of our forereef survey sites was attributed to an adjacent watershed. The proxy was calculated by multiplying standardized values for altered landuse and human populations (i.e., landuse x human population interactions). The proxy is not inclusive of any ongoing management actions since information on spatial variation in their efficacy was not available for this study. Future studies may include action efficacy in calculating proxy scores and/or greater in situ water quality data once available.
<b>*Accessibility due to wave exposure (fishing access, unitless)</b>	A primary driver of fishing pressure in CNMI is access, which is influenced by wave height and distance to boat launches and beach access points (Houk et al. 2012). Site-based wave exposures were calculated based upon 10-year wind-speed records, fetch distances to the nearest reef or land feature, and angles of exposure. The equation used for mean wave height is $H_m = 0.019 U^{1.1} F^{.45}$ , where $H_m$ is the wave height (m) for each quadrant, $U$ is the windspeed at an elevation of 10m, and $F$ is the fetch (km) (Quikscat wind datasets from 1999 to 2009; <a href="https://winds.jpl.nasa.gov/">https://winds.jpl.nasa.gov/</a> , wave energy in $J/m^3$ , full description found in Ekeboom et al. 2003, Chollett & Mumby 2012). Average wave heights were then converted to energy following $E = (1/8)\rho g H^2$ , Where $\rho$ is the water density ( $kg/m^3$ ), $g$ is the acceleration due to gravity ( $9.81 m/s^2$ ), and $H$ is the wave height (m). This process resulted in continuous data on wave exposure, expressed in terms of wave energy. The final value used was calculated by multiplying standardized wave energies and distances to the nearest points of fishing access (i.e., wave and distance interactions). Values for wave exposure and accessibility were considered to be '0' for all protected areas irrespective of wave energy at the site.

*Obj. 4. Resilience drivers*

Understanding which variables most influence differences in resilience potential is another valuable product of resilience assessments. This is because the indicators most influencing rankings are: 1) the most important to include in monitoring programs, and 2) may reveal the types of management actions that would benefit the greatest number of sites. Since the scaling factors used to weight the indicators based on differences in perceived importance were small (1-1.37), indicators with the greatest variability most drove differences in the resilience rankings. We plotted the average  $\pm 1$  standard deviation and maximum and minimum values for the final resilience scores and for the normalized values for the resilience indicators for the inter- and

intra-island analyses. We compare the range of values among the indicators for the inter-island analysis and among the indicators for the 3 island-scale analyses and identify which indicators have highest and lowest range and variability. We also used a canonical analysis of principal coordinates (CAP) (Anderson and Willis 2003) to examine which indicators were driving differences in resilience potential across the four relative classifications for the inter- and intra-island analyses. The CAP was based on Bray-Curtis similarity matrices where variables that might be responsible for group differences are investigated by calculating the Spearman-Rank correlations of canonical ordination axes with the original indicator variables (Anderson et al. 2008).

*Obj. 5. Connectivity*

Larval connectivity among the surveyed islands and with other islands in and outside of the 15-island Marianas archipelago was examined using computer simulations that tracked cohorts of virtual fish and coral larvae transported according to an ocean circulation model (Kendall and Poti 2015). Daily current vectors for the 0-10 m depth layer were from the Hybrid Coordinate Ocean Model's (HYCOM) Global Hindcast. Virtual larvae were spawned seasonally from 2004-2012 at islands in and around the Marianas. Larval production was scaled to each island's area of potential reef ecosystem as calculated from GEBCO/NOAA bathymetry. Maximum Pelagic Larval Durations (PLD) of 10, 20, 50, and 100 days were simulated where larvae were competent to settle once 60% of their maximum PLD elapsed. In one set of simulations, representing larvae with minimal and no swimming capability (corals), larvae could only settle at a destination with potential reef habitat. In another set of simulations, representing larvae with strong sensory and swimming capabilities (reef fish), larvae could settle within 18 km of potential reef habitat. A constant mortality rate was applied following competency, which resulted in 100 % mortality by the end of each maximum PLD. Matrices were produced for each PLD that state the number of larvae transported from and to each of 6 locations (Saipan/Marpi Bank, Tinian/Aguijan, Rota, Other Mariana Islands, Guam and Other archipelagos). For each PLD, total larval contributions to and from each of our survey islands were converted to percentages of the maximum value, expressing the extent to which each surveyed island is a source or destination relative to the maximum source/destination. These values were then all averaged across all four PLDs for each of the two simulations (with and without the 18-km buffer). Connectivity simulations were used to: 1) interpret spatial variation found in relative resilience potential, and 2) determine where actions are most needed to maintain larvae supply and least likely to be effective due to low larvae supply.

*Obj. 6. Assessing Anthropogenic Stressors and Identifying Management Targets*

We calculated values for each survey site for two anthropogenic stressors: LBSP and accessibility due to wave exposure. Nutrients and sediments were combined into a single proxy for land-based sources of pollution, which combines watershed size, the coverage of barren land, and human population density. Management actions on land implemented to improve water quality in reef areas were not included as part of this study. The LBSP values at each reef site (i.e., associated with each watershed) could be modified to take account of effective control of sediments and nutrients if metrics for management effectiveness for the relevant actions can be developed. Accessibility due to wave exposure is a proxy for 'fishing access' and pressure that



combines average wave energy with distance to boat access and human population density at the closest access point. Methods for our development of these are described in Table 1.

The scores for relative resilience potential, individual resilience indicators, and the proxies for anthropogenic stress were queried using 6 criteria to identify sites that are targets for different types of management actions. These action types were chosen as they reflect the range of options available to reef managers in CNMI. High resilience sites are more likely to persist as disturbance frequencies increase under climate change so are considered priority targets for several of the queries. The queries include identifying targets for: Conservation, LBSP reduction, Fishery management and enforcement, Bleaching monitoring and supporting recovery, Reef restoration/coral translocation and Tourism outreach and stewardship. The criteria used for each of these queries are presented in Table 2. Sites identified using these queries were then further prioritized at the island-scale based on the larval connectivity results; sites were considered to be of higher priority if at an island that is a relatively great source and/or destination of larvae.

**Table 2.** Criteria for queries used to suggest targets for different types of management actions in CNMI (see Figure 5). The lists of relevant management actions are examples only and those lists and this set of queries are not meant to be exhaustive; other queries and actions will be relevant for other jurisdictions.

<b>Query name</b>	<b>Criteria (<i>n</i> of 78)</b>	<b>Relevant management actions</b>
<b>Conservation</b>	High or low resilience potential and are currently outside established no-take MPAs (i.e., excludes medium-high and medium-low resilience sites) (14)	Any of the actions described below (as appropriate)
<b>Land-based sources of pollution reduction</b>	Above average scores for resilience potential and land-based sources of pollution (13)	Afforestation, stream bank stabilization, riparian restoration, road and storm drain improvement, other erosion control practices, wetland enhancement and sewage treatment upgrades
<b>Fishery management and enforcement</b>	Above average resilience potential and above average accessibility due to wave exposure (10) <b>OR</b> Below average herbivore AFG biomass and above average accessibility due to wave exposure (15) <b>OR</b> both (6)	Increased enforcement, marine protected areas <sup>1</sup> , temporary closures <sup>1</sup> , LMMAs, size regulations and bag and catch limits, moorings and no-anchoring areas, marine debris removal
<b>Bleaching monitoring and supporting recovery</b>	Low bleaching resistance and low herbivore AFG biomass (20)	Increased monitoring during warm seasons, shading or other cooling measures, supporting recovery processes through LBSP reduction or fishery management and enforcement
<b>Reef restoration/coral translocation</b>	Above average resilience potential and low coral diversity or coral cover (10)	Priority coral nursery and transplantation area, artificial reef installation
<b>Tourism outreach and stewardship</b>	Above average coral diversity and above average fish species richness and biomass and above average accessibility due to wave exposure (2)	Establish moorings, undertake targeted outreach, develop stewardship and/or citizen science programs, marine debris removal

<sup>1</sup> *Not an anticipated action in CNMI at this time but will likely be important for other regions.*

### **Obj. 7. Outreach and Engagement**

Data and results presented within this report are being discussed extensively with local manager partners in CNMI and in Guam. Our outreach and engagement efforts include: 1) data provision, 2) presentation and discussion of project results, and 3) collaborative review of our reporting materials.

*Data provision* – We developed a data folder for the project that includes raw data and final results for our work towards study objectives 1-6. These data are in tables within Excel spreadsheets and are within an ArcGIS layer package (\*.lpx), which enables data for the resilience indicators and final resilience potential results to be presented visually as maps. The data have been provided to local agencies in CNMI at the time of review of this report and are open access so can be requested in any format by anyone reading this report by emailing the first or second author.

*Presentation and discussion of project results* – Project results were shared with local agencies in CNMI via a webinar, during local agency meetings, at the Guam Coral Reef Symposium and at the NOAA PIFSC Insular Fisheries Meeting in Saipan (all in March/April of 2015). At each occasion, the results were discussed among participants and plans were made by representatives from local agencies to more broadly share the results within agencies during meetings. Further presentations and discussion of the results are planned for meetings to be held in the upcoming 6 months.

*Review of reporting materials* – Members of local agencies in CNMI were invited to review this report and the *Site Summaries* appendix during a 6-week review period and were asked to provide input to the content and format of the reports.

## **Results**

Our results for each objective are summarized below in the form of highlights we hope staff from local agencies in CNMI will use in other reports, presentations, and grant applications. We refer frequently to the report appendix, which contains many other tables and map figures that comprehensively present the project results.

### **Obj. 1 – Benthic Cover and Coral disease**

- Average values for the major benthic categories are as follows: live coral (35%), turf algae (18%), pavement (15%), CC algae (11%) and macroalgae (9%, Table 3).
- The average percent cover of live coral and macroalgae were similar in Saipan and Tinian/Aguijan; ~38% for live coral and ~7% for macroalgae.
- On average, coral cover was ~10% lower on Rota than in Saipan or Tinian/Aguijan (~28% versus ~38%) and macroalgae cover on Rota was twice that observed in Saipan or Tinian/Aguijan (~14% versus ~7%).

- Coral cover was highest at Fishing Base Staghorn, a lagoon site near Saipan, where coral cover was 100% in 2012 (this site experienced severe bleaching in 2013). Among the forereef sites, there are four sites where coral cover was > 70%: Bird Island and Lighthouse Reef in Saipan, Unlikely Wall in Tinian, and Coral Gardens in Rota (see Figure 2 and Table S1 for locations). There are only 3 sites (of 84) where coral cover was lower than 10%: Oleai Staghorn (lagoon) and Tuturam in Saipan and Joanne’s Reef in Rota.
- Macroalgae cover was >30% at 6 of the survey sites: Quartermaster Staghorn, South Dakota and Tuturam in Saipan, and Sailigai Point, South Sanctuary and Talakhaya in Rota.
- The lower coral cover and higher macroalgae cover observed in Rota may be a consequence of the lower coral recruitment and herbivore AFG biomass there (see *Obj. 4* results), which is likely a consequence of the poor connectivity between Rota and Saipan, Tinian/Aguijan and Guam (see *Obj. 5* results below).

The average percent cover for the 10 categories used to describe the benthic communities (see Table 3) is shown for all survey sites in Table S3 in the appendix, as well as in pie charts within the Site Summaries.

**Table 3.** Average percent cover and standard deviation for the 10 categories used to describe the benthic communities at the survey islands. Colors match what are used within the pie-charts for benthic cover shown within the Site Summaries.

Island		AVERAGE (%)									
		Live Coral	Soft Coral	Dead Coral	Sand	Rubble	Pavement	Macro-algae	Turf Algae	Other Inverts	CC Algae
All islands	Average	35.00	0.76	0.47	7.04	1.22	14.82	9.15	17.72	0.82	11.39
	StDEV	17.84	1.59	1.80	7.30	3.35	16.09	13.83	16.30	1.79	11.79
Saipan	Average	37.88	0.08	0.00	8.06	1.92	17.57	6.83	20.48	0.59	2.99
	StDEV	20.03	0.35	0.00	8.42	3.88	21.56	14.68	19.59	1.08	4.74
Tinian/ Aguijan	Average	37.95	1.25	1.29	6.64	1.21	12.23	7.99	16.52	0.47	14.27
	StDEV	14.37	1.81	3.01	7.51	3.90	9.75	11.98	11.65	1.05	9.17
Rota	Average	27.74	1.24	0.29	5.99	0.21	13.51	13.75	14.96	1.51	20.65
	StDEV	16.22	2.07	1.09	5.07	0.70	11.29	13.78	15.13	2.82	13.21

- The coral diseases observed include white syndromes, black band disease, skeletal eroding band, and growth anomalies. The average coral disease prevalence ( $\pm$ stdev) in Tinian/Aguijan and Rota is  $3.47 \pm 2.65\%$ .

- Greater than 85% of the coral disease observed was white syndromes. Haina Point and Agatasi in Tinian are the only two sites for which any of the other diseases observed had a prevalence >1% (skeletal eroding band).
- Average prevalence values for the coral diseases observed in Tinian/Aguijan and Rota are not significantly different. Average ( $\pm$ stdev) coral disease prevalence in Tinian/Aguijan is  $3.85 \pm 2.99\%$  and in Rota is  $2.85 \pm 1.96\%$ .

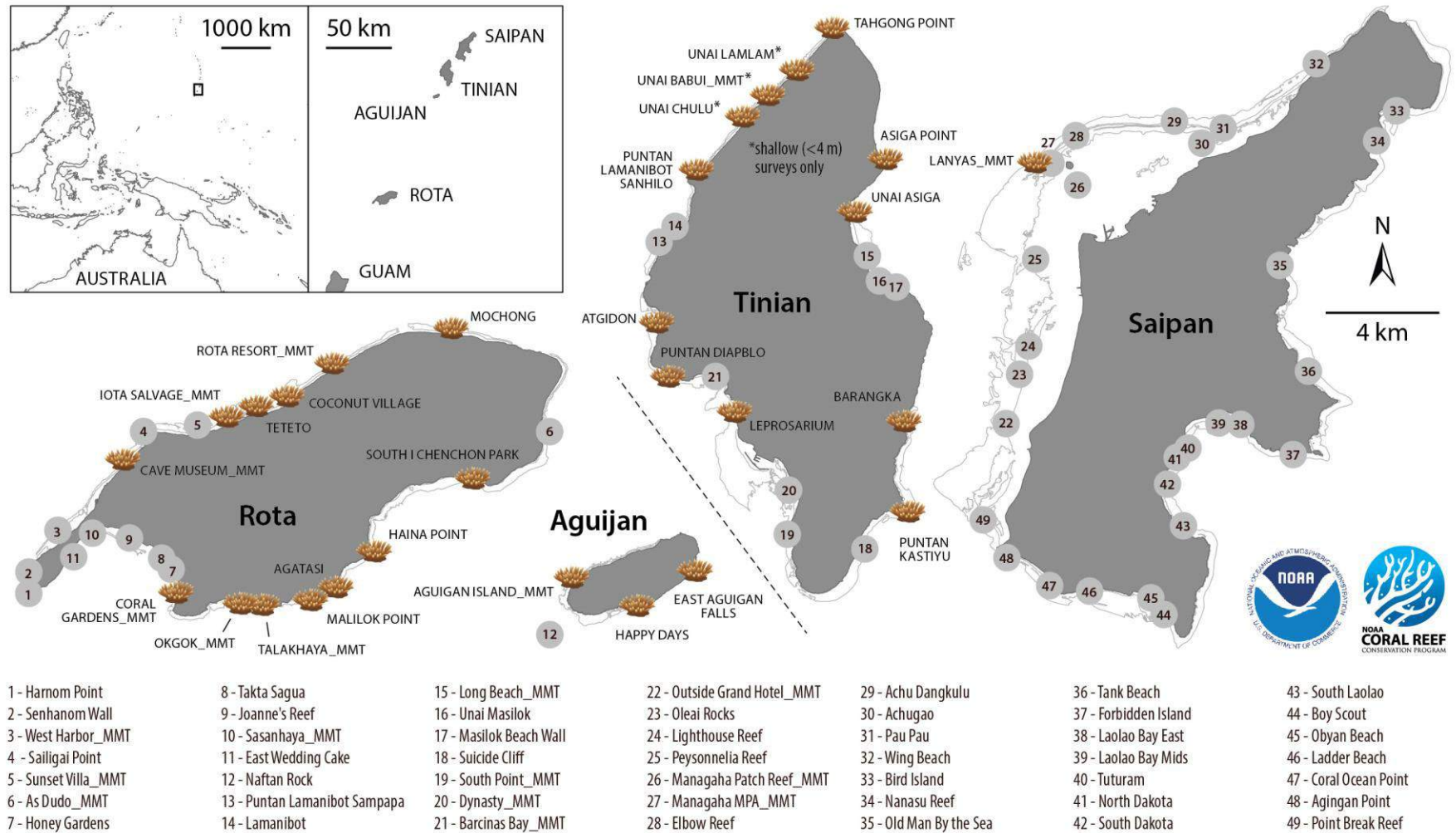
*Results for the coral disease surveys are shown for all sites where these surveys were conducted within Table S4 in the appendix, which includes average prevalence (and standard deviation) values for Tinian/Aguijan and Rota.*

### ***Obj. 2 – ESA-listed coral species***

*Acropora globiceps* is primarily expected to be observed between 0 and 8 meters. Our forereef surveys took place between 8 and 12 meters yet *A. globiceps* was observed during many of our surveys (*A. globiceps* review: [http://www.fpir.noaa.gov/Graphics/PRD/Coral/Acropora\\_globiceps.pdf](http://www.fpir.noaa.gov/Graphics/PRD/Coral/Acropora_globiceps.pdf)). This implies that *A. globiceps* is even more common in CNMI than our surveys suggest as this species may also be present in the shallow waters near our survey sites.

- *Acropora globiceps* was observed at all of the surveyed islands. *A. globiceps* was observed at only one site in Saipan but was observed at half of the sites surveyed in Tinian/Aguijan (12 of 25; including 3 of 4 Aguijan sites) and Rota (13 of 24, Figure 1). *A. globiceps* was also observed in the shallows (<4 m) at Unai Chulu, Unai Babui\_MMT, and Unai Lam Lam (see \*, Figure 1).
- There are no apparent relationships between the presence of *A. globiceps* and environmental conditions, such as wave height/energy.
- Where present, *A. globiceps* has a low density and there is little variation in the density of *A. globiceps* among the sites where this species was observed.

Observations of *Acropora globiceps* in 2012 or 2014



**Figure 1.** Locations where *A. globiceps* was observed when field data were collected in May and June of 2012 and 2014 for the ecological resilience assessment described within this report. These data were collected by coral biologists S. Johnson and L. Johnston of the CNMI Bureau of Environmental and Coastal Quality and by L. Raymundo of the University of Guam Marine Laboratory.

### **Obj. 3. Relative Resilience**

Inter-island analysis:

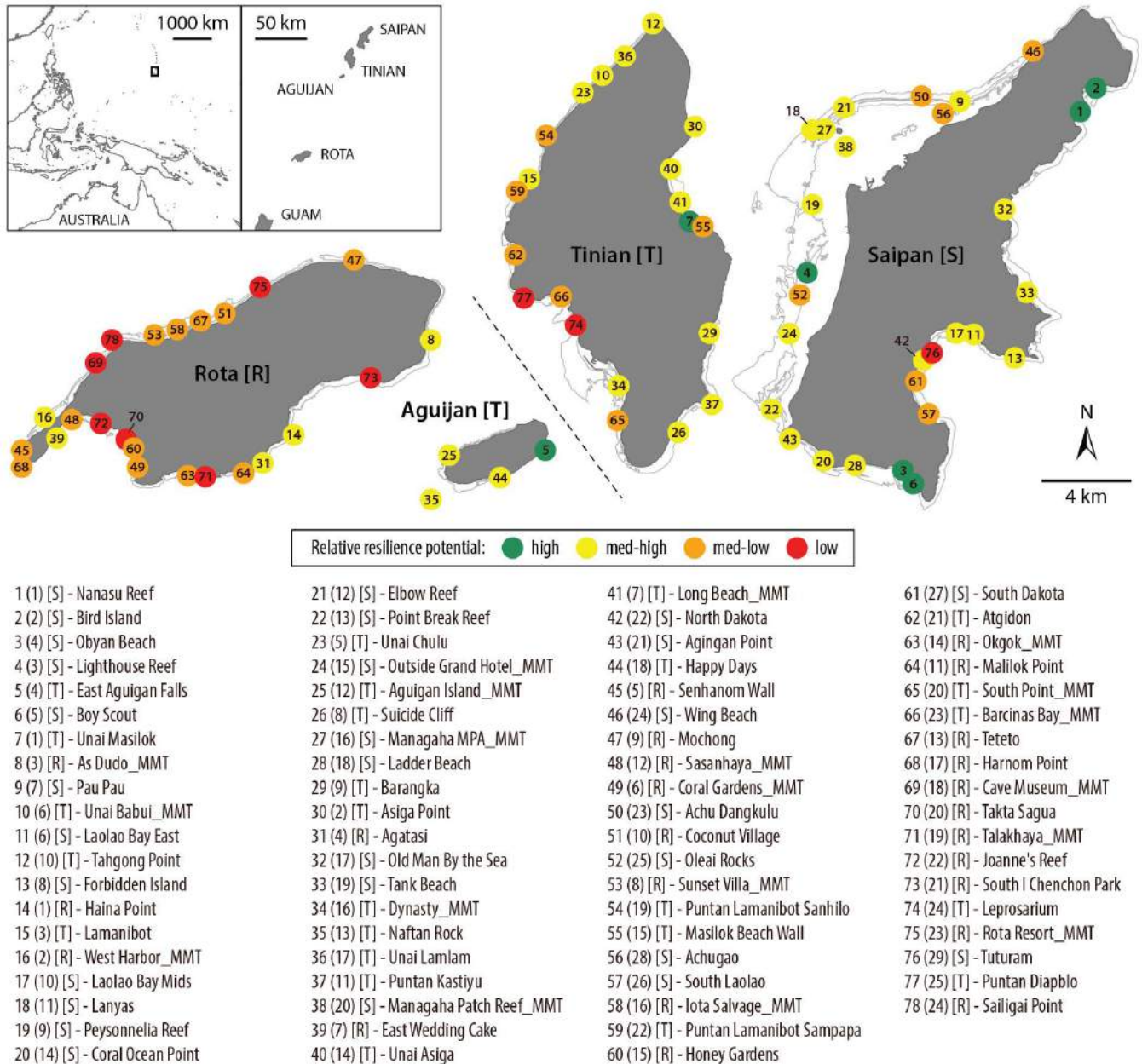
- 7 sites were assessed as having high relative resilience, 37 medium-high, 24 medium-low, and 10 have low relative resilience.
- There is great spatial variation among the islands in whether there are high and low resilience sites. All of the high resilience sites are in Saipan and Tinian/Aguijan and most of these, 5 of 7, are in Saipan. There is at least one low resilience site at each island though 7 of the 10 low resilience sites are in Rota (see pg. 1 of *Site Summaries*).
- The highest-scoring site, Nanasu Reef, is on the exposed side of Saipan (see 1 in Figure 2) and has high or medium-high scores for four of six variables (has low bleaching resistance and temperature variability).
- The lowest scoring site is Sailigai Point on the northern leeward side of Rota (see 78 in Figure 2); the score of 0.62 means the lowest score for relative resilience potential is 38% lower than the highest score. Sailigai Point has low or medium-low scores for all variables excepting temperature variability (see pg. 78 of *Site Summaries*).
- The marine protected areas, Bird Island, Forbidden Island, Managaha and Tank Beach at Saipan [2, 13, 27, and 33, Figure 1] are medium-high or high resilience sites and the MPAs at Sasanhaya and Coral Gardens at Rota [48, 49, Figure 1] are medium-low resilience sites.

*Normalised values for each of the resilience indicators and relative classifications (low-high) for indicators and the final resilience scores are shown within Tables S5a,b in the appendix.*

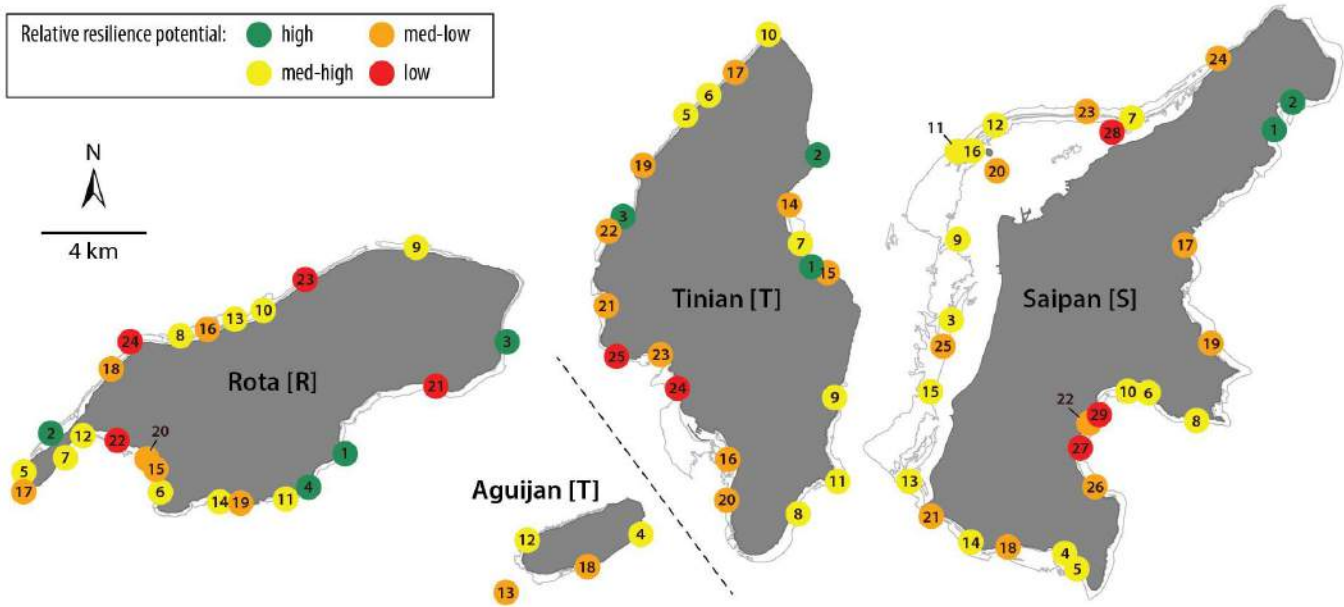
Intra-island analysis:

- There are  $\geq 2$  sites at each island with resilience scores above or below the distribution defined by the average  $\pm 1$  standard deviation (i.e., high or low resilience sites (Figure 3)).
- The general pattern is that the sites with high intra-island resilience potential are on the exposed sides of the islands and thus least accessible to humans, which applies to 7 of the 9 total high resilience sites.
- 6 of the 9 total low resilience sites in the intra-island analysis are directly offshore of human communities (i.e., within 2 km, Figure 3). Sites with higher relative resilience potential tended to be furthest from these centers. This is not due to auto-correlation since the anthropogenic stress proxies used for LBSP and fishing access are not included in the resilience potential scores. Rather, these stressors are likely acting on several of the resilience indicators. For example, sites with lower relative resilience tended to have

lower herbivore AFG biomass, lower recruitment and higher macroalgae cover, which can be influenced by fishing practices and water quality.



**Figure 2.** Inter-island relative resilience potential of the 78 forereef survey sites in CNMI. Resilience rankings are from highest to lowest resilience score; the average score for the 6 resilience indicators after normalizing and scaling scores among islands (see Tables S5a,b). Relative classifications for resilience scores are as follows: high ( $>avg+1sd$ ), medium-high ( $<avg+1sd$  and  $>avg$ ), medium-low ( $<avg$  and  $>avg-1sd$ ), and low ( $<avg-1sd$ , see Figure 3). Intra-island rankings are shown in square brackets ‘[ ]’ to the right of the inter-island rankings used as site numbers on the maps. Sites with ‘\_MMT’ in the name refer to sites surveyed by the marine monitoring team of the Bureau of Environmental and Coastal Quality in CNMI.

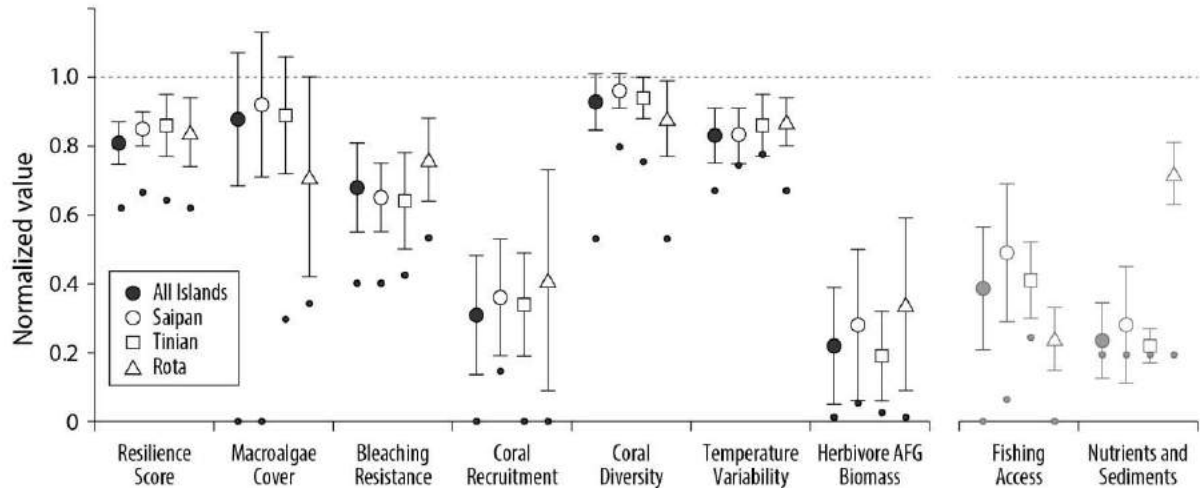


**Figure 3.** Intra-island relative resilience potential of the 78 forereef survey sites in the Mariana Islands. Resilience rankings at each island are from highest to lowest resilience score; the average score for the 6 resilience indicators after normalizing and scaling scores within islands (Tinian and Aguijan are grouped) (see Tables S6a,b-S8a,b). Site names are per Figure 2 where these intra-island rankings are shown in square brackets ‘[]’ next to the inter-island ranking.

#### *Obj. 4 – Resilience drivers*

- Herbivore AFG biomass and coral recruitment were the indicators with the greatest range of values and variability for the inter-island analysis and this was the case for all three islands (Figure 4).
- It was possible that high and low resilience sites could have these classifications as a result of having high scores for different indicators, which we examined using a CAP analysis. For the intra- and inter-island analysis, the CAP analysis indicated that herbivore AFG biomass and coral recruitment were most strongly associated with high and medium-high resilience sites (Figure 5).
- Without exception, high resilience sites have high scores for herbivore AFG biomass and coral recruitment and all low resilience sites have below average scores for herbivore AFG biomass and usually below average scores for coral recruitment (2 of 10 have medium-high scores, Figures 6 and 7).

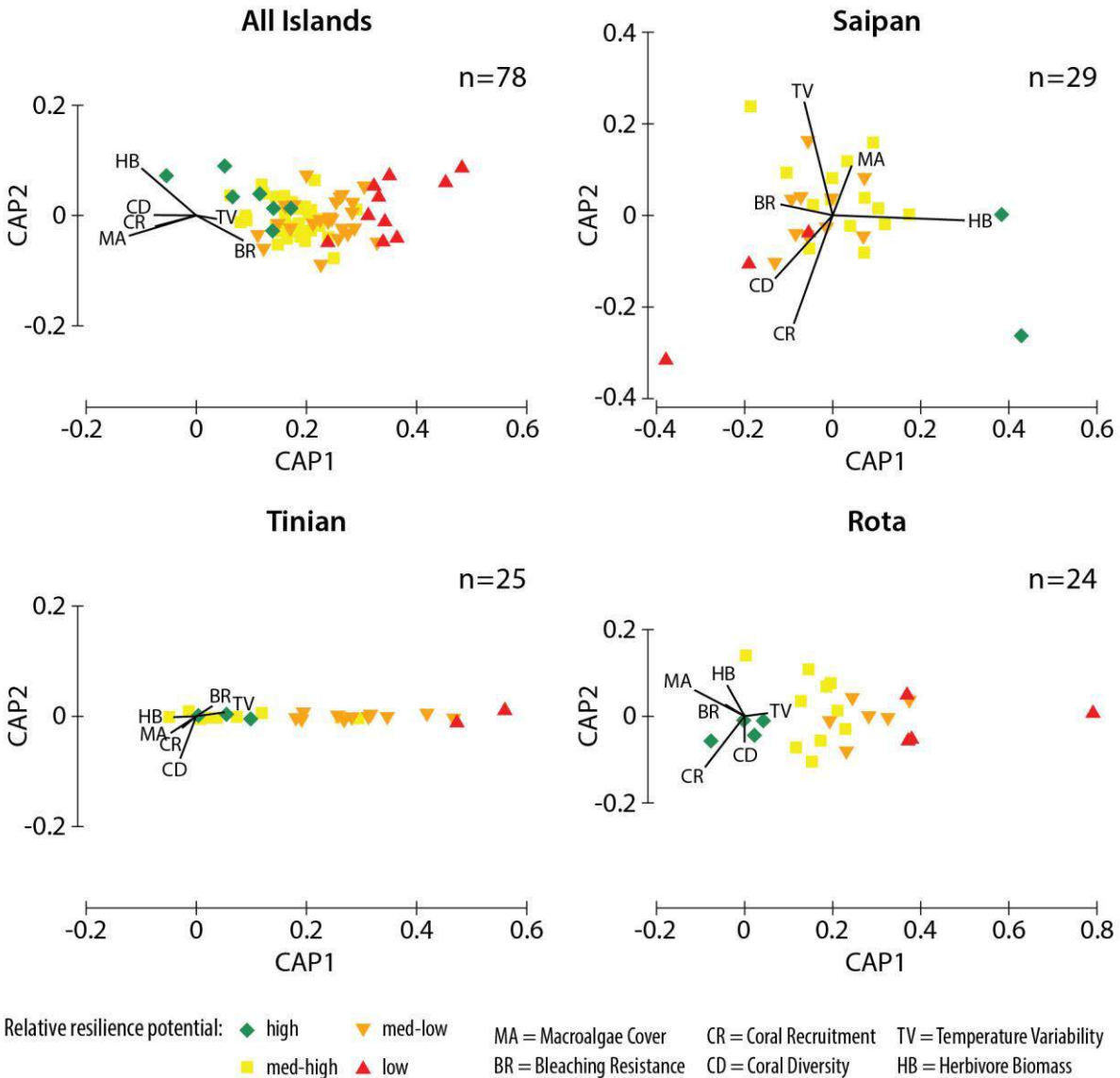




**Figure 4.** Distribution of normalized values for the resilience scores for the inter-island and intra-island analyses, and for the resilience indicators and anthropogenic stressors (see also Figures 1 and 2). Symbols represent average values, the whiskers equal 1 sd, and the small dots are the minimum values; maximum values are all 1.0 (dashed line). Relative classifications for resilience scores and resilience indicator scores are as follows: high (final scores that are  $>1$  sd above average (*avg*) as long as  $\leq 1$ ), medium-high ( $<avg+1sd$  and  $>avg$ ), medium-low ( $<avg$  and  $>avg-1sd$ ), and low ( $<avg-1sd$ ). The range in scores meant there are all four classifications among our sites for 5 of 7 indicators. For macroalgae cover and coral diversity the value of the average+1stdev exceeds the maximum possible value of 1 so no sites are described as being relatively ‘high’.

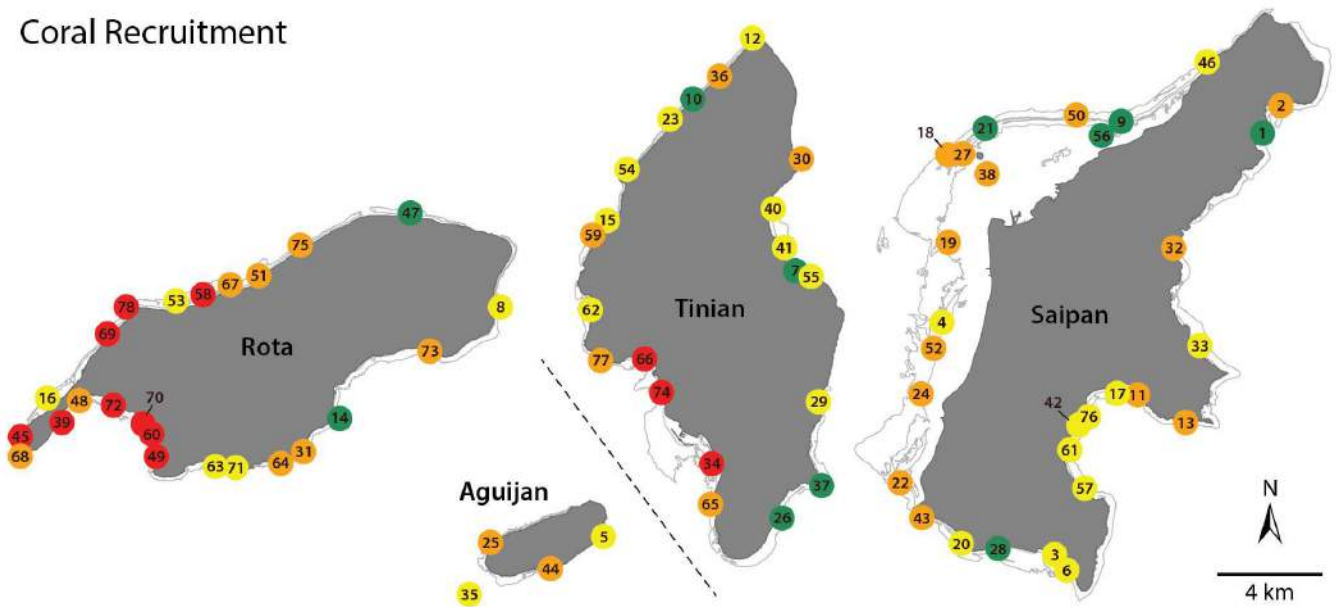
- Coral recruitment, as measured by densities of coral recruits ( $<5$  cm) per meter<sup>2</sup>, tended to be higher in Saipan and Tinian/Aguijan than in Rota. Greater than half of the sites surveyed in Saipan and Tinian/Aguijan had above-average recruitment while 2/3rds of the sites in Rota had below-average recruitment (Figure 6).
- 5 of the 11 high recruitment sites are in Saipan, 4 are in Tinian and 2 are in Rota. 9 of the 12 low recruitment sites are in Rota and the remaining 3 are in Tinian (Figure 6).
- Spatial patterns in herbivore AFG biomass (average herbivore functional group biomass) are very similar to the patterns for coral recruitment. Values for our herbivore AFG biomass metric were greatest on average in Saipan where herbivore functional group diversity is greatest and lowest in Rota where grazing parrotfish are typically larger than in Saipan but functional group diversity is lower. The excavator and browser biomass in Rota was lower than was typical of the other islands.
- Most of the sites with above average herbivore AFG biomass are on the exposed sides of the islands, suggesting links between accessibility due to wave exposure (see Figure 7) and herbivore AFG biomass.

- In this study, herbivore AFG biomass is clearly one of the largest drivers of resilience potential, which has important management implications. Management actions to maintain herbivore AFG biomass are likely to be the most important management actions in CNMI to support resilience for all sites surveyed. These results support continuing the current gear restriction regulations and other ongoing fisheries management actions.



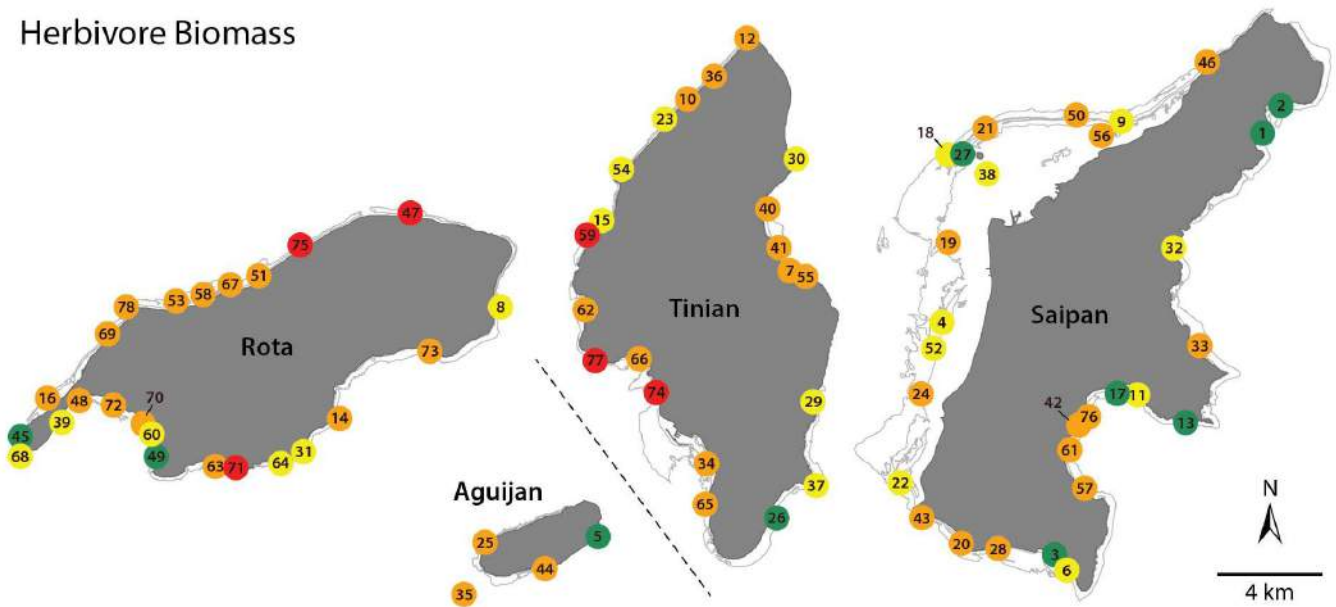
**Figure 5.** Canonical analysis of principal coordinates showing the relative contribution of six resilience indicators (overlaid as vectors) to the overall resilience of reef sites for the inter-island analysis (A) and intra-island analyses (B-D). For each analysis, high and medium-high resilience sites are associated with high herbivore AFG biomass, coral diversity and coral recruitment and low macroalgae cover. Squared canonical correlation values ( $\delta^2$ ) of the first and second ordination axes are 0.603 and 0.112 for all islands, 0.690 and 0.364 for Saipan, 0.697 and 0.001 for Tinian, 0.727 and 0.088 for Rota.

Coral Recruitment



**Figure 6.** Coral recruitment results from the inter-island analysis (see also Table S5a,b). Colors are as per Figure 2.

Herbivore Biomass



**Figure 7.** Herbivore AFG biomass results from the inter-island analysis (see also Table S5a,b). Colors are as per Figure 2.

**Obj. 5. Connectivity**

- Saipan is the biggest source of coral and fish larvae for all four of the PLDs used (10, 20, 50 and 100 days) and for both simulations (with and without larvae swimming capability, Tables S9,10).
- For both simulations, Tinian/Aguijan contributes ~50% as much larvae back to the reefs of the CNMI as Saipan. Depending on the PLD, Rota, a much smaller source based on potential habitat area, only contributes 10-30% as much larvae to reefs of the CNMI as Saipan (Tables S9,10).
- The results vary more when comparing the extent to which each island is a destination for larvae among PLDs and for the two simulations (Table S8). For the 0-km buffer simulation Tinian is the biggest larvae destination for all PLDs, Saipan is 53-98% the destination that Tinian is and Rota is a far greater destination for larvae as PLD increases (5% for 10-day PLD and 90% for 100-day (Tables S9,10)).
- For the 18-km buffer simulation, Saipan and Tinian are comparable destinations for the 10 and 20-day PLDs. Tinian is the greatest destination for the 50-day PLD and Rota is the greatest destination for the 100-day PLD (Table S10).
- Considering both simulations together and all PLDs combined, Saipan is roughly twice as great a source as Tinian and 10x that of Rota. Tinian and Saipan are comparable destinations and each is roughly twice as great a destination as Rota (Table 4).
- The lower relative resilience potential of the reefs in Rota may be due to poor connectivity to the large larvae sources of Saipan, Tinian/Aguijan, and Guam. There are two lines of evidence that suggest that this is the case. Firstly, the results of our connectivity simulations indicate that Rota is roughly half the larvae destination that either Saipan or Tinian/Aguijan is. Rota is only 10% the larvae source the larger islands are and is the poorest self-recruiter; lesser amounts and percentages of the 20, 50 and 100-PLD larvae from Rota arrive at Rota reefs for both our simulations than is the case for Saipan or Tinian/Aguijan. The second line of evidence supports the first. Average scores in Rota are lower for all four of the resilience indicators that relate to connectivity than average scores for these indicators for the other islands. Herbivore AFG biomass and coral recruitment are both lower on average in Rota. Perhaps consequently, macroalgae cover is higher and coral diversity is also lower in Rota.
- In CNMI, management actions (described next) implemented in Saipan and Tinian/Aguijan will be more helpful in maintaining larvae supply than in Rota since Saipan and Tinian/Aguijan are each roughly an order of magnitude greater a larvae source than Rota. Also, management actions may not be sufficient to support the resilience potential in Rota due to the limited availability of larvae for settlement in Rota.

Improving conditions in Rota in future decades may require reef restoration and coral translocation.

**Table 4.** The extent to which each of our survey islands is a source/destination relative to the maximum source/destination among the three island groups. These values are averages of the normalized values for source/destination extent of all four pelagic larval durations examined (10, 20, 50 and 100-day), which are shown in the bottom row and right-most column of the tables comprising Tables S9,10. Results for two connectivity simulations are shown; the first (0-km buffer) assumes larvae have limited swimming capability and must arrive at the reef location and the second (18-km buffer) assumes swimming capability and that the larvae need only arrive within two model grid cells (18-km) of reef locations at our survey islands. As an example interpretation, Tinian/Aguijan supplied 59% of the number of larvae that Saipan supplied in the first simulation (see 0.59 source value); and 46% of that number in the second simulation (see 0.46 source value).

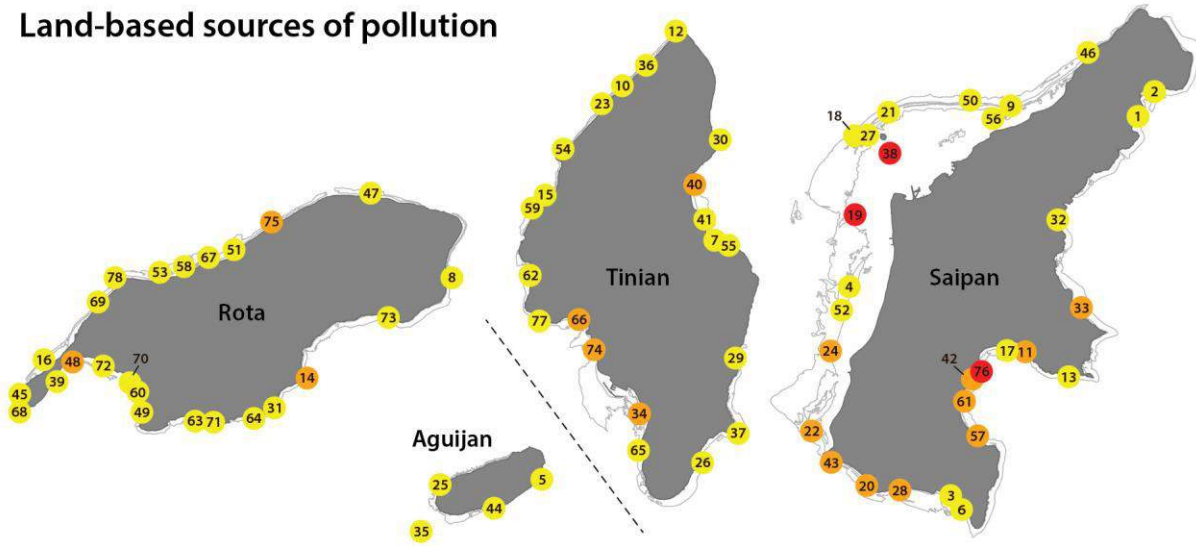
<b><i>0-km buffer</i></b>	Source	Destination
Saipan	1.00	0.73
Tinian/Aguijan	0.59	1.00
Rota	0.11	0.40
<b><i>18-km buffer</i></b>		
Saipan	1.00	0.76
Tinian/Aguijan	0.46	0.86
Rota	0.12	0.60

***Obj. 6. Assessing anthropogenic stressors and identifying management targets***

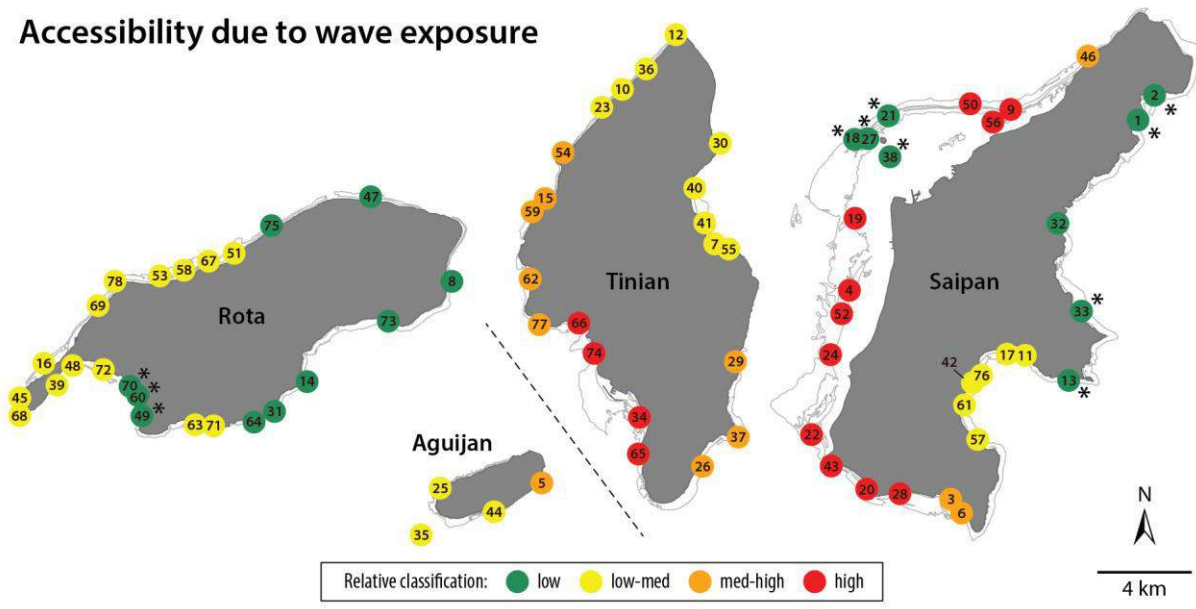
**Anthropogenic stressors:**

- Land-based sources of pollution, as assessed using our proxy, are within the average  $\pm 1$  standard deviation at all but 3 of the sites where LBSP values are low. The sites with high values for LBSP are in Saipan in Lao Lao Bay (Tuturam) and near the township of Garapan in the center of the western side of Saipan (Peysonnellia Reef and Managaha Patch Reef\_MMT, Figure 8).
- Accessibility due to wave exposure (our ‘fishing access’ proxy) is greatest on the southern and western sides of Tinian and Saipan and on the south-eastern and north-eastern sides of Rota. As expected, the wave height data used for access indicate access is highest near where the main population centers are on each of the surveyed islands (Figure 8).

Land-based sources of pollution



Accessibility due to wave exposure

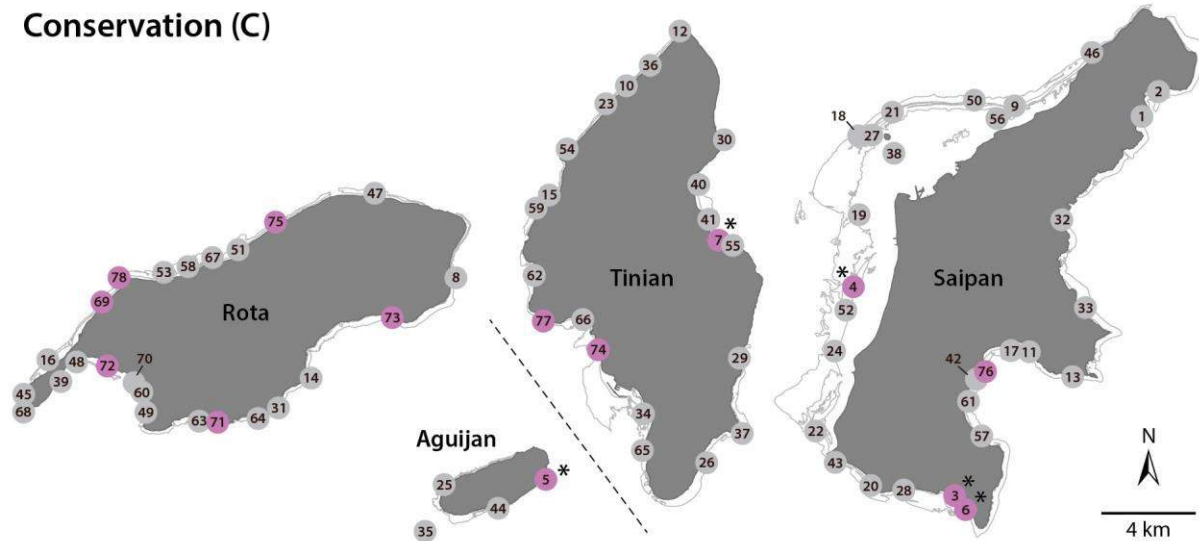


**Figure 8.** Land-based sources of pollution and Accessibility due to wave exposure results from the inter-island analysis (see also Table S5b). The colors are used in the same way here in that green is good though here green refers to lower relative stress (rather than higher relative resilience potential, as in Figure 2). \* denote sites within no-take MPAs (at the time of publication).

**Identifying Management Targets:**

**Conservation:**

**Conservation (C)**

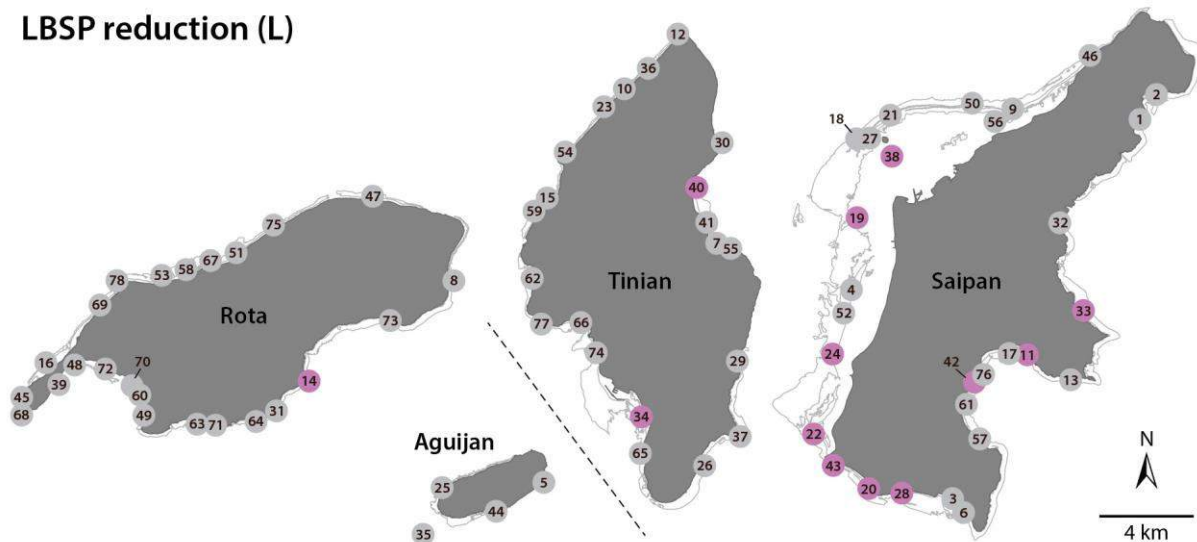


**Figure 9.** Sites that are targets for conservation (purple); these have high (\*) or low resilience potential and are currently outside established no-take MPAs. Numbers refer to resilience rankings, which are shown with site names in Figure 2.

- Sites that are targets for conservation (n=14) are low/high resilience sites currently outside established MPAs. The highest priorities are the high resilience sites that meet this criteria; there are 5 of these, four in Saipan (Nanasu and Lighthouse Reefs, Obyan Beach and Boy Scout) and one in Tinian (Unai Masilok, see Figure 9 for locations and Figure 2 for site names).
- There are a large range of options for actions to support the resilience of these locations (see Table 2). In particular, the high resilience locations are priorities for actions related to limiting anchoring and extractive practices such as herbivore fishing.

**LBSP Reduction:**

**LBSP reduction (L)**



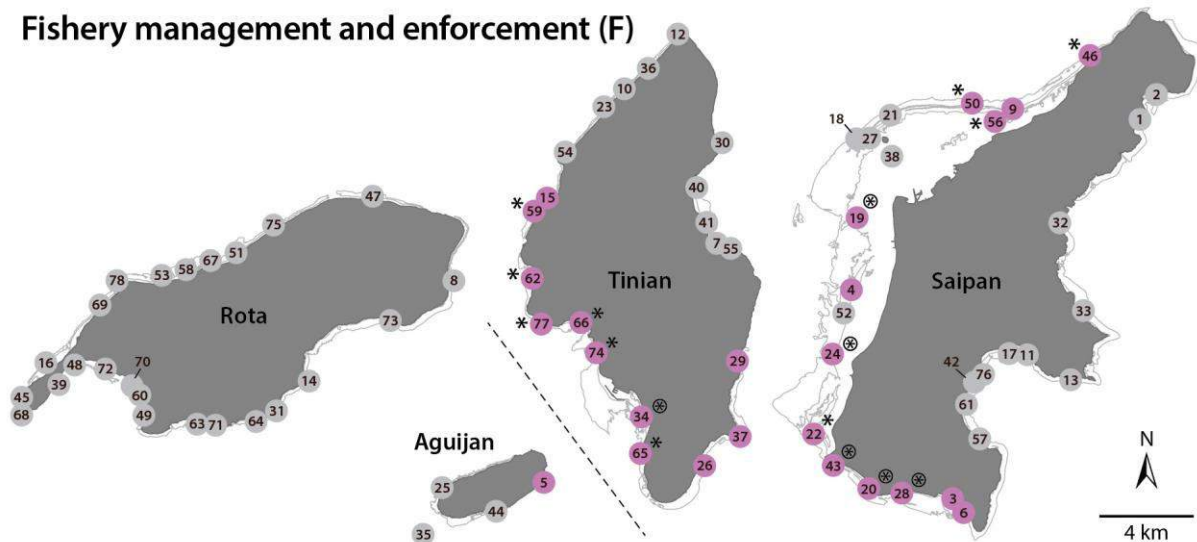
**Figure 10.** Sites that are targets for LBSP reduction (purple); these have above-average resilience potential and land-based sources of pollution. Numbers refer to resilience rankings, which are shown with site names in Figure 2.

- There are targets for LBSP reduction (i.e., above average scores for LBSP and resilience potential) at all islands (n=13) and on both the leeward and windward sides of the islands (Figure 10).
- Targets for LBSP reduction are generally in close proximity to human communities where the percentage of the watersheds made up by urban and cleared areas is greatest (see 19, 38, 76 for Saipan and 66, 74 for Tinian/Aguijan, Figure 10).
- Examples of actions that can be implemented to reduce LBSP near the identified sites include: stream bank stabilization, road and storm drain improvement, other erosion control practices and sewage treatment upgrades (see also Table 2).



**Fishery management and enforcement:**

**Fishery management and enforcement (F)**

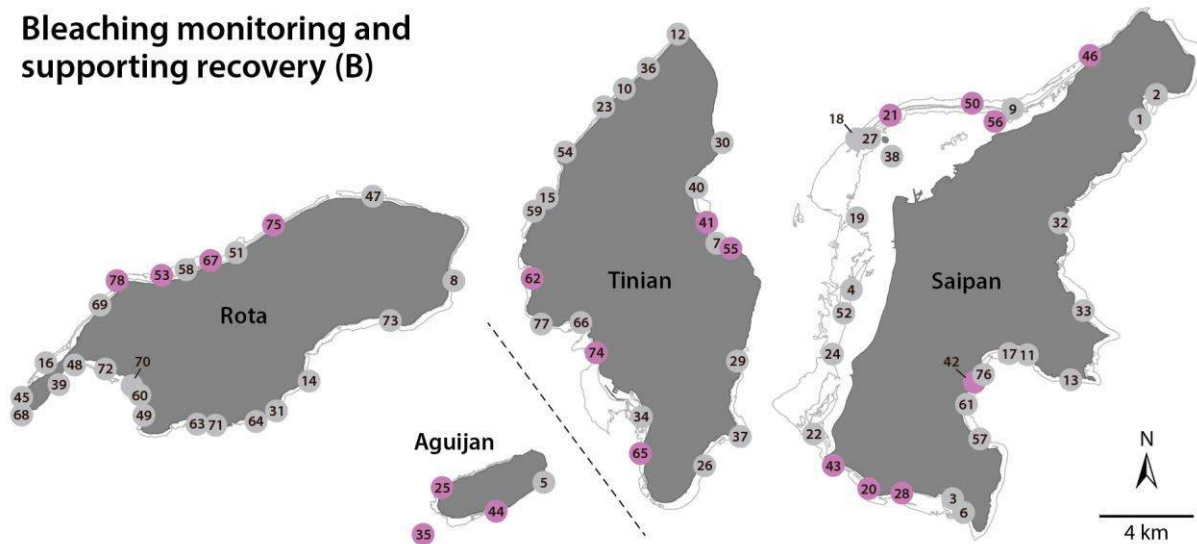


**Figure 11.** Sites that are targets for fishery management and enforcement (purple); these have above-average resilience potential *and* fishing access **OR** below-average herbivore AFG biomass and above-average fishing access (single \*) **OR** both (circled asterisk). Numbers refer to resilience rankings, which are shown with site names in Figure 2.

- Sites that are targets for fishery management and enforcement (i.e., above average scores for accessibility and: 1) resilience potential (n=10), or 2) below average herbivore AFG biomass (n=15) or both (n=6), Figure 11, Figure S10) are on the western (leeward) side of Saipan and southern end and western (leeward) side of Tinian/Aguijan (Figure 11).
- Examples of actions that can be considered for implementation at these locations include increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas, temporary closures, LMMAs, and marine debris removal.

**Bleaching monitoring and supporting recovery:**

**Bleaching monitoring and supporting recovery (B)**

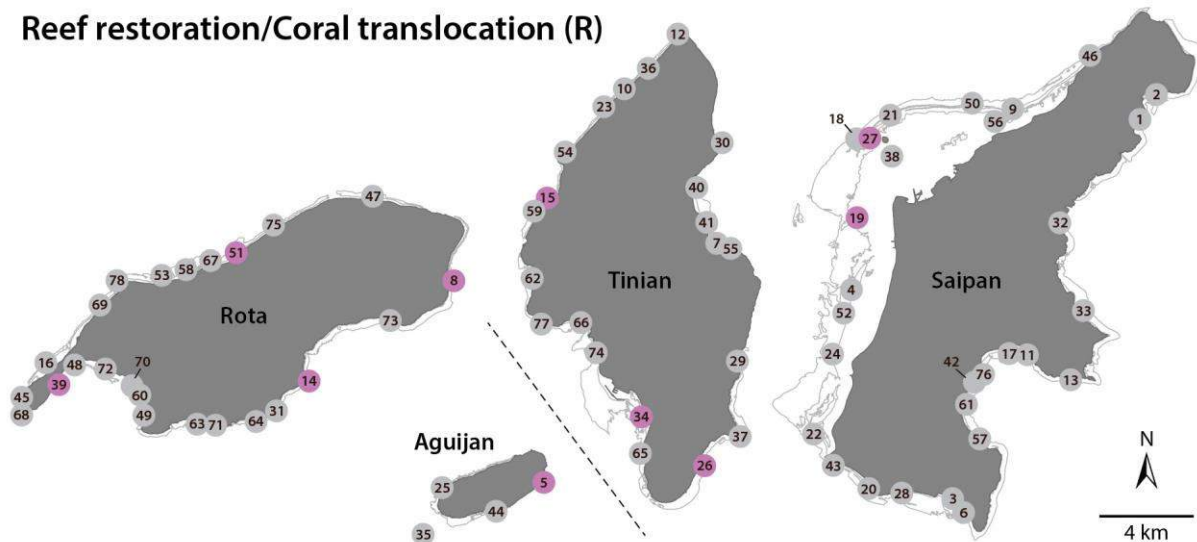


**Figure 12.** Sites that are targets for bleaching monitoring and supporting recovery; these have low bleaching resistance and low herbivore AFG biomass. Numbers refer to resilience rankings, which are shown with site names in Figure 2.

- Sites that are targets for bleaching monitoring and supporting recovery have low bleaching resistance and low herbivore AFG biomass (n=20). There are sites that meet these criteria on all islands and on both the leeward and windward sides (Figure 12).
- Examples of actions that can be considered for implementation at these locations include: increased monitoring during warm seasons, shading or other cooling measures, and supporting recovery processes through LBSP reduction or fishery management and enforcement.

**Reef restoration/coral translocation:**

**Reef restoration/Coral translocation (R)**

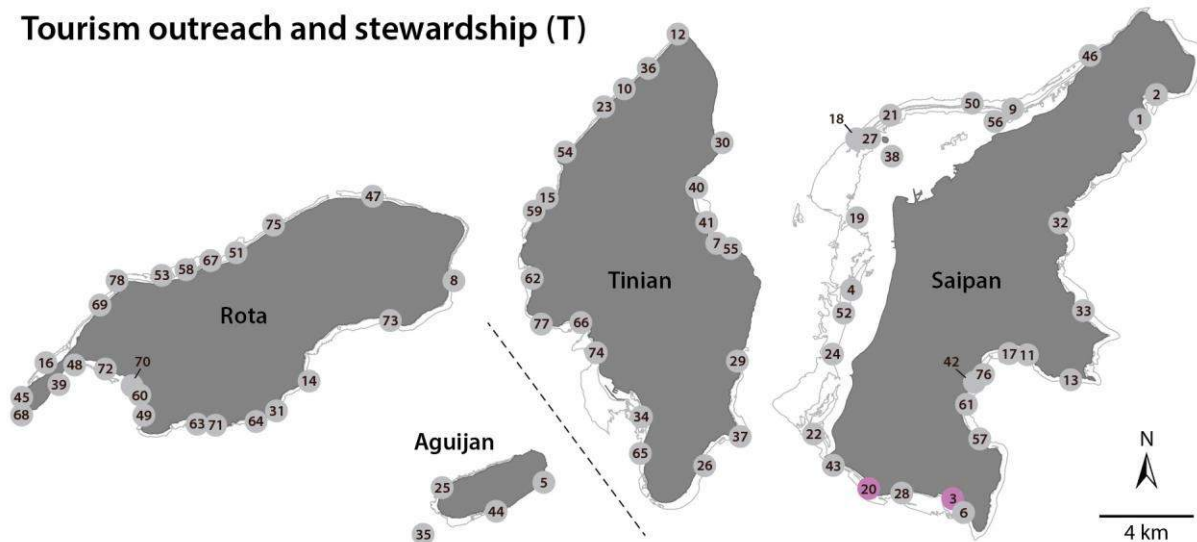


**Figure 13.** Sites that are targets for reef restoration/coral translocation (purple); these have above-average resilience potential and low coral diversity or coral cover. Numbers refer to resilience rankings, which are shown with site names in Figure 2.

- Sites that are targets for reef restoration/coral translocation (n=10) have above-average resilience potential and low coral diversity or coral cover. There are sites that meet these criteria on the leeward sides of all islands where undertaking reef restoration or coral translocation could increase coral cover or diversity.
- The very best targets for reef restoration/coral translocation may be As Dudo\_MMT and East Wedding Cake of Rota (8, 39). These are medium-high resilience sites that meet this criteria but also have below average scores for both LBSB and Accessibility due to wave exposure meaning transplanted corals may have greater survivorship at those locations (Figure 13).

**Tourism outreach and stewardship:**

**Tourism outreach and stewardship (T)**



**Figure 14.** Sites that are targets for tourism outreach and stewardship (purple); these have above-average coral diversity *and* fish species richness *and* fish biomass *and* accessibility due to wave exposure. Numbers refer to resilience rankings, which are shown with site names in Figure 2.

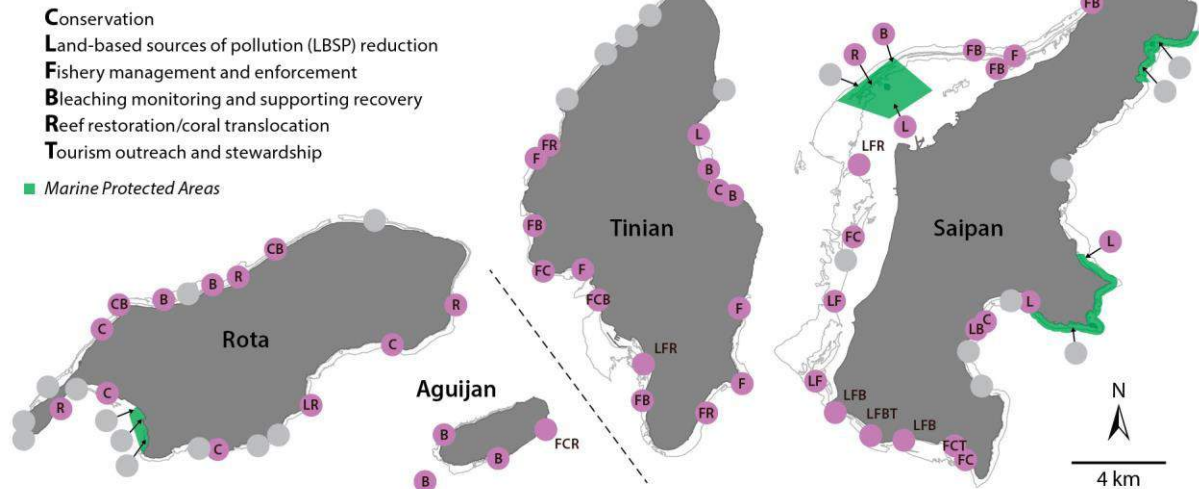
- Sites that are targets for tourism outreach and stewardship have above average coral diversity and fish species richness and fish biomass and are accessible (i.e., lower average wave heights). Two sites meet this criteria and both are in southern Saipan (Obyan Beach and Coral Ocean Point, Figure 14).
- These locations may increasingly be targeted by tourism operators for diving and snorkeling. Managers can consider establishing moorings at these locations, undertaking targeted outreach and developing stewardship and/or citizen science programs (Table 2).

**Summary for Identifying Targets for Management Actions:**

- A total of 51 of the 78 sites meet at least one of the 6 criteria set to identify targets for management actions (see Figure 15 and Table 2). There are targets for different types of management actions on all sides of all islands.
- There are sites that meet more than one of the 6 set criteria (n=27). For example, there are 9 sites that are targets for Bleaching monitoring and supporting recovery and Fishery management and enforcement. These are the highest priority areas for managing herbivore fishing as they are accessible to fishers, have above average resilience potential and have high bleaching susceptibility and low herbivore AFG biomass (see ‘FB’ in Figure 15).
- There are also sites that are targets for Conservation based on having high resilience

potential that are targets for fishery management and enforcement. Considering fishery management and increased enforcement is the highest priority to support resilience at these locations (see FC in Saipan in Figure 15).

### Targets for:



**Figure 15.** Results of the 6 queries used to target different types of management actions. Criteria for the queries and relevant suggested management actions are described within Table 2. Sites in grey meet none of the 6 set criteria but may warrant some of these same kinds of management actions for reasons distinct from the resilience assessment results. Query results are also shown in Table S11 and for each of the individual queries in Figures 9-14.

### Summary Conclusions

A slightly abbreviated version of the content below also appears in the Executive Summary.

#### *Obj. 1 – Benthic Cover and Disease*

The average percent cover of live coral and macroalgae were similar in Saipan and Tinian/Aguijan; ~38% for live coral and ~7% for macroalgae. On average, coral cover was ~10% lower on Rota than in Saipan or Tinian/Aguijan (~28% versus ~38%) and macroalgae cover on Rota was twice that observed in Saipan or Tinian/Aguijan (~14% versus ~7%). The average coral cover at the forereef sites (all islands combined) is 35%, which is greater than the average coral cover in the Great Barrier Reef in Australia. Coral disease prevalence is low and typically ~3% in Tinian/Aguijan and Rota. The most commonly observed coral diseases are white syndromes and skeletal eroding band.

#### *Obj. 2 – ESA-listed Coral Species*

There are three coral species newly listed in 2014 as Threatened under the Endangered Species Act that are known to be present on reefs within CNMI: *Acropora globiceps*, *Acropora retusa*, and *Seriatopora aculeata*. Of these, only *A. globiceps* was observed during our surveys. *A.*

*globiceps* was observed at one site in Saipan, at 13 of the 24 survey sites in Rota and at 12 of the 25 survey sites in Tinian/Aguijan. *A. globiceps* was also observed at 3 shallow (<4 m) sites in northeast Tinian (only shallow sites surveyed outside the Saipan lagoon), one of which may become the focus of military training activities (Unai Chulu).

*Obj. 3 - Relative Resilience*

Resilience potential varied greatly within and among islands with some sites having high and some having low relative resilience potential. Generally, sites closest to the main population centers and near cleared lands had lower relative resilience potential than sites more remote from population centers. Since anthropogenic stressors are examined separate to the ecological resilience assessment, these results strongly suggest human activities are impacting the resilience potential of coral reefs near population centers.

*Obj. 4 – Resilience Drivers*

Herbivore AFG biomass and coral recruitment are the indicators that most distinguish sites in the assessment from one another. These influential indicators need to continue to be assessed during research and monitoring activities. These are inter-related since herbivores clear algae from the substrate upon which coral recruits can then settle. Consequently, both are positively affected by actions that conserve herbivorous fish. Conserving herbivorous fish is among the very most important actions managers in CNMI can take to support the resilience of local reefs.

*Obj. 5 - Connectivity*

There is great variation among the islands in the extent to which each is a fish and coral larvae source and destination. The connectivity simulations indicate Saipan is roughly twice as great a source as Tinian and 10x that of Rota. Tinian and Saipan are comparable destinations and each is roughly twice as great a destination as Rota. These results help explain the lower relative resilience potential of reefs in Rota. These results also strongly suggest that actions taken to support the resilience of reefs in Rota may not be sufficient to overcome the limitations for recovery potential in Rota due to the poor connectivity with the other large islands in the Marianas chain. Therefore, actions to support resilience are likely to be more effective in the long-term if implemented in Saipan and Tinian/Aguijan.

*Obj. 6 - Assessing anthropogenic stressors and identifying management targets*

51 of the 78 foreef survey sites met at least one of the 6 criteria we set to identify targets for management actions that can support site and system resilience. The criteria for the data queries we set are an innovation in streamlining how the results of ecological resilience assessments can inform management actions. Managers in CNMI can use the connectivity results as well as our observations of the Threatened coral species *Acropora globiceps* to further prioritize from among the identified sites. For example, actions in Saipan and Tinian/Aguijan may be more effective so can be prioritized (as above) and efficiencies can be gained for managers by supporting resilience at sites that meet one or more of the set criteria and have resident *A. globiceps* colonies.

### *Obj. 7 – Outreach and engagement*

This has been an ambitious project in scope and scale that has been undertaken highly collaboratively between research scientists and managers. The project has also been as inclusive as possible of representatives of local agencies in CNMI. The formal project is complete but in a sense a large portion of the work our research can inform has just begun. The project team and collaborating scientists and managers in the Pacific and within CNMI now have the opportunity to use the wealth of data this project generated to inform local actions and similar assessments undertaken in other areas. Some of the plans for these next steps are described in the section below.

Please note that all of the raw data and map and graphic figure files are available by sending an email request to the first or second author.

### **Next Steps**

Our team intends to continue to discuss these results with agencies in CNMI that can use the results to inform decision-making and planning processes. In various ways, the information presented within this report will directly inform management actions through review of the options we presented for all the sites that met our various management queries. Our manager partners will work to identify opportunities for addressing actions we have suggested here that can support site and system resilience. Aside from continuing to share and discuss the project results, we are planning other assessments and analysis. We will undertake a project similar in scope and scale in Guam over the coming couple of years as a collaborative effort with local agencies in Guam and USVI and reef stakeholders, under funding from the NOAA NMFS Saltonstall-Kennedy Program. We are also leading a project that will deliver downscaled climate model projections of coral bleaching conditions for the Micronesia region via an interactive tool under funding from the PICSC of USGS. The projections will be used to develop sustainability forecasts for a range of culturally important locations in CNMI and Guam. In addition, in 1-2 years we aim to undertake a re-assessment of all of the sites surveyed in 2012 and 2014 under this project. This assessment will enable us to test the predictive capability of our results given bleaching events have occurred in Saipan since our 2012 surveys. We will also test the effect on our results of using additional resilience indicators such as measures of habitat complexity/rugosity. During our future CNMI surveys we will consider including surveys of the northern-most islands of the CNMI such as Pagan Island and the Islands Unit (Farallon de Pajaros or Uracas, Maug, and Asuncion) of the Marianas Trench Marine National Monument.

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## **Appendix**

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Figure S4 – Temperature variability

**Table S1.** Coordinates of the 78 foreereef survey sites. Coordinates for the 7 Saipan lagoon sites are in the *Site Summaries*. Numbers in [ ] refer to inter-island resilience rankings to aid in finding site locations within Figure 2.

Site Name	Island Name	Lat (°N)	Lon (°E)	Site Name	Island Name	Lat (°N)	Lon (°E)
Achu Dangkulu [50]	Saipan	15.26	145.75	P. Lamanibot Sanhilo [54]	Tinian	15.06	145.60
Achugao [56]	Saipan	15.25	145.75	Puntan Diapblo [77]	Tinian	14.99	145.59
Agingan Point [43]	Saipan	15.12	145.69	Puntan Kastiyu [37]	Tinian	14.95	145.67
Bird Island [2]	Saipan	15.26	145.82	South Point_MMT [65]	Tinian	14.94	145.63
Boy Scout [6]	Saipan	15.10	145.74	Suicide Cliff [26]	Tinian	14.94	145.65
Coral Ocean Point [20]	Saipan	15.11	145.71	Tahgong Point [12]	Tinian	15.10	145.64
Elbow Reef [21]	Saipan	15.25	145.71	Unai Asiga [40]	Tinian	15.04	145.65
Forbidden Island [13]	Saipan	15.15	145.78	Unai Babui_MMT [10]	Tinian	15.08	145.62
Grand Hotel_MMT [24]	Saipan	15.16	145.69	Unai Chulu [23]	Tinian	15.07	145.61
Ladder Beach [28]	Saipan	15.11	145.72	Unai Lamlam [36]	Tinian	15.09	145.63
Lanyas [18]	Saipan	15.24	145.70	Unai Masilok [7]	Tinian	15.02	145.66
Laolao Bay East [11]	Saipan	15.16	145.77	Aguijan Island_MMT [25]	Aguijan	14.85	145.54
Laolao Bay Mids [17]	Saipan	15.16	145.76	East Aguijan Falls [5]	Aguijan	14.85	145.58
Lighthouse Reef [4]	Saipan	15.18	145.70	Happy Days [44]	Aguijan	14.84	145.56
Managaha Patch_MMT [38]	Saipan	15.24	145.72	Naftan Rock [35]	Aguijan	14.83	145.53
Managaha_MMT [27]	Saipan	15.24	145.71	Agatasi [31]	Rota	14.12	145.22
Nanasu Reef [1]	Saipan	15.25	145.81	As Dudo_MMT [8]	Rota	14.17	145.29
North Dakota [42]	Saipan	15.15	145.75	Cave Museum_MMT [69]	Rota	14.16	145.15
Obyan Beach [3]	Saipan	15.10	145.74	Coconut Village [51]	Rota	14.18	145.20
Old Man By the Sea [32]	Saipan	15.21	145.78	Coral Gardens_MMT [49]	Rota	14.12	145.17
Oleai Rocks [52]	Saipan	15.18	145.70	East Wedding Cake [39]	Rota	14.13	145.14
Pau Pau [9]	Saipan	15.25	145.76	Haina Point [14]	Rota	14.13	145.23
Peysonnelia Reef [19]	Saipan	15.21	145.70	Harnom Point [68]	Rota	14.12	145.12
Point Break Reef [22]	Saipan	15.13	145.69	Honey Gardens [60]	Rota	14.13	145.17
South Dakota [61]	Saipan	15.14	145.74	Iota Salvage_MMT [58]	Rota	14.17	145.18
South Laolao [57]	Saipan	15.13	145.75	Joanne's Reef [72]	Rota	14.14	145.15
Tank Beach [33]	Saipan	15.18	145.79	Malilok Point [64]	Rota	14.12	145.21
Tuturam [76]	Saipan	15.15	145.75	Mochong [47]	Rota	14.20	145.26
Wing Beach [46]	Saipan	15.27	145.79	Okgok_MMT [63]	Rota	14.11	145.19
Asiga Point [30]	Tinian	15.06	145.66	Rota Resort_MMT [75]	Rota	14.19	145.22
Atgidon [62]	Tinian	15.01	145.59	Sailigai Point [78]	Rota	14.17	145.16
Barangka [29]	Tinian	14.98	145.66	Sasanhaya_MMT [48]	Rota	14.14	145.14
Barcinas Bay_MMT [66]	Tinian	14.99	145.61	Senhanom Wall [45]	Rota	14.12	145.12
Dynasty_MMT [34]	Tinian	14.96	145.63	South I Ch. Park [73]	Rota	14.15	145.26
Lamanibot [15]	Tinian	15.04	145.59	Sunset Villa_MMT [53]	Rota	14.17	145.17
Leprosarium [74]	Tinian	14.98	145.61	Takta Sagua [70]	Rota	14.13	145.16
Long Beach_MMT [41]	Tinian	15.03	145.65	Talakhaya_MMT [71]	Rota	14.11	145.20
Masilok Beach Wall [55]	Tinian	15.02	145.66	Teteto [67]	Rota	14.18	145.19
P. Lamanibot Sampapa [59]	Tinian	15.03	145.59	West Harbor_MMT [16]	Rota	14.14	145.13

**Table S2.** Most common morphology, bleaching susceptibility rating, and known habitats for all coral species observed during the 2012 and 2014 surveys. Bleaching susceptibility ratings range from 1-5 (from least to most susceptible). Susceptibility ratings are based on the team's personal observations during past bleaching events in CNMI as well as from a literature review. Habitat classifications are as follows, and refer to the types of habitat(s) the species is known to occur in CNMI: Lf = loose framework reef, P = patch reef, Rf = reef flat, SG = spur and groove reef.

CORAL SPECIES	GROWTH MORPHOLOGY	BLEACHING SUSCEPTIBILITY	HABITAT
<i>Acanthastrea brevis</i>	Encrusting	2	P, Sg
<i>Acanthastrea echinata</i>	Encrusting	2	Lf, P, Rf, Sg
<i>Acanthastrea hillae</i>	Encrusting	2	P, Sg
<i>Acanthastrea c.f. regularis</i>	Encrusting	2	Lf
<i>Acropora abrotanoides</i>	Arborescent	3	Lf, P, Sg
<i>Acropora aspera</i>	Staghorn	5	P, Rf
<i>Acropora azurea</i>	Digitate/corymbose	4	Lf, Sg
<i>Acropora cerealis</i>	Digitate/corymbose	4	Lf, Sg
<i>Acropora cophydactyla</i>	Digitate/corymbose	3	Lf
<i>Acropora cuneata</i>	Arborescent	2	P
<i>Acropora digitifera</i>	Digitate/corymbose	3	Lf, P, Sg
<i>Acropora gemmifera</i>	Digitate/corymbose	3	Lf, Sg
<i>Acropora granulosa</i>	Digitate/corymbose	3	Lf, Sg
<i>Acropora humilis</i>	Digitate/corymbose	3	Lf, Sg
<i>Acropora juv.</i>	Branching	3	Lf, P, Sg
<i>Acropora latistella</i>	Digitate/corymbose	4	Lf, P, Sg
<i>Acropora monticulosa</i>	Arborescent	3	Lf, Rf, Sg
<i>Acropora muricata</i>	Staghorn	5	P
<i>Acropora nana</i>	Digitate/corymbose	5	Sg
<i>Acropora nasuta</i>	Digitate/corymbose	5	Lf, Sg
<i>Acropora pulchra</i>	Staghorn	5	Rf
<i>Acropora robusta</i>	Arborescent	4	Lf, Sg
<i>Acropora secale</i>	Digitate/corymbose	3	Lf, P, Sg
<i>Acropora surculosa</i>	Digitate/corymbose	3	Lf, P, Sg
<i>Acropora c.f. striata</i>	Digitate/corymbose	4	Sg
<i>Acropora tenuis</i>	Digitate/corymbose	5	Lf, P, Rf, Sg
<i>Acropora teres</i>	Staghorn	5	P, Rf
<i>Acropora vaughani</i>	Digitate/corymbose	4	Lf, Rf, Sg
<i>Acropora verweyi</i>	Digitate/corymbose	4	Lf, P, Sg
<i>Alveopora fenestrata</i>	Massive	3	Lf
<i>Astreopora gracilis</i>	Massive	4	Lf
<i>Astreopora listeri</i>	Massive	4	Lf, P, Sg
<i>Astreopora myriophthalma</i>	Massive	4	Lf, P, Sg
<i>Astreopora randalli</i>	Massive	4	Lf, Sg
<i>Cyphastrea agassizi</i>	Massive	3	Lf, Sg
<i>Cyphastrea chalcidicum</i>	Massive	3	Lf, P, Sg
<i>Cyphastrea c.f. japonica</i>	Massive	3	Sg
<i>Cyphastrea ocellina</i>	Massive	3	Lf, Sg

CORAL SPECIES	GROWTH MORPHOLOGY	BLEACHING SUSCEPTIBILITY	HABITAT
<i>Cyphastrea seraila</i>	Massive	3	Lf, Sg
<i>Diploastrea heliopora</i>	Massive	1	Lf
<i>Echinophyllia aspera</i>	Encrusting	2	P
<i>Echinopora lamellosa</i>	Plate	2	Lf, P, Sg
<i>Favia danae</i>	Massive	3	Lf, R
<i>Favia fавus</i>	Massive	3	Lf, P, Sg
<i>Favia helianthoides</i>	Massive	3	Lf, Sg
<i>Favia mathaii</i>	Massive	3	Lf, P, Sg
<i>Favia pallida</i>	Massive	3	Lf, Sg
<i>Favia rotumana</i>	Massive	3	P
<i>Favia speciosa</i>	Massive	3	Lf, P, Sg
<i>Favia stelligera</i>	Massive	4	Lf, Sg
<i>Favites abdita</i>	Massive	2	Lf, P, Sg
<i>Favites flexuosa</i>	Massive	2	Lf, P
<i>Favites russelli</i>	Massive	1	Lf, P, Rf, Sg
<i>Fungia</i> sp.	Free-living	2	Lf
<i>Fungia fungites</i>	Free-living	2	Lf
<i>Fungia paumotensis</i>	Free-living	2	Lf
<i>Fungia repanda</i>	Free-living	2	Lf
<i>Fungia scutaria</i>	Free-living	2	Lf, P, Sg
<i>Galaxea fascicularis</i>	Encrusting	3	Lf, P, Sg
<i>Gardineroseris planulata</i>	Massive	3	Lf, Sg
<i>Goniastrea aspera</i>	Massive	4	P
<i>Goniastrea edwardsi</i>	Massive	4	Lf, P, Rf, Sg
<i>Goniastrea pectinata</i>	Massive	3	Lf, P, Sg
<i>Goniastrea retiformis</i>	Massive	4	Lf, P, Rf, Sg
<i>Goniopora djiboutiensis</i>	Massive	1	Lf
<i>Goniopora fruticosa</i>	Encrusting	1	Lf, Sg
<i>Goniopora minor</i>	Massive	1	P
<i>Heliopora coerulea</i>	Branching	1	Lf, P, Rf
<i>Hydnophora microconos</i>	Massive	4	Lf, P, Rf, Sg
<i>Isopora palifera</i>	Arborescent	2	Lf, P, Sg
<i>Leptastrea bottae</i>	Encrusting	2	Lf, P, Sg
<i>Leptastrea purpurea</i>	Encrusting	2	Lf, P, Sg
<i>Leptastrea transversa</i>	Encrusting	2	Lf, Sg
<i>Leptoria phrygia</i>	Massive	3	Lf, P, Rf, Sg
<i>Lobophyllia corymbosa</i>	Massive	3	Lf, Sg
<i>Lobophyllia hemprichii</i>	Massive	3	Sg
<i>Millepora dichotoma</i>	Branching	1	Sg
<i>Millepora platyphylla</i>	Massive	1	Lf
<i>Millepora tuberosa</i>	Encrusting	1	Lf, P, Sg
<i>Montastrea curta</i>	Massive	3	Lf, P, Sg
<i>Montastrea valenciennesi</i>	Massive	3	Lf, Sg
<i>Montipora</i> sp.	Encrusting	4	Lf, P, Rf, Sg
<i>Montipora</i>	Encrusting	4	Lf, Sg
<i>aequituberculata</i>			

CORAL SPECIES	GROWTH MORPHOLOGY	BLEACHING SUSCEPTIBILITY	HABITAT
<i>Montipora caliculata</i>	Encrusting	4	Lf, P, Sg
<i>Montipora danae</i>	Encrusting	4	P, Sg
<i>Montipora efflorescens</i>	Encrusting	4	Lf, P, Sg
<i>Montipora floweri</i>	Encrusting	4	Lf, Sg
<i>Montipora foveolata</i>	Encrusting	4	Lf, Sg
<i>Montipora grisea</i>	Encrusting	4	Lf, Sg
<i>Montipora hoffmeisteri</i>	Encrusting	4	Sg
<i>Montipora lobulata</i>	Encrusting	4	P
<i>Montipora monasteriata</i>	Encrusting	4	Lf, P, Sg
<i>Montipora nodosa</i>	Encrusting	4	Lf, P, Rf, Sg
<i>Montipora tuberculosa</i>	Encrusting	4	Lf, P, Sg
<i>Montipora verrilli</i>	Encrusting	4	P, Sg
<i>Montipora verrucosa</i>	Encrusting	4	Lf, Sg
<i>Oulophyllia crispa</i>	Massive	3	Lf, Sg
<i>Pavona cactus</i>	Foliose	3	P
<i>Pavona divaricata</i>	Foliose	3	Lf, P, Rf, Sg
<i>Pavona duerdini</i>	Massive	4	Lf, P, Sg
<i>Pavona explanulata</i>	Cryptic	3	Lf
<i>Pavona frondifera</i>	Cryptic	3	Lf
<i>Pavona maldiviensis</i>	Cryptic	3	Lf, Sg
<i>Pavona minuta</i>	Encrusting	3	Lf
<i>Pavona varians</i>	Encrusting	1	Lf, P, Sg
<i>Pavona venosa</i>	Encrusting	2	Lf, Sg
<i>Platygyra daedalea</i>	Massive	3	P, Sg
<i>Platygyra pini</i>	Massive	3	Lf, P, Sg
<i>Plesiastrea versipora</i>	Massive	1	Lf, Sg
<i>Pocillopora</i> sp.	Digitate/corymbose	4	Lf, P, Sg
<i>Pocillopora ankeli</i>	Digitate/corymbose	4	Lf, Sg
<i>Pocillopora damicornis</i>	Digitate/corymbose	2	Lf, P, Rf, Sg
<i>Pocillopora danae</i>	Digitate/corymbose	3	Lf, Sg
<i>Pocillopora elegans</i>	Digitate/corymbose	4	Lf, P, Sg
<i>Pocillopora eydouxi</i>	Digitate/corymbose	4	Sg
<i>Pocillopora meandrina</i>	Digitate/corymbose	4	Lf, Sg
<i>Pocillopora verrucosa</i>	Digitate/corymbose	4	Lf, Sg
<i>Pocillopora woodjonesi</i>	Digitate/corymbose	4	Sg
<i>Porites</i> sp.	Massive	1	Lf, P, Rf, Sg
<i>Porites annae</i>	Massive	2	Lf
<i>Porites australiensis</i>	Massive	1	Lf, Sg
<i>Porites cylindrica</i>	Branching	2	Lf, Rf, Sg
<i>Porites deformis</i>	Columnar	2	Lf
<i>Porites densa</i>	Massive	1	Lf
<i>Porites lichen</i>	Encrusting	1	Lf, P, Sg
<i>Porites lobata</i>	Massive	1	Lf, P, Sg
<i>Porites lutea</i>	Massive	1	Lf, P, Rf, Sg
<i>Porites "massive"</i> ( <i>lobata/lutea/australiensis</i> )	Massive	1	Lf, P, Rf, Sg

CORAL SPECIES	GROWTH MORPHOLOGY	BLEACHING SUSCEPTIBILITY	HABITAT
<i>Porites rus</i>	Columnar	1	Lf, P, Sg
<i>Porites vaughani</i>	Encrusting	1	Lf, P, Sg
<i>Psammocora</i> sp.	Encrusting	1	Lf, P, Rf, Sg
<i>Psammocora digitata</i>	Columnar	2	Lf, Rf
<i>Psammocora haimeana</i>	Cryptic	1	Lf, Sg
<i>Psammocora nierstrazi</i>	Encrusting	1	Lf, P, Sg
<i>Psammocora stellata</i>	Cryptic	1	Rf
<i>Scolymia australis</i>	Encrusting	1	P
<i>Stylocoeniella armata</i>	Encrusting	1	Lf, P, Rf, Sg
<i>Stylocoeniella guentheri</i>	Encrusting	1	Lf
<i>Stylophora mordax</i>	Branching	5	Lf, P, Rf, Sg
<i>Turbinaria reniformis</i>	Plate	3	Lf, Sg
<i>Turbinaria stellulata</i>	Encrusting	2	Lf, Sg

**Table S3.** Average benthic cover (from three 50-m transects) of 10 groups used to classify benthic community composition. The colors used refer to the pie charts in the Site Summaries where the community composition is shown for each survey site. Sites are alphabetized here with Saipan sites listed first followed by Tinian/Aguijan and Rota. See Figure 2 for site locations and Table S1 for site coordinates.

Site	AVERAGE									
	Live Coral	Soft Coral	Dead Coral	Sand	Rubble	Pave-ment	Macro-algae	Turf Algae	Other Inverts	CC Algae
Achu Dangkulu	26.00	0.00	0.00	27.33	0.00	16.00	0.00	27.00	0.00	2.33
Achugao	54.67	0.00	0.00	2.00	0.00	27.67	0.00	14.33	0.33	1.00
Agingan Point	35.33	0.00	0.00	7.33	0.00	8.00	0.00	46.67	0.00	2.67
Bird Island	70.00	0.00	0.00	2.67	2.00	10.67	0.00	11.67	0.00	2.00
Boy Scout	25.00	0.70	0.00	20.50	14.78	0.00	1.30	0.00	1.50	23.20
Coral Ocean Point	57.33	0.00	0.00	4.00	0.00	2.00	0.00	36.67	0.00	0.00
Elbow Reef	23.67	0.00	0.00	0.33	0.00	11.00	0.00	64.33	0.00	0.67
Fishing Base Staghorn	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Forbidden Island	49.00	0.00	0.00	3.00	0.00	1.67	0.00	44.33	0.00	1.33
Ladder Beach	34.00	0.00	0.00	34.00	0.00	11.33	0.00	11.67	0.00	9.00
Lanyas	45.00	0.00	0.00	0.00	0.00	54.00	0.00	0.00	0.67	0.00
Laolao Bay East	22.33	0.00	0.00	18.00	2.33	0.67	1.00	49.33	0.33	6.33
Laolao Bay Mids	14.50	0.00	0.00	4.00	0.50	0.00	0.50	72.50	1.50	6.50
Lighthouse Reef	72.00	2.00	0.00	16.67	0.00	6.67	0.00	2.00	0.00	0.67
Managaha MPA_MMT	43.33	0.00	0.00	14.00	0.67	8.00	9.33	24.00	0.00	0.67
Manag. Patch_MMT	22.67	0.00	0.00	20.00	4.00	6.67	4.00	41.33	0.67	0.67
Marianas Resort	43.00	0.00	0.00	6.33	2.33	2.33	22.33	20.67	0.00	0.67
Nanasu Reef	23.67	0.00	0.00	0.33	16.67	23.33	6.00	27.33	0.33	1.33
North Dakota	32.00	0.00	0.00	16.67	0.00	36.33	0.00	12.33	0.33	1.33

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Site	AVERAGE									
	Live Coral	Soft Coral	Dead Coral	Sand	Rubble	Pave-ment	Macro-algae	Turf Algae	Other Inverts	CC Algae
O. Grand Hotel_MMT	37.00	0.00	0.00	9.00	1.67	37.67	0.00	3.67	0.67	10.33
Obyan Beach	39.67	0.00	0.00	7.33	0.33	51.00	0.00	0.00	0.33	1.33
Old Man By the Sea	48.67	0.00	0.00	5.00	6.33	8.67	6.00	22.33	1.33	0.00
Oleai Rocks	30.33	0.00	0.00	14.33	0.67	42.00	0.00	9.00	1.67	2.00
Oleai Staghorn	3.33	0.00	0.00	4.33	0.00	80.67	11.33	0.00	0.33	0.00
Pak Pak Beach	49.00	0.00	0.00	12.67	3.00	0.00	3.00	23.33	0.00	5.33
Pau Pau	20.00	0.00	0.00	0.67	0.00	76.67	0.00	1.00	1.00	0.00
Peysonnelia Reef	61.56	0.00	0.00	0.00	0.00	12.54	1.14	1.97	20.52	2.28
Point Break Reef	24.00	0.00	0.00	10.00	0.67	15.33	0.00	41.33	0.00	8.67
Q. Staghorn	63.00	0.00	0.00	3.00	1.67	0.00	32.33	0.00	0.00	0.00
South Dakota	31.33	0.00	0.00	2.00	0.00	1.00	33.67	15.00	1.00	1.33
South Laolao	13.48	0.00	0.00	1.65	0.00	21.20	24.61	21.02	0.56	11.19
Tanapag Staghorn	48.33	0.00	0.00	2.00	1.67	2.33	10.67	34.67	0.00	0.00
Tank Beach	43.33	0.00	0.00	7.67	7.33	10.67	0.35	27.91	1.00	0.00
Tuturam	8.85	0.00	0.00	3.21	0.00	3.89	72.44	9.88	0.00	1.74
Wing Beach	54.00	0.00	0.00	2.00	0.67	33.67	0.00	1.00	1.00	1.67
Archie's Hole	34.33	0.00	1.33	2.00	1.67	40.67	4.67	11.00	0.00	4.33
Barcinas Bay	48.00	0.00	0.00	4.67	1.67	9.67	16.33	5.00	0.67	13.33
Dynasty_MMT	36.33	1.67	1.33	30.00	2.33	3.00	3.00	16.33	4.67	1.00
East Goat Falls	39.67	0.67	0.33	0.33	0.67	26.00	0.33	11.33	0.00	20.67
Goat Island_MMT	43.00	7.00	0.00	1.00	0.00	25.33	0.00	12.00	0.00	11.67
Haggan Rocks	65.00	0.00	6.33	0.00	0.00	11.00	0.00	8.33	0.00	9.33
Happy Days	29.67	2.33	0.33	11.00	0.00	22.00	0.00	8.00	0.33	26.33
Long Beach_MMT	27.00	2.67	10.00	16.67	1.33	2.67	1.33	23.33	1.33	13.00
Naftan Rock	51.33	0.00	0.67	2.00	0.00	18.00	0.00	9.33	0.33	18.33
Puntan Kastiyu	56.67	0.00	0.33	0.00	0.00	15.33	1.67	20.67	0.00	5.00
Short Beach Wall	31.00	4.67	10.67	10.33	0.67	0.00	0.00	21.00	0.00	20.00
South Point	26.67	0.00	0.33	19.67	19.67	0.67	5.67	16.33	2.67	8.33
Unai Asiga	44.00	1.67	0.00	4.33	0.00	13.67	3.33	31.00	0.00	1.33
Unai Masilok	53.33	0.33	0.33	0.00	0.00	0.00	0.33	33.67	0.00	11.67
Unlikely Wall	70.67	0.00	0.33	0.67	0.00	7.33	0.00	7.67	0.00	13.33
Leprosarium	48.33	0.00	0.00	5.00	0.00	8.33	0.33	34.67	0.33	3.00
Puntan Diapblo	25.67	0.00	0.00	1.67	0.00	5.33	51.00	9.33	0.33	6.67
Unai Lam Lam	27.67	4.00	0.00	6.00	0.33	10.00	18.00	6.33	0.00	27.67
Unai Chulu	18.33	3.00	0.00	3.33	0.00	9.33	22.33	8.67	0.00	35.00
Atgidon	22.00	0.00	0.00	15.67	0.00	24.00	20.00	3.00	0.00	15.33
Lamanibot	47.67	0.33	0.00	6.33	0.33	14.00	7.00	10.33	0.00	14.00
Unai Babui	17.67	1.33	0.00	11.00	0.33	11.33	13.00	13.00	0.00	32.33
Lamanibot Sampapa	32.33	0.33	0.00	1.67	0.00	9.00	5.33	41.00	0.67	9.67



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Site	AVERAGE									
	Live Coral	Soft Coral	Dead Coral	Sand	Rubble	Pave-ment	Macro-algae	Turf Algae	Other Inverts	CC Algae
Lamanibot Sanhilo	29.67	1.33	0.00	11.33	1.33	3.00	25.00	8.00	0.33	20.00
Tahgong Point	22.67	0.00	0.00	1.33	0.00	16.00	1.00	43.67	0.00	15.33
Agatasi	22.00	0.00	0.00	0.33	0.00	31.00	0.00	17.00	1.67	28.00
Cave Museum	22.33	1.33	0.00	8.67	0.00	7.33	16.67	3.00	5.00	35.67
Coconut Village	17.00	0.33	0.00	4.00	0.00	6.00	17.67	6.67	0.00	48.33
Coral Gardens	73.67	0.33	0.00	1.00	1.00	18.33	0.00	4.33	0.00	1.33
East Wedding Cake	13.33	1.67	0.00	3.67	0.00	13.33	2.00	42.00	6.67	17.33
Haina Point	11.00	0.00	0.67	0.00	0.00	48.67	0.00	6.67	0.00	33.00
Harnom Point	26.00	0.00	0.00	0.67	0.00	8.67	26.00	12.33	1.67	24.67
Honey Gardens	58.67	0.00	0.00	0.33	0.00	22.67	5.00	7.00	0.00	6.33
Iota Salvage_MMT	46.33	5.67	0.33	9.67	0.00	8.33	0.67	8.00	0.67	19.67
Joanne's Reef	8.33	3.00	0.00	8.33	0.00	7.33	14.00	58.00	0.33	0.67
Malilok Point	17.00	1.67	0.00	6.33	0.00	23.33	0.00	28.33	0.33	23.00
Mochong	30.67	0.33	0.00	2.00	0.00	1.00	25.67	14.67	0.00	25.67
Okgok	11.67	2.00	0.00	4.67	0.00	15.33	25.67	26.00	2.00	12.67
ROTA 1_MMT	32.00	0.67	0.00	11.33	0.33	10.00	2.67	5.67	0.00	36.67
Rota Resort_MMT	25.00	0.00	0.33	19.33	0.33	2.00	22.67	2.67	0.00	26.67
Sailigai Point	33.33	0.00	0.00	1.00	0.00	0.33	47.67	0.00	0.00	17.67
Sasanhaya	15.33	0.00	0.00	6.33	0.00	26.67	7.67	37.67	0.67	5.67
Senhanom Wall	19.33	0.00	0.00	3.67	0.00	9.67	9.67	34.67	4.67	18.33
South Sanctuary	16.33	2.33	5.33	12.67	0.00	15.67	39.67	1.33	0.00	6.00
Sunset Villa	29.00	1.00	0.00	10.67	0.00	4.67	12.00	11.33	0.00	31.33
Takta Sagua	46.67	0.00	0.00	5.67	3.33	17.67	19.00	4.00	0.67	3.00
Talakhaya	18.00	0.00	0.00	14.33	0.00	1.33	32.67	8.33	11.67	13.67
Teteto	46.33	8.67	0.00	2.67	0.00	6.00	2.67	16.00	0.00	17.67
West Harbor_MMT	26.33	0.67	0.33	6.33	0.00	19.00	0.33	3.33	0.33	42.67

**Table S4.** Prevalence of four types of coral diseases observed at survey sites in Rota and Tinian. All prevalence values are percentages. Rankings refer to the inter-island resilience analysis and can be used to find the site locations within Figure 2.

Site name	Island	Ranking	Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band Disease	Growth Anomalies
<i>AVERAGE</i>	<b>Rota</b>		<b>3.73</b>	<b>3.25</b>	<b>0.31</b>	<b>0.13</b>	<b>0.04</b>
<i>STDEV</i>	<b>Rota</b>		<b>2.82</b>	<b>2.48</b>	<b>0.61</b>	<b>0.30</b>	<b>0.11</b>
Rota Resort_MMT	Rota	75	1.75	1.40	0.00	0.00	0.35
Iota Salvage_MMT	Rota	58	0.95	0.95	0.00	0.00	0.00
West Harbor_MMT	Rota	16	2.74	2.74	0.00	0.00	0.00
As Dudo_MMT	Rota	8	5.76	5.76	0.00	0.00	0.00
South I Chenchon Park	Rota	73	2.57	2.30	0.26	0.00	0.00
Malilok Point	Rota	64	0.61	0.61	0.00	0.00	0.00
Haina Point	Rota	14	7.31	5.99	1.32	0.00	0.00
Agatasi	Rota	31	7.78	5.59	2.19	0.00	0.00
Okgok_MMT	Rota	63	1.45	1.45	0.00	0.00	0.00
Sasanhaya_MMT	Rota	48	0.90	0.90	0.00	0.00	0.00
Mochong	Rota	47	1.33	1.33	0.00	0.00	0.00
Coconut Village	Rota	51	2.99	2.57	0.21	0.21	0.00
Teteto	Rota	67	4.93	4.38	0.28	0.00	0.28
Talakhaya_MMT	Rota	71	3.11	2.35	0.00	0.76	0.00
Coral Gardens_MMT	Rota	49	9.83	9.63	0.00	0.20	0.00
Takta Sagua	Rota	70	5.73	4.09	0.65	0.99	0.00
<i>AVERAGE</i>	<b>Tinian</b>		<b>2.67</b>	<b>2.58</b>	<b>0.08</b>	<b>0.01</b>	<b>0.00</b>
<i>STDEV</i>	<b>Tinian</b>		<b>1.95</b>	<b>1.98</b>	<b>0.21</b>	<b>0.02</b>	<b>0.00</b>
Leprosarium	Tinian	74	1.96	1.96	0.00	0.00	0.00
Puntan Diapblo	Tinian	77	0.75	0.60	0.15	0.00	0.00
Unai Lamlam	Tinian	36	3.00	3.00	0.00	0.00	0.00
Unai Chulu	Tinian	23	2.92	2.92	0.00	0.00	0.00
Atgidon	Tinian	62	0.80	0.80	0.00	0.00	0.00
Lamanibot	Tinian	15	7.04	7.04	0.00	0.00	0.00
Unai Babui_MMT	Tinian	10	4.55	4.55	0.00	0.00	0.00
Pn. Lamanibot Sampapa	Tinian	59	2.45	1.77	0.68	0.00	0.00
Puntan Lamanibot Sanhilo	Tinian	54	2.40	2.34	0.00	0.07	0.00
Tahgong Point	Tinian	12	0.81	0.81	0.00	0.00	0.00

**Table S5a.** Inter-island analysis - Distribution of normalized data values for the resilience scores (no shade), six environmental resilience indicators (light grey) and proxies for anthropogenic stress (dark grey) for the inter-island analysis. Colored cells contain the upper limit for the four relative classifications: high (>avg+1sd), medium-high (<avg+1sd and >avg), medium-low (<avg and >avg-1sd), land ow (<avg-1sd), derived from the values in Table S5b. Colors are reversed for the stress proxies as high stress is negative.

	Final RS	Raw RS	MA	BR	CR	CD	TV	HB	FA	NS
AVG	0.81	0.73	0.88	0.68	0.31	0.93	0.83	0.22	0.39	0.24
SD	0.06	0.06	0.19	0.13	0.17	0.08	0.08	0.17	0.18	0.11
High	1.00	1.00	NA	1.00	1.00	NA	1.00	1.00	1.00	1.00
Med-High	0.87	0.78	1.00	0.81	0.48	1.00	0.91	0.39	0.57	0.35
Low-Med	0.81	0.73	0.88	0.68	0.31	0.93	0.83	0.22	0.39	0.24
Low	0.75	0.67	0.69	0.55	0.14	0.85	0.75	0.05	0.21	0.13

**Table S5b.** Inter-island analysis - Resilience rankings and normalized values for environmental resilience indicators (light grey) and proxies for anthropogenic stress (dark grey) for the inter-island analysis. Colored cells denote low-high relative classifications per the Table S5a caption. These data for resilience scores correspond to Figure 2 in the report, which along with Table S1 can be referred to for site locations.

Site Name	Island Name	Overall Rank	Island Rank	Final RS	Raw RS	MA	BR	CR	CD	TV	HB	FA	NS
Nanasu Reef	Saipan	1	1	1.00	0.90	0.92	0.54	1.00	0.95	0.74	0.78	MPA	0.19
Bird Island	Saipan	2	2	0.92	0.83	1.00	0.60	0.15	0.98	0.74	1.00	MPA	0.20
Obyan Beach	Saipan	3	4	0.89	0.80	1.00	0.59	0.36	0.98	0.89	0.45	0.52	0.21
Lighthouse Reef	Saipan	4	3	0.89	0.80	1.00	0.72	0.36	0.98	0.82	0.38	0.64	0.19
East Aguijan Falls	Aguijan	5	4	0.88	0.79	1.00	0.44	0.41	0.91	1.00	0.51	0.39	0.19
Boy Scout	Saipan	6	5	0.88	0.79	0.98	0.71	0.32	0.97	0.89	0.31	0.50	0.19
Unai Masilok	Tinian	7	1	0.87	0.78	1.00	0.68	0.56	0.99	0.78	0.18	0.32	0.19
As Dudo_MMT	Rota	8	3	0.87	0.78	0.96	0.85	0.34	0.91	0.82	0.24	0.00	0.19
Pau Pau	Saipan	9	7	0.87	0.78	1.00	0.54	0.62	0.97	0.81	0.28	0.61	0.19
Unai Babui_MMT	Tinian	10	6	0.87	0.78	0.82	0.81	0.57	1.00	0.78	0.13	0.33	0.23
Laolao Bay East	Saipan	11	6	0.86	0.78	0.99	0.82	0.19	0.96	0.76	0.37	0.24	0.30
Tahgong Point	Tinian	12	10	0.86	0.78	0.99	0.69	0.37	0.97	0.99	0.09	0.29	0.19
Forbidden Island	Saipan	13	8	0.86	0.77	1.00	0.65	0.22	0.96	0.76	0.54	MPA	0.19
Haina Point	Rota	14	1	0.86	0.77	1.00	0.74	0.53	0.99	0.72	0.13	0.14	0.27
Lamanibot	Tinian	15	3	0.86	0.77	0.90	0.81	0.46	0.90	0.78	0.23	0.43	0.20
West Harbor_MMT	Rota	16	2	0.85	0.77	1.00	0.72	0.48	0.93	0.83	0.12	0.36	0.20
Laolao Bay Mids	Saipan	17	10	0.85	0.77	0.99	0.64	0.31	0.94	0.76	0.44	0.26	0.21
Lanyas	Saipan	18	11	0.85	0.77	1.00	0.60	0.24	0.98	0.96	0.29	MPA	0.19
Peysonnelia Reef	Saipan	19	9	0.85	0.76	1.00	0.86	0.29	0.81	0.96	0.07	0.68	1.00
Coral Ocean Point	Saipan	20	14	0.85	0.76	1.00	0.51	0.45	1.00	0.94	0.19	0.61	0.27

Reef resilience in the Marianas\_Supplementary Material

Site Name	Island Name	Overall Rank	Island Rank	Final RS	Raw RS	MA	BR	CR	CD	TV	HB	FA	NS
Elbow Reef	Saipan	21	12	0.85	0.76	1.00	0.64	0.52	0.99	0.79	0.13	MPA	0.19
Point Break Reef	Saipan	22	13	0.84	0.76	1.00	0.62	0.30	0.95	0.92	0.24	0.68	0.31
Unai Chulu	Tinian	23	5	0.84	0.76	0.69	0.80	0.48	0.98	0.78	0.25	0.35	0.19
Grand Hotel_MMT	Saipan	24	15	0.84	0.76	1.00	0.70	0.27	0.98	0.92	0.12	0.71	0.27
Aguijan Island_MMT	Aguijan	25	12	0.84	0.76	1.00	0.63	0.25	0.99	0.95	0.19	0.34	0.19
Suicide Cliff	Tinian	26	8	0.84	0.76	0.94	0.45	0.48	0.90	0.80	0.52	0.51	0.19
MMT - Managaha MPA	Saipan	27	16	0.84	0.75	0.87	0.71	0.18	0.80	0.96	0.45	MPA	0.19
Ladder Beach	Saipan	28	18	0.84	0.75	1.00	0.54	0.49	1.00	0.94	0.05	0.57	0.29
Barangka	Tinian	29	9	0.84	0.75	1.00	0.49	0.46	1.00	0.80	0.31	0.43	0.21
Asiga Point	Tinian	30	2	0.84	0.75	1.00	0.55	0.26	0.98	0.86	0.37	0.24	0.19
Agatasi	Rota	31	4	0.83	0.75	1.00	0.73	0.31	0.95	0.72	0.27	0.17	0.19
Old Man By the Sea	Saipan	32	17	0.83	0.75	0.92	0.70	0.30	0.97	0.74	0.35	0.15	0.20
Tank Beach	Saipan	33	19	0.83	0.75	1.00	0.69	0.42	0.99	0.78	0.10	MPA	0.30
Dynasty_MMT	Tinian	34	16	0.83	0.74	0.96	0.88	0.11	0.91	0.82	0.18	0.64	0.34
Naftan Rock	Aguijan	35	13	0.82	0.74	1.00	0.49	0.40	0.97	0.95	0.15	0.29	0.19
Unai Lamlam	Tinian	36	17	0.82	0.74	0.75	0.73	0.29	0.98	0.99	0.12	0.31	0.20
Puntan Kastiyu	Tinian	37	11	0.82	0.74	0.98	0.42	0.51	0.99	0.80	0.28	0.48	0.19
Managaha Patch_MMT	Saipan	38	20	0.82	0.74	0.94	0.65	0.28	0.95	0.85	0.24	MPA	0.64
East Wedding Cake	Rota	39	7	0.82	0.73	0.97	0.82	0.06	0.88	0.83	0.28	0.33	0.20
Unai Asiga	Tinian	40	14	0.82	0.73	0.95	0.69	0.32	0.99	0.86	0.07	0.28	0.34
Long Beach_MMT	Tinian	41	7	0.82	0.73	0.98	0.62	0.42	1.00	0.78	0.11	0.31	0.19
North Dakota	Saipan	42	22	0.81	0.73	1.00	0.65	0.41	0.98	0.76	0.11	0.29	0.33
Agingan Point	Saipan	43	21	0.81	0.73	1.00	0.67	0.15	0.94	0.94	0.16	0.64	0.27
Happy Days	Aguijan	44	18	0.81	0.73	1.00	0.49	0.29	0.97	1.00	0.14	0.34	0.19
Senhanom Wall	Rota	45	5	0.81	0.72	0.87	0.71	0.09	0.88	0.79	0.48	0.32	0.19
Wing Beach	Saipan	46	24	0.80	0.72	1.00	0.51	0.40	0.98	0.81	0.18	0.52	0.19
Mochong	Rota	47	9	0.80	0.72	0.65	0.80	0.49	0.97	0.82	0.04	0.12	0.19
Sasanhaya_MMT	Rota	48	12	0.80	0.72	0.89	0.78	0.16	0.93	0.83	0.19	0.35	0.24
Coral Gardens_MMT	Rota	49	6	0.80	0.72	1.00	0.96	0.01	0.63	0.67	0.47	MPA	0.20
Achu Dangkulu	Saipan	50	23	0.80	0.72	1.00	0.68	0.27	0.98	0.79	0.10	0.64	0.19
Coconut Village	Rota	51	10	0.80	0.72	0.76	0.76	0.27	0.97	0.85	0.14	0.22	0.20
Oleai Rocks	Saipan	52	25	0.79	0.71	1.00	0.59	0.16	0.96	0.82	0.28	0.67	0.19
Sunset Villa_MMT	Rota	53	8	0.79	0.71	0.83	0.64	0.42	0.90	0.85	0.11	0.27	0.21
P. Lamanibot Sanhilo	Tinian	54	19	0.79	0.71	0.65	0.79	0.32	0.94	0.78	0.23	0.39	0.19
Masilok Beach Wall	Tinian	55	15	0.79	0.71	1.00	0.56	0.38	1.00	0.78	0.08	0.33	0.19
Achugao	Saipan	56	28	0.79	0.71	1.00	0.40	0.55	0.97	0.81	0.09	0.64	0.19
South Laolao	Saipan	57	26	0.78	0.70	0.66	0.74	0.37	0.99	0.76	0.17	0.35	0.25
Iota Salvage_MMT	Rota	58	16	0.78	0.70	0.99	0.77	0.06	0.86	0.85	0.14	0.25	0.20
P. Lamanibot Sampapa	Tinian	59	22	0.78	0.70	0.93	0.72	0.16	0.87	0.95	0.02	0.45	0.20
Honey Gardens	Rota	60	15	0.77	0.70	0.93	1.00	0.05	0.53	0.83	0.25	MPA	0.19

Site Name	Island Name	Overall Rank	Island Rank	Final RS	Raw RS	MA	BR	CR	CD	TV	HB	FA	NS
South Dakota	Saipan	61	27	0.77	0.70	0.54	0.81	0.36	0.98	0.76	0.17	0.32	0.24
Atgidon	Tinian	62	21	0.77	0.70	0.72	0.55	0.32	0.97	0.95	0.16	0.50	0.19
Okgok_MMT	Rota	63	14	0.77	0.69	0.65	0.85	0.43	0.87	0.67	0.16	0.23	0.20
Malilok Point	Rota	64	11	0.77	0.69	1.00	0.59	0.14	0.96	0.72	0.27	0.19	0.20
South Point_MMT	Tinian	65	20	0.76	0.69	0.92	0.63	0.26	0.88	0.82	0.12	0.60	0.19
Barcinas Bay_MMT	Tinian	66	23	0.76	0.68	0.77	0.93	0.13	0.75	0.81	0.13	0.57	0.24
Teteto	Rota	67	13	0.75	0.68	0.96	0.53	0.25	0.88	0.85	0.12	0.23	0.20
Harnom Point	Rota	68	17	0.75	0.68	0.64	0.78	0.19	0.86	0.79	0.25	0.31	0.19
Cave Museum_MMT	Rota	69	18	0.74	0.67	0.77	0.72	0.13	0.95	0.83	0.07	0.31	0.22
Takta Sagua	Rota	70	20	0.73	0.65	0.74	0.85	0.04	0.80	0.83	0.11	MPA	0.19
Talakhaya_MMT	Rota	71	19	0.72	0.65	0.55	0.86	0.31	0.92	0.67	0.05	0.22	0.19
Joanne's Reef	Rota	72	22	0.71	0.64	0.81	0.80	0.00	0.76	0.83	0.12	0.33	0.21
South I Chenchon Park	Rota	73	21	0.71	0.64	0.45	0.71	0.27	0.87	0.82	0.19	0.07	0.19
Leprosarium	Tinian	74	24	0.69	0.62	1.00	0.54	0.00	0.89	0.81	0.04	0.59	0.34
Rota Resort_MMT	Rota	75	23	0.69	0.62	0.69	0.57	0.21	0.91	0.85	0.01	0.19	0.29
Tuturam	Saipan	76	29	0.67	0.60	0.00	0.72	0.48	0.98	0.76	0.12	0.28	0.42
Puntan Diapblo	Tinian	77	25	0.64	0.58	0.30	0.72	0.23	0.85	0.81	0.05	0.54	0.19
Sailigai Point	Rota	78	24	0.62	0.56	0.34	0.59	0.00	0.89	0.92	0.10	0.30	0.19

**Table S6a.** Intra-island analysis for *Saipan* - Distribution of normalized data values for the resilience scores (no shade), six environmental resilience indicators (light grey) and proxies for anthropogenic stress (dark grey). The relative classifications and color scheme are all as per Table S5a.

	Final RS	Raw RS	MA	BR	CR	CD	TV	HB	FA	NS
AVG	0.85	0.79	0.92	0.65	0.36	0.96	0.83	0.28	0.49	0.28
SD	0.05	0.05	0.21	0.10	0.17	0.05	0.08	0.22	0.20	0.17
High	1.00	1.00	NA	1.00	1.00	NA	1.00	1.00	1.00	1.00
Med-High	0.90	0.84	1.00	0.75	0.53	1.00	0.91	0.50	0.69	0.44
Low-Med	0.85	0.79	0.92	0.65	0.36	0.96	0.83	0.28	0.49	0.28
Low	0.79	0.73	0.72	0.55	0.19	0.91	0.76	0.07	0.28	0.11

**Table S6b.** Intra-island analysis for *Saipan* - Resilience rankings and normalized values for environmental resilience indicators (light grey) and proxies for anthropogenic stress (dark grey). Colored cells denote low-high relative classifications per the Table S6a caption and according to values presented in Table S5a. These data for resilience scores correspond to Figure 3 in the report, which along with Figure 2 and Table S1 can be referred to for site locations.

Site Name	Island Rank	Overall Rank	Final RS	Raw RS	MA	BR	CR	CD	TV	HB	FA	NS
Nanasu Reef	1	1	1.00	0.93	0.92	0.54	1.00	0.95	0.74	0.78	MPA	0.19
Bird Island	2	2	0.92	0.86	1.00	0.60	0.15	0.98	0.74	1.00	MPA	0.20
Lighthouse Reef	3	4	0.90	0.83	1.00	0.72	0.36	0.98	0.82	0.38	0.64	0.19
Obyan Beach	4	3	0.89	0.83	1.00	0.59	0.36	0.98	0.89	0.45	0.52	0.21
Boy Scout	5	6	0.89	0.82	0.98	0.71	0.32	0.97	0.89	0.31	0.50	0.19
Laolao Bay East	6	11	0.88	0.81	0.99	0.82	0.19	0.96	0.76	0.37	0.24	0.30
Pau Pau	7	9	0.87	0.81	1.00	0.54	0.62	0.97	0.81	0.28	0.61	0.19
Forbidden Island	8	13	0.87	0.80	1.00	0.65	0.22	0.96	0.76	0.54	MPA	0.19
Peysonnelia Reef	9	19	0.87	0.80	1.00	0.86	0.29	0.81	0.96	0.07	0.68	1.00
Laolao Bay Mids	10	17	0.86	0.80	0.99	0.64	0.31	0.94	0.76	0.44	0.26	0.21
Lanyas	11	18	0.86	0.80	1.00	0.60	0.24	0.98	0.96	0.29	MPA	0.19
Elbow Reef	12	21	0.85	0.79	1.00	0.64	0.52	0.99	0.79	0.13	MPA	0.19
Point Break Reef	13	22	0.85	0.79	1.00	0.62	0.30	0.95	0.92	0.24	0.68	0.31
Coral Ocean Point	14	20	0.85	0.79	1.00	0.51	0.45	1.00	0.94	0.19	0.61	0.27
Grand Hotel_MMT	15	24	0.85	0.79	1.00	0.70	0.27	0.98	0.92	0.12	0.71	0.27
MMT - Managaha MPA	16	27	0.85	0.79	0.87	0.71	0.18	0.80	0.96	0.45	MPA	0.19
Old Man By the Sea	17	32	0.84	0.78	0.92	0.70	0.30	0.97	0.74	0.35	0.15	0.20
Ladder Beach	18	28	0.84	0.78	1.00	0.54	0.49	1.00	0.94	0.05	0.57	0.29
Tank Beach	19	33	0.84	0.78	1.00	0.69	0.42	0.99	0.78	0.10	MPA	0.30
Managaha Patch_MMT	20	38	0.83	0.77	0.94	0.65	0.28	0.95	0.85	0.24	MPA	0.64
Agingan Point	21	43	0.83	0.76	1.00	0.67	0.15	0.94	0.94	0.16	0.64	0.27
North Dakota	22	42	0.82	0.76	1.00	0.65	0.41	0.98	0.76	0.11	0.29	0.33
Achu Dangkulu	23	50	0.81	0.75	1.00	0.68	0.27	0.98	0.79	0.10	0.64	0.19
Wing Beach	24	46	0.81	0.75	1.00	0.51	0.40	0.98	0.81	0.18	0.52	0.19
Oleai Rocks	25	52	0.80	0.74	1.00	0.59	0.16	0.96	0.82	0.28	0.67	0.19
South Laolao	26	57	0.80	0.74	0.66	0.74	0.37	0.99	0.76	0.17	0.35	0.25
South Dakota	27	61	0.79	0.73	0.54	0.81	0.36	0.98	0.76	0.17	0.32	0.24
Achugao	28	56	0.79	0.73	1.00	0.40	0.55	0.97	0.81	0.09	0.64	0.19
Tuturam	29	76	0.68	0.63	0.00	0.72	0.48	0.98	0.76	0.12	0.28	0.42

**Table S7a.** Intra-island analysis for *Tinian and Aguijan* - Distribution of normalized data values for the resilience scores (no shade), six environmental resilience indicators (light grey) and proxies for anthropogenic stress (dark grey). The relative classifications and color scheme are all as per Table S5a.

	Final RS	Raw RS	MA	BR	CR	CD	TV	HB	FA	NS
AVG	0.86	0.80	0.89	0.64	0.34	0.94	0.86	0.19	0.41	0.22
SD	0.09	0.08	0.17	0.14	0.15	0.06	0.09	0.13	0.11	0.05
High	1.00	1.00	NA	1.00	1.00	NA	1.00	1.00	1.00	1.00
Med-High	0.95	0.89	1.00	0.79	0.48	1.00	0.94	0.32	0.53	0.26
Low-Med	0.86	0.80	0.89	0.64	0.34	0.94	0.86	0.19	0.41	0.22
Low	0.78	0.72	0.72	0.50	0.19	0.88	0.77	0.06	0.30	0.17

**Table S7b.** Intra-island analysis for *Tinian and Aguijan* - Resilience rankings and normalized values for environmental resilience indicators (light grey) and proxies for anthropogenic stress (dark grey). Colored cells denote low-high relative classifications per the Table S5a caption and according to values presented in Table S7a. These data for resilience scores correspond to Figure 3 in the report, which along with Figure 2 and Table S1 can be referred to for site locations.

Site Name	Island Rank	Overall Rank	Final RS	Raw RS	MA	BR	CR	CD	TV	HB	FA	NS
Unai Masilok	1	7	1.00	0.93	1.00	0.68	0.56	0.99	0.78	0.18	0.32	0.19
Asiga Point	2	30	0.97	0.90	1.00	0.55	0.26	0.98	0.86	0.37	0.24	0.19
Lamanibot	3	15	0.96	0.90	0.90	0.81	0.46	0.90	0.78	0.23	0.43	0.20
East Aguijan Falls	4	5	0.95	0.88	1.00	0.44	0.41	0.91	1.00	0.51	0.39	0.19
Unai Chulu	5	23	0.94	0.87	0.69	0.80	0.48	0.98	0.78	0.25	0.35	0.19
Unai Babui_MMT	6	10	0.93	0.87	0.82	0.81	0.57	1.00	0.78	0.13	0.33	0.23
Long Beach_MMT	7	41	0.93	0.86	0.98	0.62	0.42	1.00	0.78	0.11	0.31	0.19
Suicide Cliff	8	26	0.92	0.86	0.94	0.45	0.48	0.90	0.80	0.52	0.51	0.19
Barangka	9	29	0.90	0.84	1.00	0.49	0.46	1.00	0.80	0.31	0.43	0.21
Tahgong Point	10	12	0.90	0.84	0.99	0.69	0.37	0.97	0.99	0.09	0.29	0.19
Puntan Kastiyu	11	37	0.89	0.83	0.98	0.42	0.51	0.99	0.80	0.28	0.48	0.19
Aguijan Island_MMT	12	25	0.87	0.81	1.00	0.63	0.25	0.99	0.95	0.19	0.34	0.19
Naftan Rock	13	35	0.86	0.80	1.00	0.49	0.40	0.97	0.95	0.15	0.29	0.19
Unai Asiga	14	40	0.86	0.80	0.95	0.69	0.32	0.99	0.86	0.07	0.28	0.34
Masilok Beach Wall	15	55	0.85	0.80	1.00	0.56	0.38	1.00	0.78	0.08	0.33	0.19
Dynasty_MMT	16	34	0.85	0.79	0.96	0.88	0.11	0.91	0.82	0.18	0.64	0.34
Unai Lamlam	17	36	0.85	0.79	0.75	0.73	0.29	0.98	0.99	0.12	0.31	0.20
Happy Days	18	44	0.84	0.79	1.00	0.49	0.29	0.97	1.00	0.14	0.34	0.19
P. Lamanibot Sanhilo	19	54	0.83	0.77	0.65	0.79	0.32	0.94	0.78	0.23	0.39	0.19
South Point_MMT	20	65	0.80	0.75	0.92	0.63	0.26	0.88	0.82	0.12	0.60	0.19
Atgidon	21	62	0.80	0.75	0.72	0.55	0.32	0.97	0.95	0.16	0.50	0.19
P. Lamanibot Sampapa	22	59	0.79	0.73	0.93	0.72	0.16	0.87	0.95	0.02	0.45	0.20
Barcinas Bay_MMT	23	66	0.78	0.73	0.77	0.93	0.13	0.75	0.81	0.13	0.57	0.24

Site Name	Island Rank	Overall Rank	Final RS	Raw RS	MA	BR	CR	CD	TV	HB	FA	NS
Leprosarium	24	74	0.68	0.63	1.00	0.54	0.00	0.89	0.81	0.04	0.59	0.34
Puntan Diablo	25	77	0.62	0.58	0.30	0.72	0.23	0.85	0.81	0.05	0.54	0.19

**Table S8a.** Intra-island analysis for *Rota* - Distribution of normalized data values for the resilience scores (no shade), six environmental resilience indicators (light grey) and proxies for anthropogenic stress (dark grey). The relative classifications and color scheme are all as per Table S5a.

	Final RS	Raw RS	MA	BR	CR	CD	TV	HB	FA	NS
AVG	0.84	0.75	0.71	0.76	0.41	0.88	0.87	0.34	0.24	0.72
SD	0.10	0.08	0.29	0.12	0.32	0.11	0.07	0.25	0.09	0.09
High	1.00	1.00	NA	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Med-High	0.94	0.84	1.00	0.87	0.73	0.99	0.94	0.59	0.34	0.81
Low-Med	0.84	0.75	0.71	0.76	0.41	0.88	0.87	0.34	0.24	0.72
Low	0.73	0.67	0.42	0.64	0.09	0.77	0.79	0.10	0.15	0.63

**Table S8b.** Intra-island analysis for *Rota* - Resilience rankings and normalized values for environmental resilience indicators (light grey) and proxies for anthropogenic stress (dark grey). Colored cells denote low-high relative classifications per the Table S5a caption and according to values presented in Table S8a. These data for resilience scores correspond to Figure 3 in the report, which along with Figure 2 and Table S1 can be referred to for site locations.

Site Name	Island Rank	Overall Rank	Final RS	Raw RS	MA	BR	CR	CD	TV	HB	FA	NS
Haina Point	1	14	1.00	0.88	1.00	0.74	1.00	1.00	0.78	0.21	0.14	0.95
West Harbor_MMT	2	16	0.99	0.87	0.99	0.72	0.89	0.94	0.89	0.22	0.36	0.71
As Dudo_MMT	3	8	0.98	0.87	0.94	0.85	0.64	0.92	0.89	0.40	0.00	0.67
Agatasi	4	31	0.95	0.84	1.00	0.73	0.58	0.95	0.78	0.45	0.17	0.67
Senhanom Wall	5	45	0.93	0.83	0.80	0.71	0.17	0.89	0.86	1.00	0.32	0.67
Coral Gardens_MMT	6	49	0.91	0.82	1.00	0.96	0.03	0.63	0.73	0.98	MPA	0.68
East Wedding Cake	7	39	0.90	0.81	0.96	0.82	0.11	0.89	0.89	0.59	0.33	0.70
Sunset Villa_MMT	8	53	0.89	0.79	0.75	0.64	0.78	0.91	0.92	0.18	0.27	0.73
Mochong	9	47	0.87	0.78	0.46	0.80	0.93	0.98	0.89	0.07	0.12	0.67
Coconut Village	10	51	0.86	0.78	0.63	0.76	0.50	0.98	0.92	0.29	0.22	0.70
Malilok Point	11	64	0.86	0.76	1.00	0.59	0.27	0.96	0.78	0.47	0.19	0.68
Sasanhaya_MMT	12	48	0.86	0.77	0.84	0.78	0.30	0.94	0.89	0.31	0.35	0.83
Teteto	13	67	0.84	0.74	0.94	0.53	0.47	0.88	0.92	0.23	0.23	0.68
Okgok_MMT	14	63	0.84	0.76	0.46	0.85	0.81	0.87	0.73	0.26	0.23	0.69
Honey Gardens	15	60	0.83	0.76	0.90	1.00	0.09	0.53	0.89	0.53	MPA	0.67
Iota Salvage_MMT	16	58	0.82	0.74	0.99	0.77	0.11	0.87	0.92	0.24	0.25	0.68
Harnom Point	17	68	0.80	0.73	0.45	0.78	0.37	0.87	0.86	0.48	0.31	0.67



Site Name	Island Rank	Overall Rank	Final RS	Raw RS	MA	BR	CR	CD	TV	HB	FA	NS
Cave Museum_MMT	18	69	0.77	0.70	0.65	0.72	0.24	0.96	0.89	0.17	0.31	0.75
Talakhaya_MMT	19	71	0.75	0.68	0.31	0.86	0.58	0.93	0.73	0.12	0.22	0.67
Takta Sagua	20	70	0.74	0.68	0.60	0.85	0.07	0.81	0.89	0.26	MPA	0.67
South I Ch. Park	21	73	0.73	0.67	0.17	0.71	0.51	0.88	0.89	0.30	0.07	0.67
Joanne's Reef	22	72	0.71	0.66	0.71	0.80	0.00	0.77	0.89	0.22	0.33	0.73
Rota Resort_MMT	23	75	0.71	0.64	0.52	0.57	0.40	0.91	0.92	0.02	0.19	1.00
Sailigai Point	24	78	0.56	0.53	0.00	0.59	0.00	0.89	1.00	0.18	0.30	0.67

**Table S9.** Numbers of virtual larvae dispersed from sources (columns) to destinations (rows) between our three survey islands, within the Mariana Islands, and to/from coral reefs in other archipelagos for four pelagic larval durations (PLDs). These tables refer to simulations that assume larvae have limited swimming ability and must land at the reef location. Normalized values (norm) compare our three survey islands relative to the maximum source and maximum destination totals among the three survey islands. See Table S9 for the results of the simulation that assumes swimming ability.

<b>10-day</b>	Saipan	Tinian/ Aguijan	Rota	Other Marianas	Guam	Other Archipelagos	Total	Sink (norm)
Saipan	34549	10022	90	7224	0	0	51885	0.72
Tinian/Aguijan	36926	33798	717	771	0	0	72212	1.00
Rota	1092	1383	1181	298	179	0	4133	0.06
Other Marianas	13363	11079	261	116263	7968	402	149336	
Guam	0	0	160	4122	69821		74103	
Oth. Archipelago	0	0	596	2276	459	0	3331	
Total	85930	56282	3005	130954	78427	402		
Source (norm)	1.00	0.65	0.03					

<b>20-day</b>	Saipan	Tinian/ Aguijan	Rota	Other Marianas	Guam	Other Archipelagos	Total	Sink (norm)
Saipan	19781	7872	1764	19377	21	29	48844	0.69
Tinian/Aguijan	23790	29921	3609	12976	158	52	70506	1.00
Rota	1109	596	220	1476	1457	0	4858	0.07
Other Marianas	36687	10681	532	57391	1585	3140	110016	
Guam	762	348	271	6619	54866		62866	
Oth. Archipelago	3374	1568	343	16882	1317	0	23484	
Total	85503	50986	6739	114721	59404	3221		
Source (norm)	1.00	0.60	0.08					

<b>50-day</b>	Saipan	Tinian/ Aguijan	Rota	Other Marianas	Guam	Other Archipelagos	Total	Sink (norm)
Saipan	1065	385	420	2143	28	28899	32940	0.53
Tinian/Aguijan	8297	9913	932	4968	70	37838	62018	1.00
Rota	1248	876	913	1156	338	31985	36516	0.59
Other Marianas	17242	6791	2849	48703	4794	388132	468511	
Guam	5457	1357	425	4332	34738		46309	
Oth. Archipelago	5661	2837	652	26493	4074	0	39717	
Total	38970	22159	6191	87795	44042	486854		
Source (norm)	1.00	0.57	0.16					

<b>100-day</b>	Saipan	Tinian/ Aguijan	Rota	Other Marianas	Guam	Other Archipelagos	Total	Sink (norm)
Saipan	60	162	74	1179	94	185237	186806	0.98
Tinian/Aguijan	5448	9308	602	2057	130	174032	191577	1.00
Rota	58	42	38	651	123	170857	171769	0.90
Other Marianas	12901	4838	1653	46038	4642	1520420	1590492	
Guam	4269	987	200	1477	19752		26685	
Oth. Archipelago	13907	4458	3138	108368	23593	0	153464	
Total	36643	19795	5705	159770	48334	2050546		
Source (norm)	1.00	0.54	0.16					

**Table S10.** Numbers of virtual larvae dispersed from sources (columns) to destinations (rows) between our three survey islands, within the Mariana Islands, and to/from coral reefs in other archipelagos for four pelagic larval durations (PLDs). These tables refer to simulations that assume larvae have swimming ability and can locate reefs if within two model grid cells (18 km) of a reef location. Normalized values (norm) compare our three survey islands relative to the maximum source and maximum destination totals among the three survey islands. See Table S8 for the results of the simulation that assumes limited swimming ability.

<b>10-day</b>	Saipan	Tinian/ Aguijan	Rota	Other Marianas	Guam	Other Archipelagos	Total	Sink (norm)
Saipan	74975	18304	214	24720	0	0	118213	1.00
Tinian/Aguijan	55236	47104	3470	2437	0	0	108247	0.92
Rota	11011	9468	8117	4066	3511	0	36173	0.31
Other Marianas	70572	33297	2465	401043	23378	991	531746	
Guam	0	58	2682	8816	111748		123304	
Oth. Archipelago	4	7	7619	37793	10216	0	55639	
Total	211798	108238	24567	478875	148853	991		
Source (norm)	1.00	0.51	0.12					

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<b>20-day</b>	Saipan	Tinian/ Aguijan	Rota	Other Marianas	Guam	Other Archipelagos	Total	Sink (norm)
Saipan	42019	14986	2330	36591	2	9	95937	0.85
Tinian/Aguijan	42549	35554	4410	30667	154	27	113361	1.00
Rota	4629	1848	453	4358	3676	0	14964	0.13
Other Marianas	84671	26681	4791	193337	10321	14112	333913	
Guam	6683	1851	1609	14034	71264		95441	
Oth. Archipelago	52877	21294	10704	178564	23713	0	287152	
<b>Total</b>	<b>233428</b>	<b>102214</b>	<b>24297</b>	<b>457551</b>	<b>109130</b>	<b>14148</b>		
Source (norm)	1.00	0.44	0.10					

<b>50-day</b>	Saipan	Tinian/ Aguijan	Rota	Other Marianas	Guam	Other Archipelagos	Total	Sink (norm)
Saipan	2636	749	570	4553	45	60377	68930	0.51
Tinian/Aguijan	9176	10435	1470	9176	130	105703	136090	1.00
Rota	4530	2254	1822	5097	1715	114785	130203	0.96
Other Marianas	59255	17143	6832	192626	9998	926499	1212353	
Guam	10171	4313	616	7918	37040		60058	
Oth. Archipelago	57081	29369	6064	224612	35214	0	352340	
<b>Total</b>	<b>142849</b>	<b>64263</b>	<b>17374</b>	<b>443982</b>	<b>84142</b>	<b>1207364</b>		
Source (norm)	1.00	0.45	0.12					

<b>100-day</b>	Saipan	Tinian/ Aguijan	Rota	Other Marianas	Guam	Other Archipelagos	Total	Sink (norm)
Saipan	102	418	81	2272	296	437931	441100	0.69
Tinian/Aguijan	6097	10746	671	2641	184	308612	328951	0.51
Rota	87	92	99	1619	301	637159	639357	1.00
Other Marianas	35076	12348	4132	127971	9571	3387057	3576155	
Guam	4672	1113	253	1894	21628		29560	
Oth. Archipelago	62556	24931	9287	319498	60068	0	476340	
<b>Total</b>	<b>108590</b>	<b>49648</b>	<b>14523</b>	<b>455895</b>	<b>92048</b>	<b>4770759</b>		
Source (norm)	1.00	0.46	0.13					

**Table S11.** Results of queries for targets for different types of management actions. Locations of sites that meet the set criteria are shown in summary in Figure 5 in the paper and are in individual sets of maps in the upcoming pages (See Figures S8-13). Within the Reef restoration/coral translocation column \* means low coral diversity, \*\* means low coral cover and [!] denotes the only site with med-high resilience and below average coral cover and diversity as well as below average fishing access and LBSP.

**Targets for**

Conservation – high or low resilience potential and are currently outside established no-take MPAs

Land-based sources of pollution (LBSP) reduction – above-average resilience potential and land-based sources of pollution

Fishery management and enforcement - above-average resilience potential and accessibility due to wave exposure **OR**

below-average herbivore AFG biomass and above-average fishing access [\*] **OR** both  
[\*\*]

Bleaching monitoring and supporting recovery - low bleaching resistance and low herbivore AFG biomass

Reef restoration/coral translocation – above-average resilience potential and low coral diversity or coral cover

Tourism outreach and stewardship – above-average coral diversity, fish species richness and biomass and accessibility due to wave exposure.

Site Name	Island Name	R. Rank	Conservation	LBSP reduction	Fishery management and enforcement	Bleaching monitoring and supporting recovery	Reef restoration/coral translocation	Tourism outreach and stewardship
Nanasu Reef	Saipan	1						
Bird Island	Saipan	2						
Obyan Beach	Saipan	3	X		X			X
Lighthouse Reef	Saipan	4	X		X			
East Aguijan Falls	Tinian	5	X		X		X*	
Boy Scout	Saipan	6	X		X			
Unai Masilok	Tinian	7	X					
As Dudo_MMT	Rota	8					X* [!]	

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Site Name	Island Name	R. Rank	Conservation	LBSP reduction	Fishery management and enforcement	Bleaching monitoring and supporting recovery	Reef restoration/coral translocation	Tourism outreach and stewardship
Pau Pau	Saipan	9			X			
Unai Babui_MMT	Tinian	10						
Laolao Bay East	Saipan	11		X				
Tahgong Point	Tinian	12						
Forbidden Island	Saipan	13						
Haina Point	Rota	14		X			X**	
Lamanibot	Tinian	15			X		X*	
West Harbor_MMT	Rota	16						
Laolao Bay Mids	Saipan	17						
Lanyas	Saipan	18						
Peysonnalia Reef	Saipan	19		X	X**		X*	
Coral Ocean Point	Saipan	20		X	X**	X		X
Elbow Reef	Saipan	21				X		
Point Break Reef	Saipan	22		X	X*			
Unai Chulu	Tinian	23						
Grand Hotel_MMT	Saipan	24		X	X**			
Aguijan Island_MMT	Tinian	25				X		
Suicide Cliff	Tinian	26			X		X*	
Managaha_MMT	Saipan	27					X*	
Ladder Beach	Saipan	28		X	X**	X		
Barangka	Tinian	29			X			
Asiga Point	Tinian	30						
Agatasi	Rota	31						

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Site Name	Island Name	R. Rank	Conservation	LBSP reduction	Fishery management and enforcement	Bleaching monitoring and supporting recovery	Reef restoration/coral translocation	Tourism outreach and stewardship
Old Man By the Sea	Saipan	32						
Tank Beach	Saipan	33		X				
Dynasty_MMT	Tinian	34		X	X**		X*	
Naftan Rock	Tinian	35				X		
Unai Lamlam	Tinian	36						
Puntan Kastiyu	Tinian	37			X			
Managaha Patch_MMT	Saipan	38		X				
East Wedding Cake	Rota	39					X* [!]	
Unai Asiga	Tinian	40		X				
Long Beach_MMT	Tinian	41				X		
North Dakota	Saipan	42		X		X		
Agingan Point	Saipan	43		X	X**	X		
Happy Days	Tinian	44				X		
Senhanom Wall	Rota	45						
Wing Beach	Saipan	46			X*	X		
Mochong	Rota	47						
Sasanhaya_MMT	Rota	48						
Coral Gardens_MMT	Rota	49						
Achu Dangkulu	Saipan	50			X*	X		
Coconut Village	Rota	51					X**	
Oleai Rocks	Saipan	52						
Sunset Villa_MMT	Rota	53				X		

*Reef resilience in the Marianas\_Supplementary Material*

Site Name	Island Name	R. Rank	Conservation	LBSP reduction	Fishery management and enforcement	Bleaching monitoring and supporting recovery	Reef restoration/coral translocation	Tourism outreach and stewardship
P. Lamanibot Sanhilo	Tinian	54						
Masilok Beach Wall	Tinian	55				X		
Achugao	Saipan	56			X*	X		
South Laolao	Saipan	57						
Iota Salvage_MMT	Rota	58						
P. Lam. Sampapa	Tinian	59			X*			
Honey Gardens	Rota	60						
South Dakota	Saipan	61						
Atgidon	Tinian	62			X*	X		
Okgok_MMT	Rota	63						
Malilok Point	Rota	64						
South Point_MMT	Tinian	65			X*	X		
Barcinas Bay_MMT	Tinian	66			X*			
Teteto	Rota	67				X		
Harnom Point	Rota	68						
Cave Museum_MMT	Rota	69	X					
Takta Sagua	Rota	70						
Talakhaya_MMT	Rota	71	X					
Joanne's Reef	Rota	72	X					
South I Ch. Park	Rota	73	X					
Leprosarium	Tinian	74	X		X*	X		
Rota Resort_MMT	Rota	75	X			X		
Tuturam	Saipan	76	X					

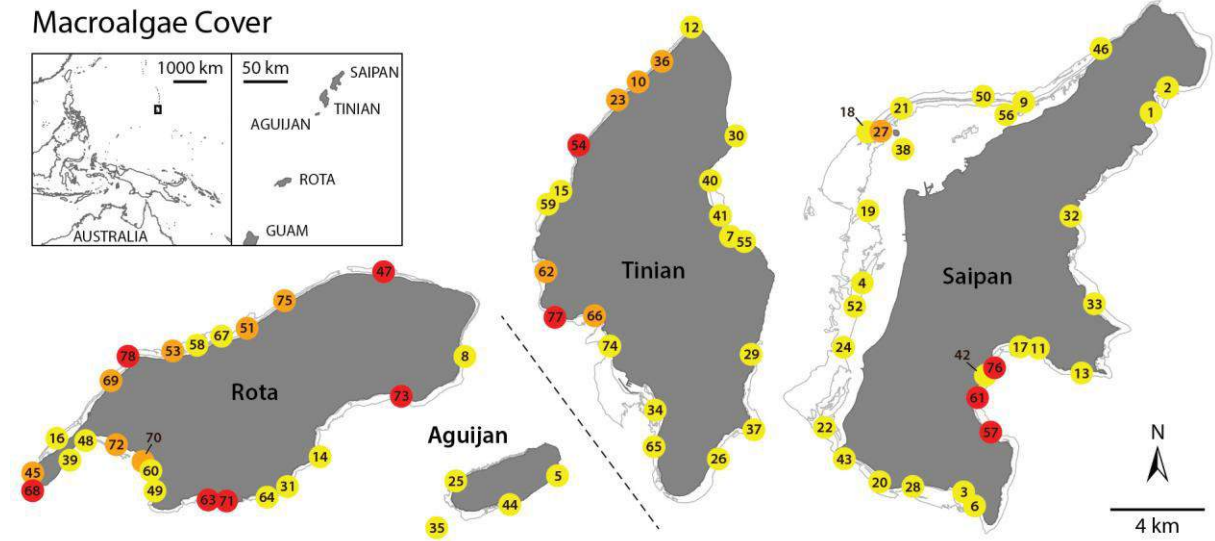
*Reef resilience in the Marianas\_Supplementary Material*

Site Name	Island Name	R. Rank	Conservation	LBSP reduction	Fishery management and enforcement	Bleaching monitoring and supporting recovery	Reef restoration/coral translocation	Tourism outreach and stewardship
Puntan Diapblo	Tinian	77	X		X*			
Sailigai Point	Rota	78	X			X		

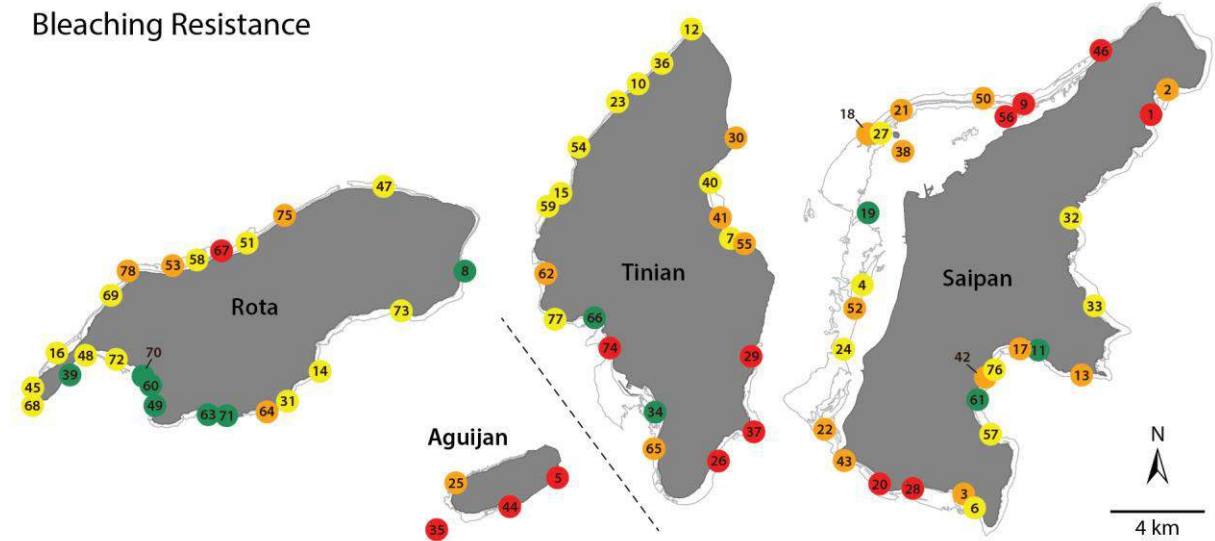


*Resilience indicator summaries*

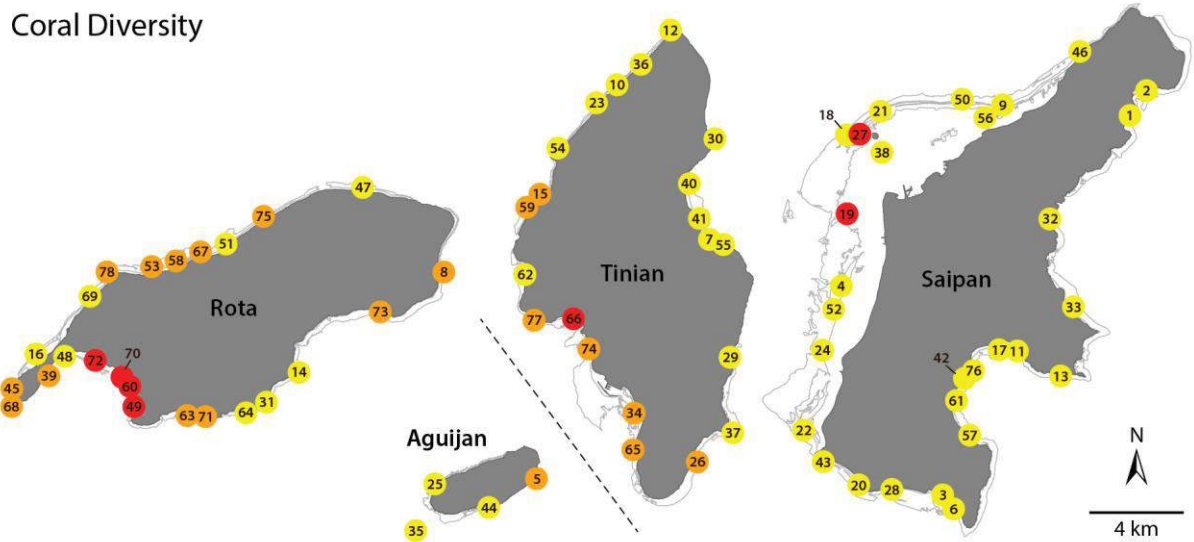
*Note: Coral recruitment and herbivore AFG biomass are shown on page 27.*



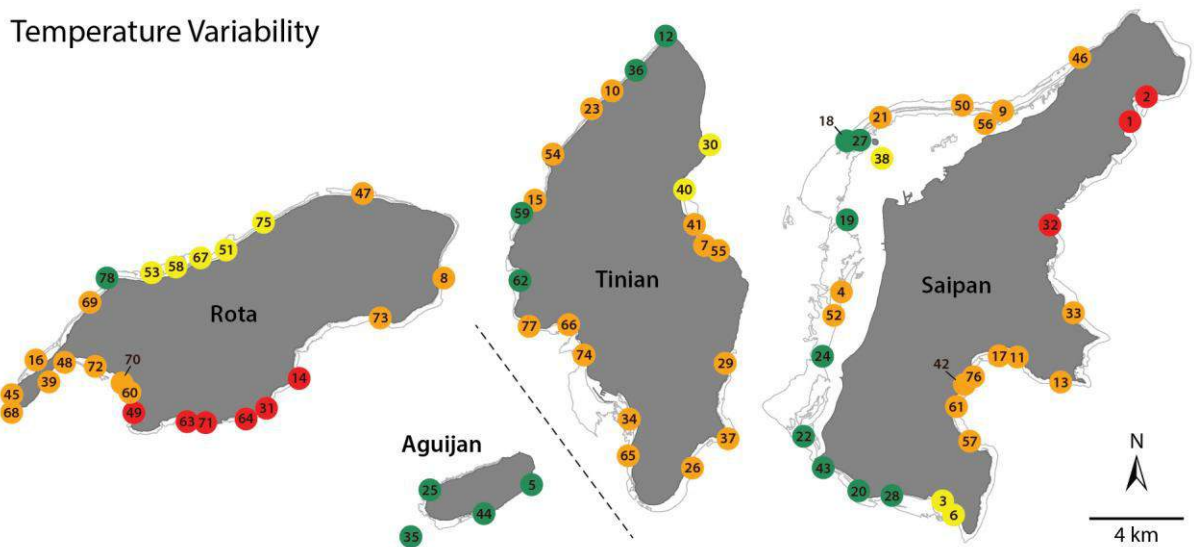
**Figure S1.** Macroalgae cover results from the inter-island analysis (see also Table S5b). Colors are as per Figure 2 in the report, where red indicates low (worst condition) scores (meaning high relative macroalgae cover). No sites had the best condition for macroalgae cover (i.e., no scores were below the average minus one standard deviation).



**Figure S2.** Bleaching resistance results from the inter-island analysis (see also Table S5b). Colors are as per Figure 2 in the report.



**Figure S3.** Coral diversity results from the inter-island analysis (see also Table S5b). Colors are as per Figure 2 in the report.



**Figure S4.** Temperature variability results from the inter-island analysis (see also Table S5b). Colors are as per Figure 2 in the report.

## Site Summaries

The site summaries section begins on the following page.

# Assessing relative resilience potential of coral reefs to inform management in the Commonwealth of the Northern Mariana Islands

## -- *Site Summaries* --

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Site name	Island	Page	Site name	Island	Page	Site name	Island	Page
Nanasu Reef	Saipan	1	Barangka	Tinian	29	South Laolao	Saipan	57
Bird Island	Saipan	2	Asiga Point	Tinian	30	Iota Salvage_MMT	Rota	58
Obyan Beach	Saipan	3	Agatasi	Rota	31	P. Lamanibot Sampapa	Tinian	59
Lighthouse Reef	Saipan	4	Old Man By the Sea	Saipan	32	Honey Gardens	Rota	60
East Aguijan Falls	Tinian	5	Tank Beach	Saipan	33	South Dakota	Saipan	61
Boy Scout	Saipan	6	Dynasty_MMT	Tinian	34	Atgidon	Tinian	62
Unai Masilok	Tinian	7	Naftan Rock	Tinian	35	Okgok_MMT	Rota	63
As Dudo_MMT	Rota	8	Unai Lamlam	Tinian	36	Malilok Point	Rota	64
Pau Pau	Saipan	9	Puntan Kastiyu	Tinian	37	South Point_MMT	Tinian	65
Unai Babui_MMT	Tinian	10	Managaha Patch_MMT	Saipan	38	Barcinas Bay_MMT	Tinian	66
Laolao Bay East	Saipan	11	East Wedding Cake	Rota	39	Teteto	Rota	67
Tahgong Point	Tinian	12	Unai Asiga	Tinian	40	Harnom Point	Rota	68
Forbidden Island	Saipan	13	Long Beach_MMT	Tinian	41	Cave Museum_MMT	Rota	69
Haina Point	Rota	14	North Dakota	Saipan	42	Takta Sagua	Rota	70
Lamanibot	Tinian	15	Agingan Point	Saipan	43	Talakhaya_MMT	Rota	71
West Harbor_MMT	Rota	16	Happy Days	Tinian	44	Joanne's Reef	Rota	72
Laolao Bay Mids	Saipan	17	Senhanom Wall	Rota	45	South I Chenchon Park	Rota	73
Lanyas	Saipan	18	Wing Beach	Saipan	46	Leprosarium	Tinian	74
Peysonnelia Reef	Saipan	19	Mochong	Rota	47	Rota Resort_MMT	Rota	75
Coral Ocean Point	Saipan	20	Sasanhaya_MMT	Rota	48	Tuturam	Saipan	76
Elbow Reef	Saipan	21	Coral Gardens_MMT	Rota	49	Puntan Diapblo	Tinian	77
Point Break Reef	Saipan	22	Achu Dangkulu	Saipan	50	Sailigai Point	Rota	78
Unai Chulu	Tinian	23	Coconut Village	Rota	51	<i>*Fishing Base Staghorn_MMT</i>	<i>Saipan</i>	79
Grand Hotel_MMT	Saipan	24	Oleai Rocks	Saipan	52	<i>*Marianas Resort_MMT</i>	<i>Saipan</i>	80
Aguijan Island_MMT	Tinian	25	Sunset Villa_MMT	Rota	53	<i>*Oleai Staghorn_MMT</i>	<i>Saipan</i>	81
Suicide Cliff	Tinian	26	P. Lamanibot Sanhilo	Tinian	54	<i>*Pak Pak Beach_MMT</i>	<i>Saipan</i>	82
Managaha_MMT	Saipan	27	Masilok Beach Wall	Tinian	55	<i>*Quartermaster Staghorn_MMT</i>	<i>Saipan</i>	83
Ladder Beach	Saipan	28	Achugao	Saipan	56	<i>*Tanapag Staghorn_MMT</i>	<i>Saipan</i>	84

\*sites surveyed within the Saipan lagoon (pages 79-84).

# Site Summary Guide

The first one-page summary is shown in the graphic below. Each part of the summary is enclosed within a box that has a letter label. Descriptions for each of these parts of the summary are presented next to the relevant letter label. This guide refers to the forereef survey sites, which are presented within pages 1-78. The site summaries for the 7 sites surveyed within the Saipan lagoon (pages 79-84) are the same as is presented on pages 1-78 but do not have part D as these sites are not included in the ecological resilience assessment.

**A** – Ranking from the inter-island resilience analysis, site name, island name.

**B** – Narrative describing: the source of site name, any interesting sightings during surveys, resilience assessment results, benthic community, herbivorous fish community, results of management queries if applicable, and whether Threatened coral species were observed if applicable.

**C** – representative site photo and inset map showing site location.

**D** – Inter- and Intra-island resilience assessment results with scores shown for each indicator and a legend. Please note herbivore biomass is herbivore AFG biomass in these tables. Has reverse legend to that below (i.e., green is *high* resilience)

**E** – Inter- and intra-island comparisons for the proxies used for two anthropogenic stressors. Has reverse legend to that above (i.e., green is *low* stress)

**F** – Pie chart showing the benthic community composition *at the time of surveys*.

**G** – List of Threatened coral species observed *at the time of surveys*.

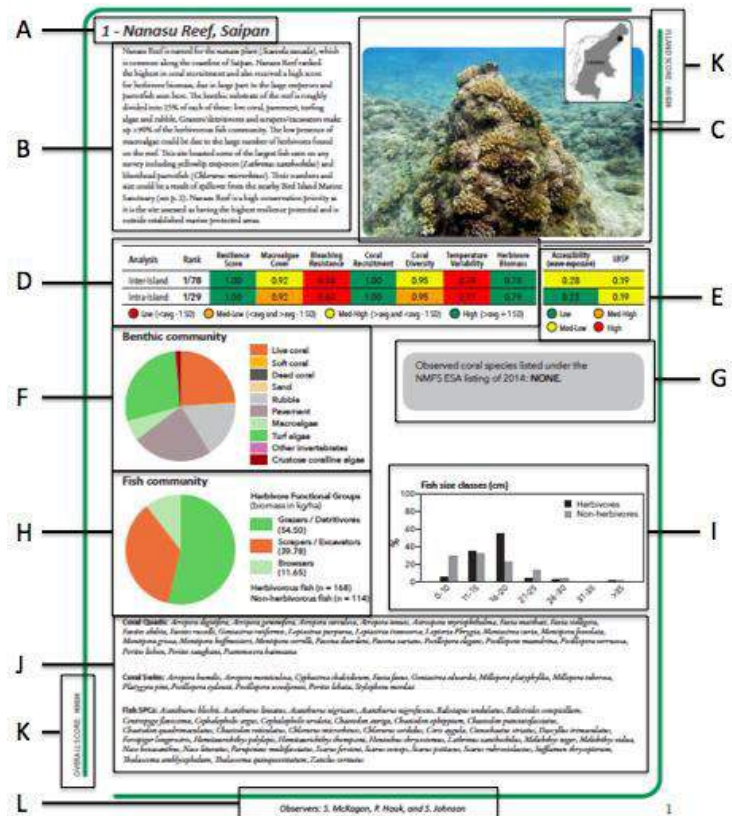
**H** – Pie chart showing the percent of the total herbivorous fish biomass made up by 3 major functional groups *at the time of surveys*. The legend here shows biomass for each group and the numbers of herbivorous and non-herbivorous fish observed.

**I** – Size-class distribution for herbivorous and non-herbivorous fish observed *at the time of surveys*.

**J** – Lists of coral and fish species seen within quads (corals) and stationary point counts (fish) as well as during swims to assess species richness *at the time of surveys*.

**K** – Classification of the site for the inter-island (left and top) and intra-island (right and bottom) resilience assessments among the classes low, medium-low, medium-high, and high based on the final resilience scores (see colour legend for D).

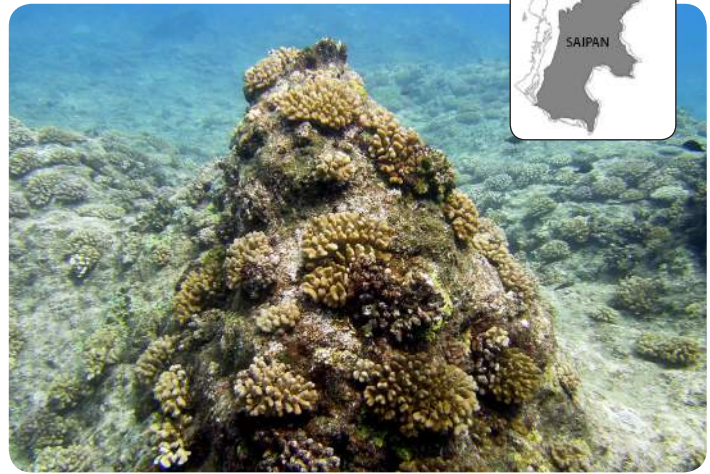
**L** – Observers within the project team that surveyed the site.



**Field survey timing:** Saipan surveys were conducted in May/June of 2012. Some of the data presented may not be representative of the current coral and fish community composition or condition due to a coral bleaching event in 2013. Surveys at sites in Tinian/Aguijan and Rota were conducted in May/June of 2014.

# 1 - Nanasu Reef, Saipan

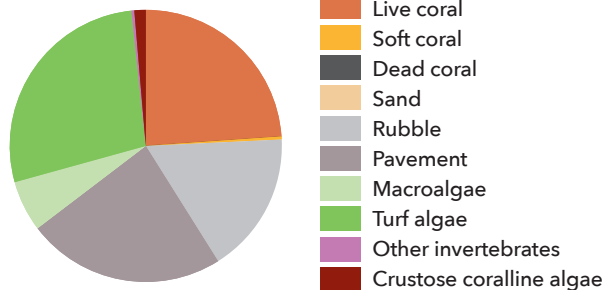
Nanasu Reef is named for the *nanasu* plant (*Scaevola taccada*), which is common along the coastline of Saipan. Nanasu Reef is located within the Bird Island Marine Sanctuary. Nanasu Reef ranked the highest in coral recruitment and also received a high score for herbivore biomass, due in large part to the parrotfish seen here. The benthic substrate of the reef is roughly divided into 25% of each of these: live coral, pavement, turfing algae and rubble. Grazers/detritivores and scrapers/excavators make up >90% of the herbivorous fish community. The low presence of macroalgae could be due to the large number of herbivores found on the reef. This site boasted some of the largest fish seen on any survey including yellowlip emperors (*Lethrinus xanthurus*) and blunthead parrotfish (*Chlorurus microrhinos*). This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	1/78	1.00	0.92	0.54	1.00	0.95	0.74	0.78	N/A - MPA	0.19
Intra-Island	1/29	1.00	0.92	0.63	1.00	0.95	0.77	0.79	N/A - MPA	0.19

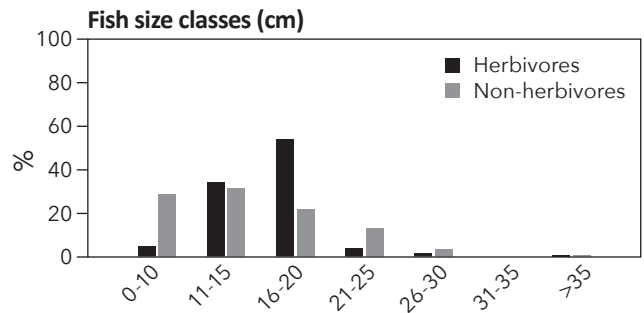
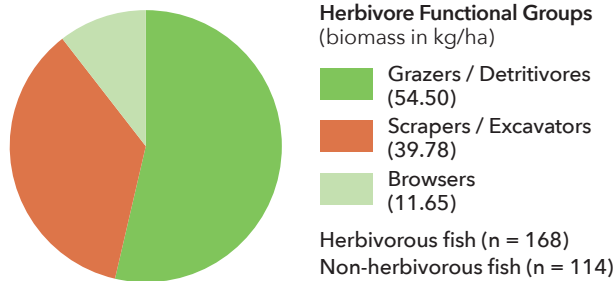
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



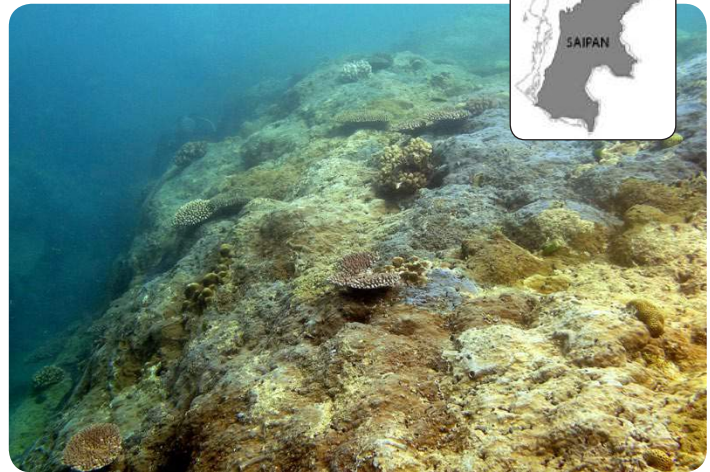
**Coral Quads:** *Acropora digitifera*, *Acropora gemmifera*, *Acropora surculosa*, *Acropora tenuis*, *Astreopora myriophthalma*, *Favia matthaii*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Goniastrea retiformis*, *Leptastrea purpurea*, *Leptastrea transversa*, *Leptoria Phrygia*, *Montastrea curta*, *Montipora foveolata*, *Montipora grisea*, *Montipora hoffmeisteri*, *Montipora verrilli*, *Pavona duerdeni*, *Pavona varians*, *Pocillopora elegans*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites lichen*, *Porites vaughani*, *Psammocora haimeana*

**Coral Swim:** *Acropora humilis*, *Acropora monticulosa*, *Cyphastrea chalcidicum*, *Favia fava*, *Goniastrea edwardsi*, *Millepora platyphyllia*, *Millepora tuberosa*, *Platygyra pini*, *Pocillopora eydouxi*, *Pocillopora woodjonesi*, *Porites lobata*, *Stylophora mordax*

**Fish SPCs:** *Acanthurus blochii*, *Acanthurus lineatus*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Balistapus undulatus*, *Balistoides conspicillum*, *Centropyge flavissima*, *Cephalopholis argus*, *Cephalopholis urodeta*, *Chaetodon auriga*, *Chaetodon ephippium*, *Chaetodon punctatofasciatus*, *Chaetodon quadrimaculatus*, *Chaetodon reticulatus*, *Chlorurus microrhinos*, *Chlorurus sordidus*, *Coris aygula*, *Ctenochaetus striatus*, *Dascyllus trimaculatus*, *Forcipiger longirostris*, *Hemitaurichthys polylepis*, *Hemitaurichthys thompsoni*, *Heniochus chrysostomus*, *Lethrinus xanthurus*, *Melichthys niger*, *Melichthys vidua*, *Naso hexacanthus*, *Naso lituratus*, *Parupeneus multifasciatus*, *Scarus forsteni*, *Scarus oviceps*, *Scarus psittacus*, *Scarus rubroviolaceus*, *Sufflamen chrysopterum*, *Thalassoma amblycephalum*, *Thalassoma quinquevittatum*, *Zanclus cornutus*

## 2 - Bird Island, Saipan

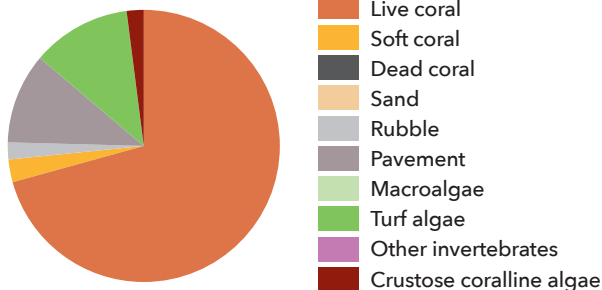
Bird Island is located within the Bird Island Marine Sanctuary, a fully protected no-take area established in 2002 that extends from the Grotto in the north to the Bird Island lookout point in the south. Likely due to its status as a fully protected no-take marine preserve, Bird Island has the highest score for herbivore biomass. This site also has medium-high coral diversity and has low macroalgae cover. The benthic community is comprised mostly of live coral cover; this is one of <5 sites with coral cover >70%. Greater than half of the total biomass of herbivorous fish at this site was made up of browsers, which was rare for the survey sites as both other functional groups had greater biomass on average. Uniquely, large bluespine unicornfish (*Naso unicornis*; tataga) can be found at this site. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	2/78	0.92	1.00	0.60	0.15	0.98	0.74	1.00	N/A - MPA	0.20
Intra-Island	2/29	0.92	1.00	0.70	0.15	0.98	0.77	1.00	N/A - MPA	0.20

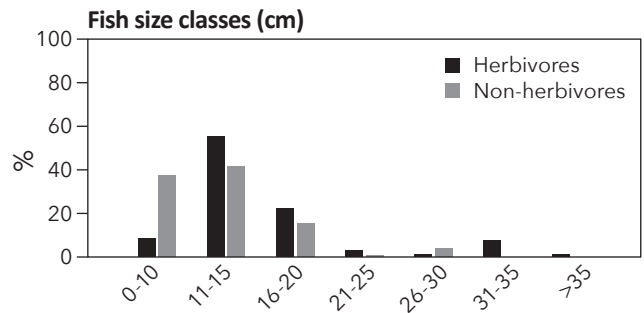
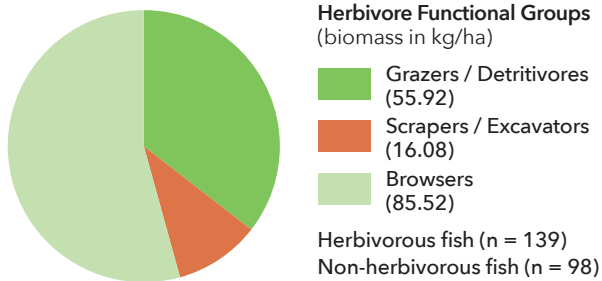
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



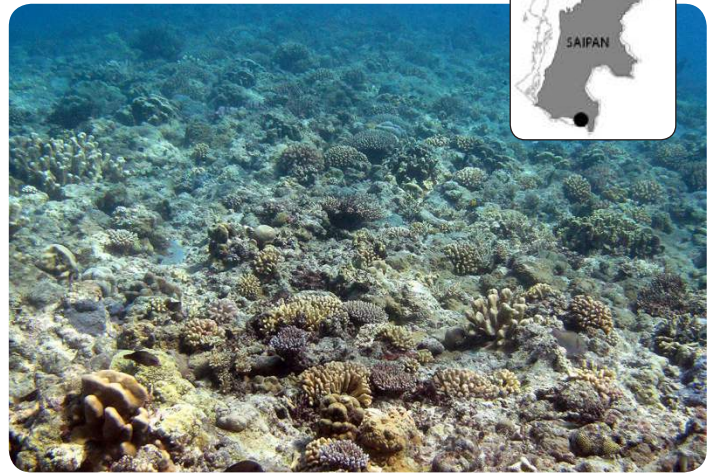
**Coral Quads:** *Acanthastrea brevis*, *Acanthastrea echinata*, *Acropora digitifera*, *Acropora gemmifera*, *Acropora monticulosa*, *Acropora secale*, *Acropora surculosa*, *Acropora tenuis*, *Astreopora listeri*, *Astreopora myriophthalma*, *Cyphastrea chalcidicum*, *Cyphastrea japonica*, *Cyphastrea ocellina*, *Favia favius*, *Favia matthaii*, *Favia speciosa*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Galaxea fascicularis*, *Goniastrea retiformis*, *Hydnophora microconos*, *Leptastrea purpurea*, *Leptastrea transversa*, *Leptoria Phrygia*, *Lobophyllia corymbosa*, *Montipora caliculata*, *Montipora efflorescens*, *Montipora floweri*, *Montipora grisea*, *Montipora hoffmeisteri*, *Montipora monasteriata*, *Montipora nodosa*, *Pavona varians*, *Platygyra pini*, *Pocillopora ankei*, *Pocillopora danae*, *Pocillopora elegans*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites lobata*, *Stylophora mordax*

**Coral Swim:** *Acropora abrotenoides*, *Acropora azurea*, *Acropora humilis*, *Acropora vaughani*, *Acropora verweyi*, *Cyphastrea serailia*, *Fungia scutaria*, *Goniastrea edwardsi*, *Goniastrea pectinata*, *Goniopora fruticosa*, *Goniopora minor*, *Millepora platyphyllia*, *Millepora tuberosa*, *Montastrea curta*, *Oulophyllia crispa*, *Platygyra daedalea*, *Pocillopora damicornis*

**Fish SPCs:** *Acanthurus blochii*, *Acanthurus guttatus*, *Acanthurus lineatus*, *Acanthurus nigricans*, *Acanthurus olivaceus*, *Acanthurus triostegus*, *Aphareus furca*, *Cantherbines dumerilii*, *Caranx melampygus*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon ephippium*, *Chaetodon lunula*, *Chaetodon mertensii*, *Chaetodon meyeri*, *Chaetodon ornatissimus*, *Chaetodon quadrimaculatus*, *Chaetodon unimaculatus*, *Cheilinus chlorourus*, *Chlorurus sordidus*, *Coris gaimard*, *Ctenochaetus striatus*, *Halichoeres hortulanus*, *Halichoeres margaritaceus*, *Halichoeres marginatus*, *Heniochus chrysostomus*, *Kyphosus cinerascens*, *Labroides dimidiatus*, *Melichthys vidua*, *Naso lituratus*, *Naso unicornis*, *Parupeneus multifasciatus*, *Pseudodax moluccanus*, *Rhinecanthus rectangulus*, *Scarus psittacus*, *Scarus rubroviolaceus*, *Thalassoma quinquevittatum*

### 3 - Obyan Beach, Saipan

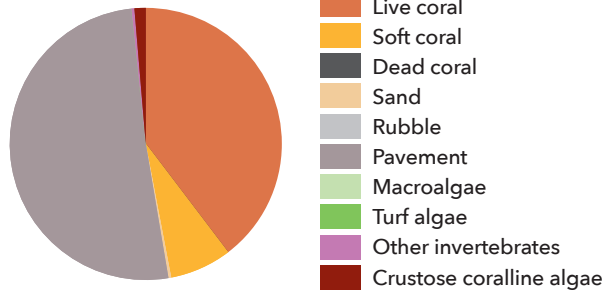
Obyan Beach is a popular beach among locals and visitors to the island making it one of the main recreational areas in Saipan and one of the most popular dive sites. Between the inner and outer reefs at Obyan, you can find spotted garden eels (*Heteroconger bassi*), but approach slowly or you will miss them. Obyan Beach received a high score for herbivore biomass, despite the sites location being favored by local fishers. The benthic community at Obyan Beach is dominated by pavement, but the areas that do have live coral (39.67%) are very diverse. Greater than half of the total herbivorous fish biomass was comprised of scrapers/excavators. This site is a high priority for conservation efforts because of its high resilience potential and that it is currently outside established marine protected areas. This site is also a target for tourism outreach and stewardship. Tourism operators of diving and snorkeling may increasingly target this site given its coral and fish diversity. Lastly, this site meets the criteria set for increased fishery regulations and enforcement due to having high resilience potential and accessibility. Examples of actions that can be considered for implementation at this location include increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	3/78	0.89	1.00	0.59	0.36	0.98	0.89	0.45	0.52	0.21
Intra-Island	4/29	0.89	1.00	0.69	0.36	0.98	0.93	0.45	0.49	0.21

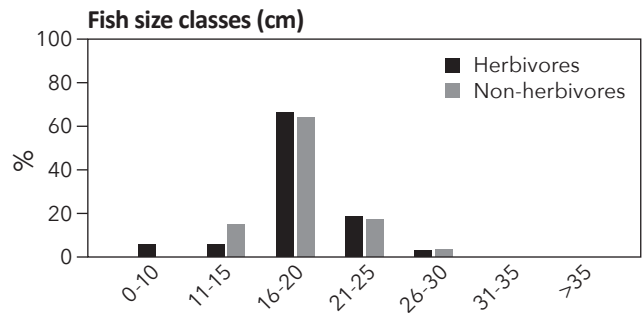
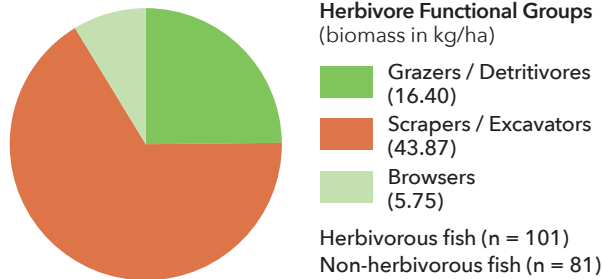
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

#### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

#### Fish community



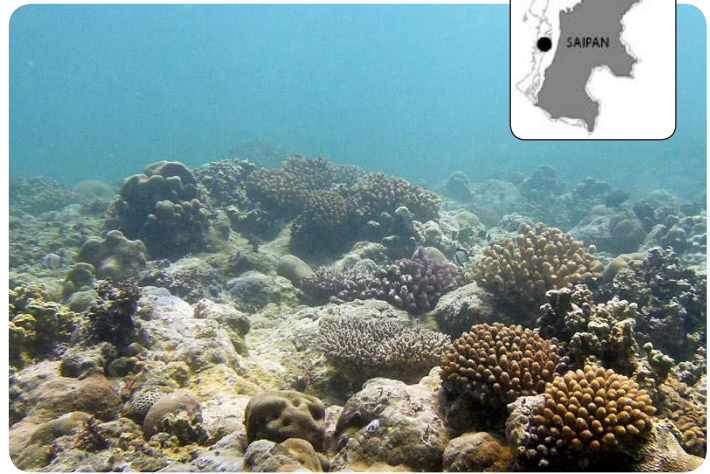
**Coral Quads:** *Acanthastrea brevis, Acanthastrea echinata, Acropora digitifera, Acropora humilis, Acropora palifera, Astreopora listeri, Astreopora myriophthalma, Cyphastrea chalcidicum, Cyphastrea serailia, Echinopora lamellosa, Favia favus, Favia matthaii, Favia stelligera, Favites abdita, Favites russelli, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea pectinata, Goniastrea retiformis, Hydnohpora microconos, Leptastrea purpurea, Leptastrea transversa, Leptoria Phrygia, Millepora tuberosa, Montipora floweri, Montipora grisea, Montipora hoffmeisteri, Montipora monasteriata, Montipora nodosa, Montipora verrilli, Pavona divaricata, Pavona varians, Platygyra pini, Pocillopora danae, Pocillopora elegans, Pocillopora eydouxi, Pocillopora verrucosa, Porites australiensis, Porites lichen, Porites lobata, Porites rus, Porites vaughani, Stylophora mordax*

**Coral Swim:** *Acropora secale, Acropora surculosa, Acropora verweyi, Montastrea curta, Pocillopora ankei*

**Fish SPCs:** *Abudefduf vaigiensis, Acanthurus nigricans, Balistapus undulatus, Cantherbines dumerilii, Canthigaster solandri, Centropyge flavissima, Cephalopholis argus, Cephalopholis urodeta, Chaetodon lunula, Chaetodon lunulatus, Chaetodon ornatissimus, Chaetodon punctatofasciatus, Chaetodon quadrimaculatus, Chaetodon reticulatus, Chaetodon ulietensis, Cheilinus chlorurus, Chlorurus frontalis, Chlorurus sordidus, Ctenochaetus striatus, Epibulus insidiator, Gomphosus varius, Halichoeres hortulanus, Hemigymnus fasciatus, Heniochus chrysostomus, Melichthys vidua, Myripristis kuntee, Naso hexacanthus, Naso lituratus, Neoniphon samara, Oxycheilinus unifasciatus, Pseudanthias pascalus, Sargocentron caudimaculatum, Sargocentron tiere, Scarus frenatus, Scarus ghobban, Scarus niger, Scarus psittacus, Scarus rubroviolaceus, Thalassoma lutescens, Thalassoma quinquevittatum, Zanclus cornutus*

## 4 - Lighthouse Reef, Saipan

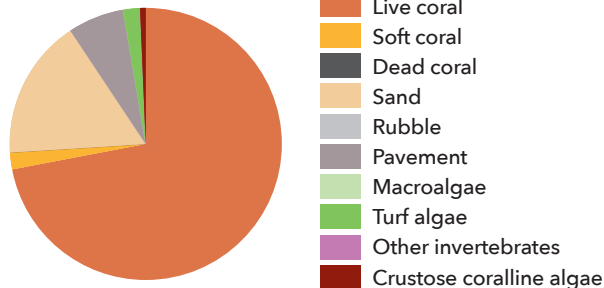
Lighthouse Reef is located near an old Japanese lighthouse that marks a channel that leads out from the Garapan Fishing Base boat ramp. The Lighthouse Reef is also a preserve area for species of topshell (*Trochus* sp.). This site has medium-high scores for all resilience indicators excepting temperature variability. This is among the few sites where coral cover was >70%. No macroalgae was observed during our surveys. Greater than half of the total herbivorous fish biomass was made up of grazers/detritivores. This site has high resilience potential and is currently outside established marine protected areas so is a high priority for conservation efforts. This site is also a target for fishery regulations and increased enforcement due to the high resilience potential and that the site is easy for fishers to access. Examples of actions that can be considered for implementation at this location include increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	4/78	0.89	1.00	0.72	0.36	0.98	0.82	0.38	0.64	0.19
Intra-Island	3/29	0.90	1.00	0.84	0.36	0.98	0.85	0.39	0.62	0.19

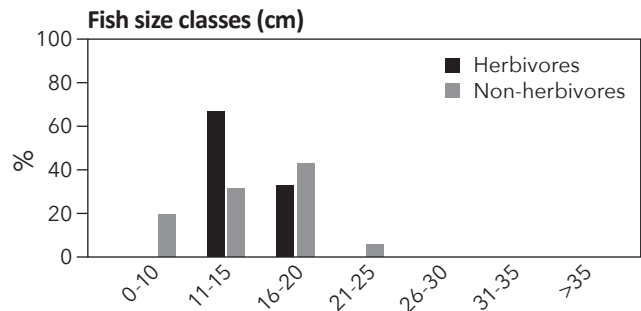
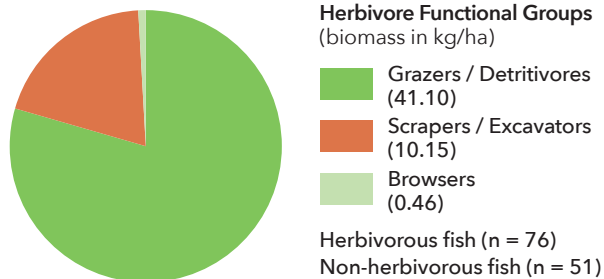
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE**.

### Fish community



**Coral Quads:** *Acanthastrea brevis*, *Acanthastrea echinata*, *Acropora digitifera*, *Acropora humilis*, *Astreoopora listeri*, *Astreoopora myriophthalma*, *Astreoopora randalli*, *Cyphastrea chalcidicum*, *Cyphastrea serailia*, *Echinopora lamellosa*, *Favia favus*, *Favia matthaii*, *Favia speciosa*, *Favites abdita*, *Favites russelli*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Lobophyllia hemprichii*, *Montipora efflorescens*, *Montipora grisea*, *Montipora hoffmeisteri*, *Montipora nodosa*, *Pavona duerdeni*, *Pocillopora damicornis*, *Pocillopora danae*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites lobata*, *Porites rus*, *Stylocoeniella armata*, *Stylophora mordax*

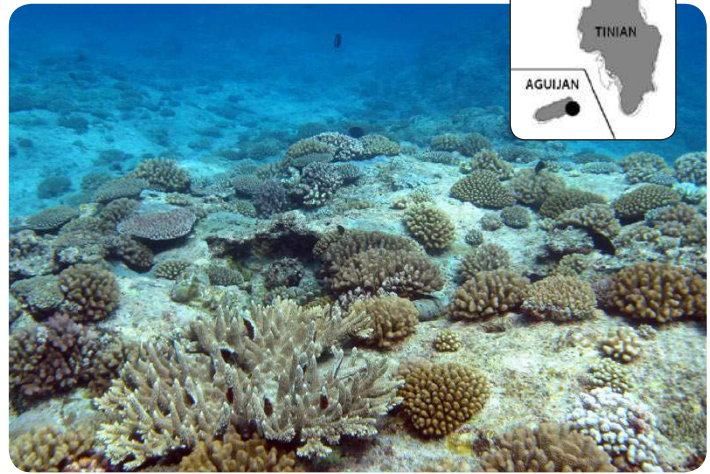
**Coral Swim:** *Acropora azurea*, *Acropora gemmifera*, *Acropora robusta*, *Acropora secale*, *Acropora surculosa*, *Acropora tenuis*, *Acropora vaughani*, *Cyphastrea japonica*, *Favia stelligera*, *Goniastrea retiformis*, *Goniopora minor*, *Hydnophora microconos*, *Montastrea curta*, *Pavona varians*, *Pocillopora eydouxi*, *Pocillopora woodjonesi*, *Porites lutea*

**Fish SPCs:** *Abudefduf vaigiensis*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Canthigaster janthinoptera*, *Centropyge flavissima*, *Chaetodon lunula*, *Chaetodon lunulatus*, *Chaetodon ornatissimus*, *Chaetodon reticulatus*, *Chaetodon trifascialis*, *Cheilinus trilobatus*, *Chlorurus sordidus*, *Ctenochaetus striatus*, *Epinephelus* sp., *Gomphosus varius*, *Halichoeres hortulanus*, *Labroides dimidiatus*, *Naso lituratus*, *Parupeneus multifasciatus*, *Scarus psittacus*, *Stethojulis bandanensis*, *Thalassoma quinquevittatum*, *Zanclus cornutus*



## 5 - East Aguigan Falls, Tinian

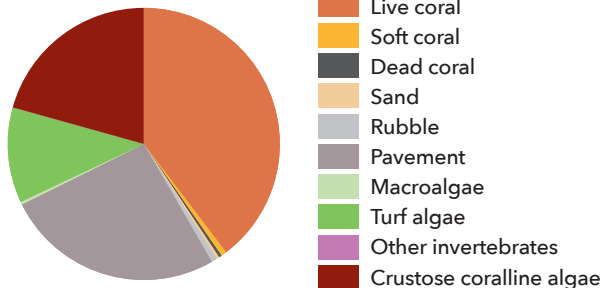
East Aguigan Falls is located on the eastern side of Aguigan (Goat Island). The topography of the island adjacent to the reef resembles a waterfall, only instead of rushing water; it is made of coral limestone. This site has greater warm season temperature variability than any of the other sites surveyed and has high coral recruitment and herbivore biomass. The benthic cover of the site was primarily made up of live coral and crustose coralline algae. Greater than 75% of the total herbivorous fish biomass was made up of grazers/detritivores. This site is a high conservation priority because of its high resilience potential and that it is currently outside and established marine protected area. This site is also a target for conservation, fishery regulations and enforcement, and reef restoration/coral translocation. Examples of actions that can be considered for implementation at this location include increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	5/78	0.88	1.00	0.44	0.41	0.91	1.00	0.51	0.39	0.19
Intra-Island	4/25	0.95	0.99	0.47	0.72	0.91	1.00	0.71	0.19	0.56

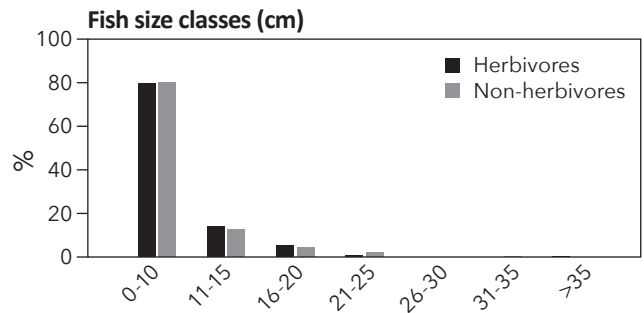
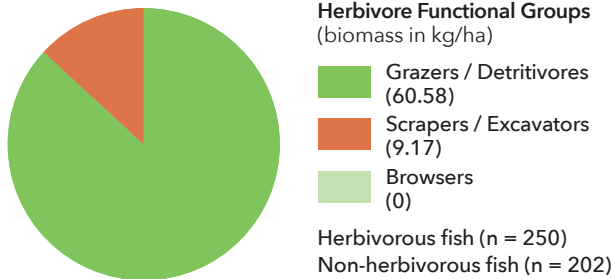
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

### Fish community



**Coral Quads:** *Acropora gemmifera*, *Acropora surculosa*, *Astreopora myriophthalma*, *Favia stelligera*, *Favites russelli/abdita* (CNMI #95), *Leptastrea purpurea*, *Millepora platyphylla*, *Montipora efflorescens*, *Platygyra pini*, *Pocillopora elegans*, *Pocillopora meandrina*, *Pocillopora verrucosa*

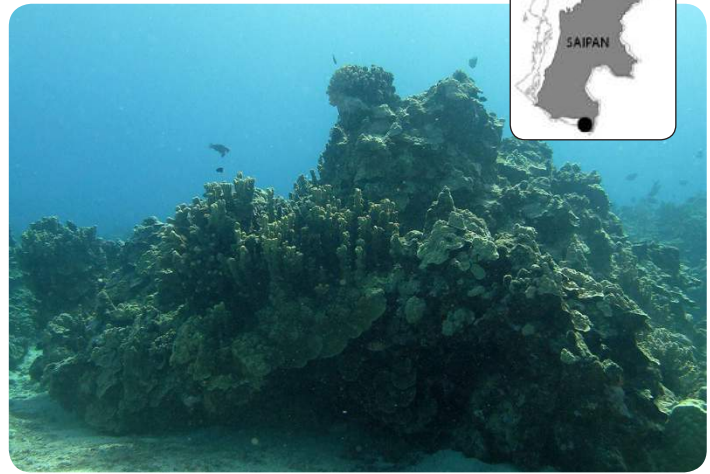
**Coral Swim:** *Acropora cuneata*, *Acropora digitifera*, *Acropora globiceps*, *Acropora humilis*, *Cyphastrea microphthalma*, *Favia danae*, *Favia fava*, *Favia helianthoides*, *Favia pallida*, *Heliopora coerulea*, *Montipora foveolata*, *Pavona duerdeni*, *Pavona varians*, *Pocillopora ankei*, *Pocillopora eydouxi*, *Porites australiensis*, *Porites lobata*, *Porites lutea*, *Psammocora haimeana*, *Stylophora mordax*

**Fish SPCs:** *Acanthurus blochii*, *Acanthurus lineatus*, *Acanthurus nigrofuscus*, *Acanthurus olivaceus*, *Amanes scopas*, *Centropyge flavissima*, *Centropyge beraldi*, *Cephalopholis argus*, *Cephalopholis urodeta*, *Chaetodon lunula*, *Chaetodon ornatissimus*, *Chaetodon quadrimaculatus*, *Chaetodon reticulatus*, *Cheilinus chlorourus*, *Chromis acares*, *Chromis margaritifer*, *Chrysiptera traceyi*, *Ctenochaetus striatus*, *Dascyllus reticulatus*, *Dascyllus trimaculatus*, *Epinephelus hexagonatus*, *Epinephelus tawina*, *Halichoeres biocellatus*, *Labroides dimidiatus*, *Lutjanus bohar*, *Melichthys niger*, *Melichthys vidua*, *Neocirrhites armatus*, *Oxycheilinus digrammus*, *Paracanthurus hepatus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Paracirrhites bemistictus*, *Plectroglyphidodon dickii*, *Plectroglyphidodon phoenixensis*, *Pomachromis guamensis*, *Rhinecanthus rectangulus*, *Scarus psittacus*, *Scarus rubroviolaceus*, *Stegastes fasciolatus*, *Thalassoma amblycephalum*, *Thalassoma quinquevittatum*, *Variola louti*, *Zanclus cornutus*

**Fish Swim:** *Acanthurus guttatus*, *Acanthurus nigricans*, *Aphareus furca*, *Apolemichthys trimaculatus*, *Aprion virescens*, *Balistoides viridescens*, *Chaetodon auriga*, *Chlorurus sordidus*, *Coris gaimard*, *Monotaxis grandoculis*, *Naso lituratus*, *Naso unicornis*, *Scarus forsteni*, *Sufflamen fraenatum*

## 6 - Boy Scout, Saipan

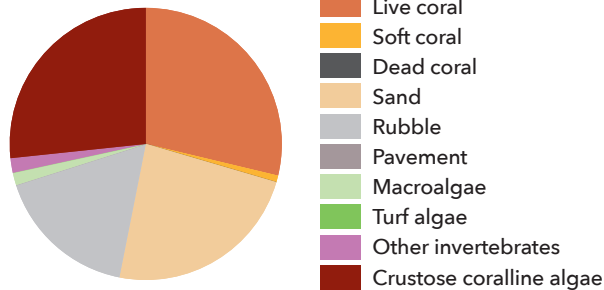
Boy Scout is popular recreational area in Saipan. The beach received its name due to its frequent use for camping by local Boy Scout troops. This site has medium-high scores for all of the resilience indicators. Due to the patchy nature of the reef here, the benthic substrate that was not live coral or crustose coralline algae (combined 48.2%) was covered by sand or rubble (combined 35.18%). Greater than 50% of the total herbivorous fish biomass was made up of grazers/detritivores. Because of its high resilience potential and currently being outside of established marine protected areas, conservation efforts are a high priority at this site. This site is also a target for fishery regulations and increased enforcement. Examples of actions that can be considered for implementation at this location include increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	6/78	0.88	0.98	0.71	0.32	0.97	0.89	0.31	0.50	0.19
Intra-Island	5/29	0.89	0.98	0.82	0.32	0.97	0.93	0.31	0.47	0.19

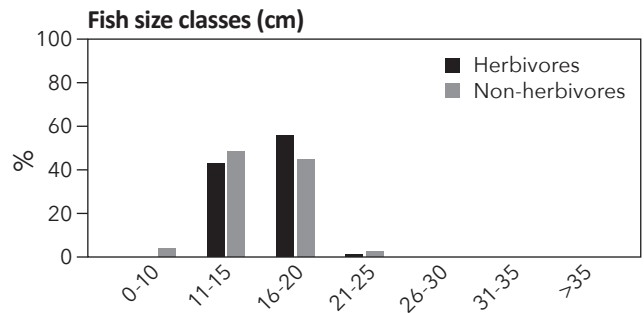
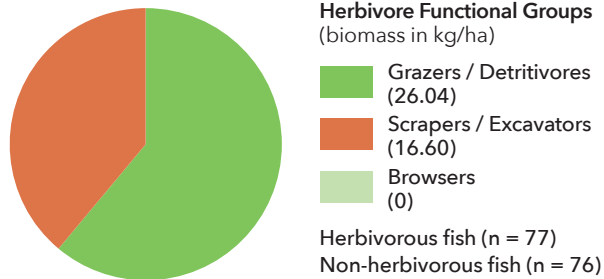
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg + 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Acropora palifera*, *Cyphastrea serailia*, *Echinopora lamellosa*, *Favia favaus*, *Favia matthaii*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Hydnophora microconos*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Montipora efflorescens*, *Montipora floweri*, *Montipora grisea*, *Montipora hoffmeisteri*, *Montipora nodosa*, *Pavona duerdeni*, *Pavona varians*, *Platygyra pini*, *Pocillopora verrucosa*, *Porites lobata*, *Porites rus*, *Porites vaughani*, *Psammacora haimaana*, *Stylophora mordax*

**Coral Swim:** *Acropora azurea*, *Acropora digitifera*, *Astreopora myriophthalma*, *Cyphastrea chalcidicum*, *Favia speciosa*, *Fungia scutaria*

**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Balistapus undulatus*, *Caranx melampygus*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon ornatissimus*, *Chaetodon reticulatus*, *Chlorurus sordidus*, *Ctenochaetus striatus*, *Halichoeres hortulanus*, *Hemigymmus fasciatus*, *Labroides dimidiatus*, *Oxycheilinus unifasciatus*, *Parupeneus multifasciatus*, *Ptereleotris evides*, *Scarus psittacus*, *Stethojulis bandanensis*, *Stethojulis strigiventer*, *Sufflamen fraenatum*, *Thalassoma Hardwicke*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*

## 7 - Unai Masalok, Tinian

Unai Masalok is a small beach located on the east coast of Tinian. It is one of the many beaches on the island where you can find intact latte stone villages. This site has a high score for coral recruitment and also had high coral diversity and low macroalgae cover. Unai Masalok has coral cover greater than 50% and 11% crustose coralline algae; however, the reef also has high levels of turfing algae (33.67%). Roughly half of the total herbivorous fish biomass was made up of scrapers/excavators; the other half was split between grazers/detritivores and browsers. This is one of the few sites where we saw eagle rays during our surveys. Unai Masalok is a high conservation priority as the site was assessed as having the highest resilience potential for the island of Tinian and is currently outside established marine protected areas.

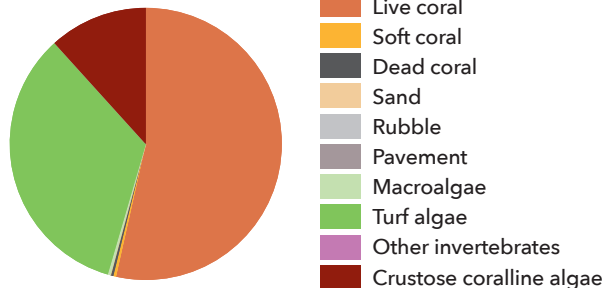


ISLAND SCORE: HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	7/78	0.87	1.00	0.68	0.56	0.99	0.78	0.18	0.32	0.19
Intra-Island	1/25	1.00	0.99	0.73	0.98	0.99	0.78	0.57	0.10	0.56

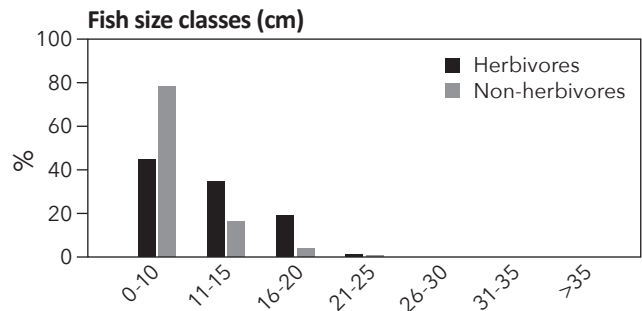
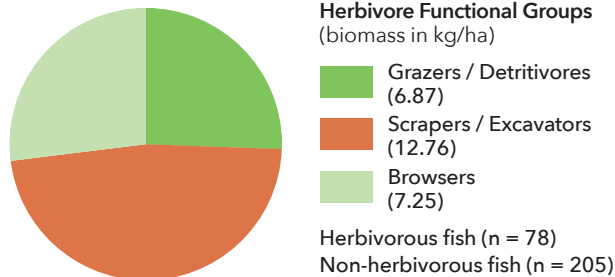
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Acanthastrea echinata*, *Acropora gemmifera*, *Astreopora listeri*, *Astreopora myriophthalma*, *Cyphastrea microphthalma*, *Cyphastrea senailia*, *Echinopora lamellosa*, *Favia danae*, *Favia fava*, *Favia matthaii*, *Favia pallida*, *Favia speciosa*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Fungia scutaria*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea pectinata*, *Goniastrea retiformis*, *Hydnophora microconos*, *Leptastrea purpurea*, *Leptastrea transversa*, *Leptoria Phrygia*, *Lobophyllia hemprichii*, *Montipora efflorescens*, *Montipora grisea*, *Montipora nodosa*, *Montipora verrilli*, *Pavona duerdeni*, *Pavona varians*, *Platygyra pini*, *Pocillopora damicornis*, *Pocillopora danae*, *Pocillopora meandrina*, *Porites rus*, *Psammocora haimeana*, *Psammocora nierstraszi*, *Stylocoeniella armata*, *Stylophora mordax*

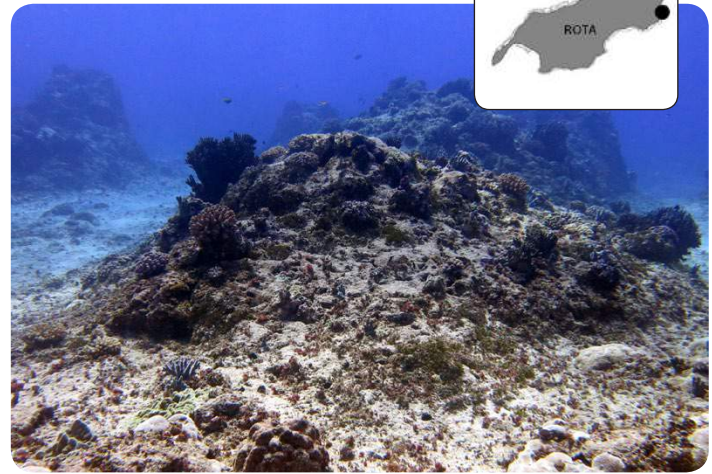
**Coral Swim:** *Acropora digitifera*, *Acropora humilis*, *Acropora tenuis*, *Millepora tuberosa*, *Montipora aequituberculata*, *Oulophyllia crispa*, *Platygyra daedalea*, *Pocillopora elegans*, *Porites australiensis*, *Porites lichen*, *Porites lobata*, *Porites lutea*

**Fish SPCs:** *Acanthurus nigrofuscus*, *Canthigaster solandri*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon melanotus*, *Chaetodon reticulatus*, *Chlorurus sordidus*, *Chromis margaritifer*, *Chrysiptera brownriggii*, *Coris aygula*, *Coris gaimard*, *Ctenochaetus striatus*, *Dascyllus reticulatus*, *Epibulus insidiator*, *Gomphosus varius*, *Halichoeres biocellatus*, *Halichoeres hortulanus*, *Halichoeres ornatus*, *Hemigymnus fasciatus*, *Labrid sp.*, *Labroides dimidiatus*, *Macolor niger*, *Macropharyngodon meleagris*, *Melichthys vidua*, *Naso lituratus*, *Neocirrhites armatus*, *Oxycheilinus digrammus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Parupeneus insularis*, *Parupeneus multifasciatus*, *Plectroglyphidodon dickii*, *Plectroglyphidodon johnstonianus*, *Plectroglyphidodon lacrymatus*, *Pomacanthus imperator*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Rhinecanthus rectangularis*, *Scarus psittacus*, *Scarus rubroviolaceus*, *Stegastes fasciolatus*, *Stethojulis bandanensis*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*

**Fish Swim:** *Abudefduf vaigiensis*, *Aetobatus narinari*, *Anampses caeruleopunctatus*, *Chaetodon quadrimaculatus*, *Scarus forsteni*

## 8 - As Dudo\_MMT, Rota

As Dudo\_MMT is one of the more difficult sites to access across the CNMI and is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. The site is located on the far eastern coast of Rota, as far as possible from the two main ports in Rota. The site is also completely exposed to the open ocean, creating difficult diving conditions. This site has a high score for bleaching resistance and medium-high scores for coral recruitment and herbivore biomass. The majority of the benthic substrate was covered in either live coral (32%) or crustose coralline algae (36.67). Uniquely, the herbivorous fish community was comprised entirely of grazers/detritivores. This site had a wide range of marine fauna including green sea turtles, large blunthead parrotfish (*Chlorurus microrhinos*) and Napoleon wrasse (*Cheilinus undulatus*). This site is a target for reef restoration/coral translocation activities due to the availability of favorable reef substrate, the low coral diversity and the low LBSP and fishing access.

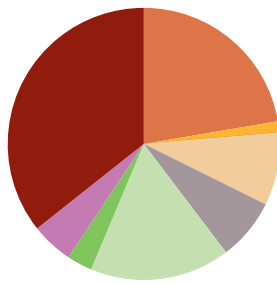


ISLAND SCORE: HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	8/78	0.87	0.96	0.85	0.34	0.91	0.82	0.24	0.00	0.19
Intra-Island	3/24	0.98	0.94	0.85	0.64	0.92	0.89	0.40	0.00	0.67

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

### Benthic community



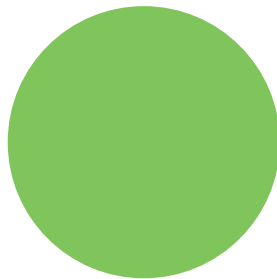
- Live coral
- Soft coral
- Dead coral
- Sand
- Rubble
- Pavement
- Macroalgae
- Turf algae
- Other invertebrates
- Crustose coralline algae

### Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
5.76	5.76	0	0	0

Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community

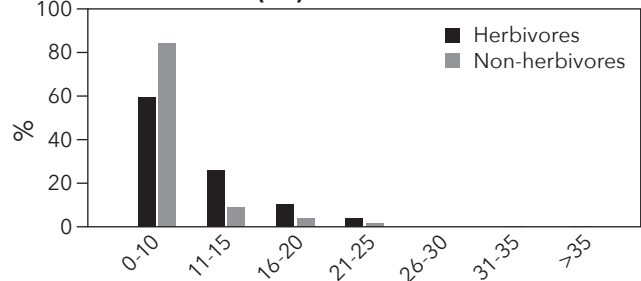


**Herbivore Functional Groups**  
(biomass in kg/ha)

- Grazers / Detritivores (32.18)
- Scrapers / Excavators (0)
- Browsers (0)

Herbivorous fish (n = 104)  
Non-herbivorous fish (n = 280)

### Fish size classes (cm)



**Coral Quads:** *Acanthastrea echinata*, *Acropora abrotenoides*, *Acropora surculosa*, *Astreopora myriophthalma*, *Cyphastrea microphthalma*, *Favia danae*, *Favia helianthoides*, *Favia pallida*, *Favia stelligera*, *Helipora coerula*, *Platygyra pini*, *Pocillopora elegans*, *Pocillopora meandrina*, *Porites australiensis*, *Porites lobata*, *Porites lutea*, *Porites vaughani*, *Psammocora haimeana*, *Stylocoeniella armata*

**Coral Swim:** *Acropora gemmifera*, *Acropora verweyi*, *Echinopora lamellosa*, *Favia fava*, *Fungia paumotensis*, *Goniastrea retiformis*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Millepora platyphylla*, *Pocillopora verrucosa*, *Stylophora mordax*

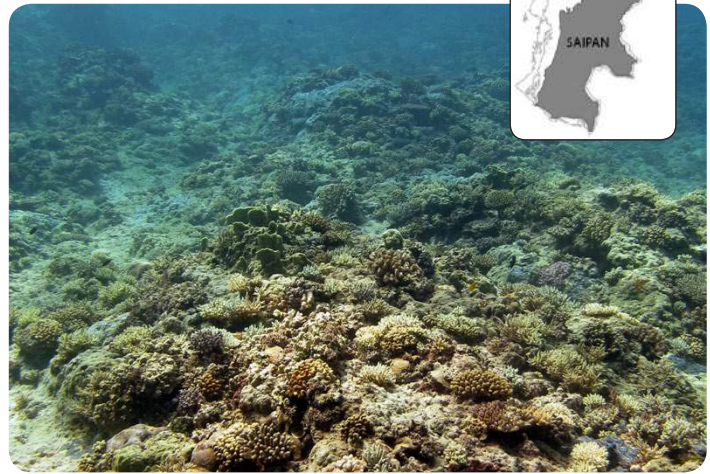
**Fish SPCs:** *Acanthurus guttatus*, *Acanthurus lineatus*, *Acanthurus nigrofuscus*, *Acanthurus olivaceus*, *Acanthurus sp.*, *Acanthurus triostegus*, *Apolemichthys trimaculatus*, *Balistapus undulatus*, *Cephalopholis argus*, *Chaetodon auriga*, *Chaetodon citrinellus*, *Chaetodon ephippium*, *Chaetodon quadrimaculatus*, *Cheilinus trilobatus*, *Chromis acares*, *Chromis margaritifer*, *Chrysiptera brownriggii*, *Ctenochaetus striatus*, *Dascyllus reticulatus*, *Epinephelus hexagonatus*, *Epinephelus tawuina*, *Forcipiger longirostris*, *Halichoeres hortulanus*, *Labroides dimidiatus*, *Melichthys niger*, *Melichthys vidua*, *Paracanthurus hepatus*, *Paracirrhites arcatus*, *Plectroglyphidodon dickii*, *Plectroglyphidodon phoenixensis*, *Pomacanthus imperator*, *Pomachromis guamensis*, *Rhinecanthus rectangulus*, *Sargocentron tere*, *Stegastes fasciatus*, *Thalassoma amblycephalum*, *Thalassoma purpurum*, *Thalassoma quinquevittatum*, *Zanclus cornutus*

**Fish Swim:** *Acanthurus nigricans*, *Amanses scopas*, *Cantherhines dumerilii*, *Chaetodon lunula*, *Chaetodon reticulatus*, *Cheilinus undulatus*, *Chelonia sp.*, *Chlorurus microrhinos*, *Chlorurus sordidus*, *Cirripectes variolosus*, *Coris aygula*, *Coris gaimard*, *Epinephelus maculatus*, *Lethrinus sp.*, *Naso brevirostris*, *Naso lituratus*, *Ostracion meleagris*, *Oxycheilinus digrammus*, *Parupeneus cyclostomus*, *Scarus forsteni*, *Scarus frenatus*, *Scarus psittacus*, *Scarus rubroviolaceus*, *Variola louti*, *Zebрасoma veliferum*

OVERALL SCORE: MED-HIGH

## 9 - Pau Pau, Saipan

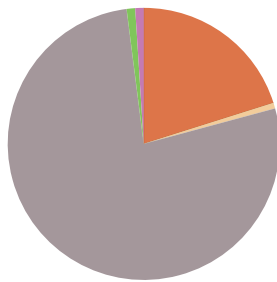
Pau Pau (*paopao* is a chamorro word meaning sweet or fragrant) Beach is known for its many flowering plants with sweet aromatic smells. This site has a high score for coral recruitment but also received a low score for bleaching resistance, as the majority of the corals found on this reef are highly susceptible to bleaching. This reef was overwhelmingly dominated by bare pavement substrate (>75%). Nearly 75% of the total herbivorous fish biomass was comprised of grazers/detritivores with the remaining ~25% split between browsers and scrapers/excavators. Pau Pau is highly accessible to fishers so the site is a target for fishery regulations & enforcement actions. Examples of actions that can be considered for implementation at this location include increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	9/78	0.87	1.00	0.54	0.62	0.97	0.81	0.28	0.61	0.19
Intra-Island	7/29	0.87	1.00	0.63	0.62	0.97	0.84	0.28	0.58	0.19

● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

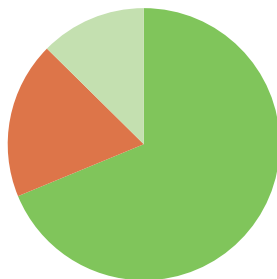
### Benthic community



- Live coral
- Soft coral
- Dead coral
- Sand
- Rubble
- Pavement
- Macroalgae
- Turf algae
- Other invertebrates
- Crustose coralline algae

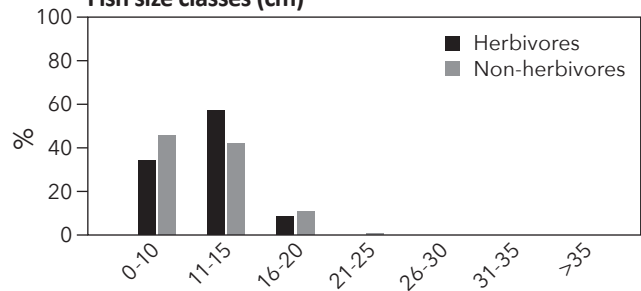
Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



- Herbivore Functional Groups**  
(biomass in kg/ha)
- Grazers / Detritivores (26.97)
  - Scrapers / Excavators (7.31)
  - Browsers (4.94)
- Herbivorous fish (n = 143)  
Non-herbivorous fish (n = 111)

### Fish size classes (cm)



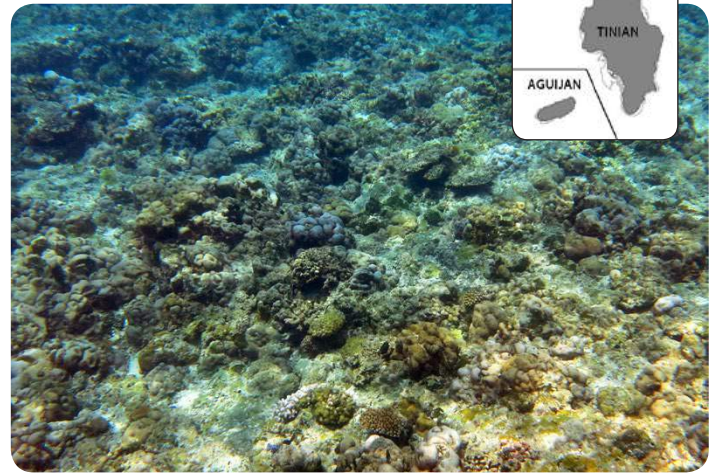
**Coral Quads:** *Acropora nasuta*, *Acropora surculosa*, *Acropora verweyi*, *Astreopora listeri*, *Astreopora myriophthalma*, *Astreopora randalli*, *Favia matthaii*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea pectinata*, *Goniastrea retiformis*, *Hydnopora microconos*, *Leptastrea purpurea*, *Leptastrea transversa*, *Millepora platyphyllia*, *Millepora tuberosa*, *Montipora grisea*, *Montipora hoffmeisteri*, *Montipora sp. # 1*, *Pavona duerdeni*, *Pavona varians*, *Pocillopora danae*, *Pocillopora elegans*, *Pocillopora juv.*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites lobata*, *Porites vaughani*, *Psammacora haimeana*, *Stylophora mordax*

**Coral Swim:** *Acropora gemmifera*, *Acropora monticulosa*, *Acropora palifera*, *Acropora robusta*, *Acropora secale*, *Acropora tenuis*, *Acropora vaughani*, *Favia speciosa*, *Fungia scutaria*, *Heliopora coerulea*, *Pavona divaricata*, *Platygyra pini*, *Pocillopora ankei*, *Pocillopora woodjonesi*, *Porites lutea*

**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Balistapus undulatus*, *Cantherhines pardalis*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon citrinellus*, *Chaetodon lunula*, *Chaetodon melannotus*, *Chaetodon ornatissimus*, *Chaetodon reticulatus*, *Chaetodon trifascialis*, *Cheilinus trilobatus*, *Chlorurus sordidus*, *Ctenochaetus striatus*, *Gomphosus varius*, *Haliichoeres hortulanus*, *Labrid sp.*, *Labroides bicolor*, *Labroides dimidiatus*, *Melichthys vidua*, *Monotaxis grandoculis*, *Naso lituratus*, *Oxycheilinus unifasciatus*, *Parupeneus insularis*, *Sargocentron caudimaculatum*, *Scarus psittacus*, *Scarus rubroviolaceus*, *Stethojulis strigiventer*, *Sufflamen bursa*, *Sufflamen fraenatum*, *Thalassoma amblycephalum*, *Thalassoma quinquevittatum*, *Zebrosoma flavescens*

# 10 - Unai Babui\_MMT, Tinian

Unai Babui\_MMT (Unai Babui — “Pig Beach”) was one of the landing beaches used by US military forces during the Battle of Tinian. Along with Unai Chulu and Unai Lamlam, Unai Babui was chosen due to its small size, making it an unlikely place for a tactical attack. This site is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. This site has high scores for coral recruitment but medium-low scores for temperature variability and herbivore biomass. Half of the benthic community is comprised of live coral and crustose coralline algae. Greater than half of the total herbivorous fish biomass is comprised of grazers/detritivores. Bring your camera if you visit this site as you can find anemonefish and giant moray eels here. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results. The Threatened coral species *Acropora globiceps* was seen in the shallow waters (<4 m) adjacent to this site during our surveys in May/June of 2014.

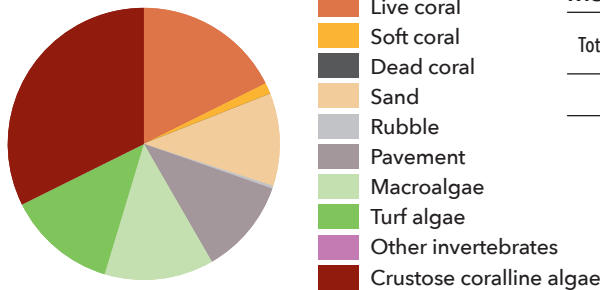


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	10/78	0.87	0.82	0.81	0.57	1.00	0.78	0.13	0.33	0.23
Intra-Island	6/25	0.93	0.75	0.87	1.00	1.00	0.78	0.23	0.12	0.66

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg + 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community

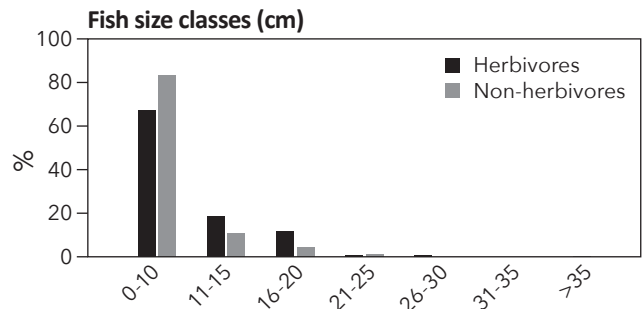
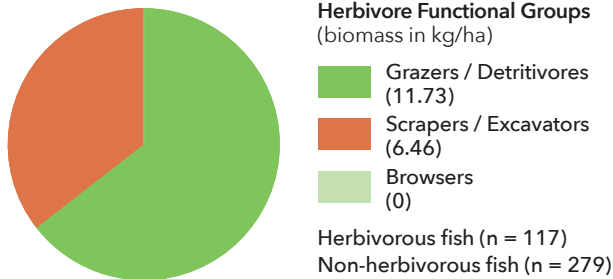


## Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
4.55	4.55	0	0	0

Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acanthastrea echinata*, *Acropora digitifera*, *Astreopora listeri*, *Astreopora myriophthalma*, *Cyphastrea chalcidicum*, *Cyphastrea microphthalma*, *Cyphastrea serailia*, *Favia danae*, *Favia matthaii*, *Favia stelligera*, *Fungia scutaria*, *Gardinerosia planulata*, *Goniastrea edwardsi*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Lobophyllia hemprichii*, *Montastrea valenciennesi*, *Montipora efflorescens*, *Pavona duerdeni*, *Pavona varians*, *Pavona venosa*, *Platygyra daedalea*, *Platygyra pini*, *Porites australiensis*, *Porites lutea*, *Psammocora baimeana*, *Psammocora nierstraszi*, *Stylophora mordax*

**Coral Swim:** *Alveopora fenestrata*, *Favia pallida*, *Favites abdita*, *Galaxea fascicularis*, *Goniastrea pectinata*, *Hydnophora microconos*, *Isopora palifera*, *Millepora platyphylla*, *Porites lobata*, *Porites rus*, *Turbinaria stellulata*

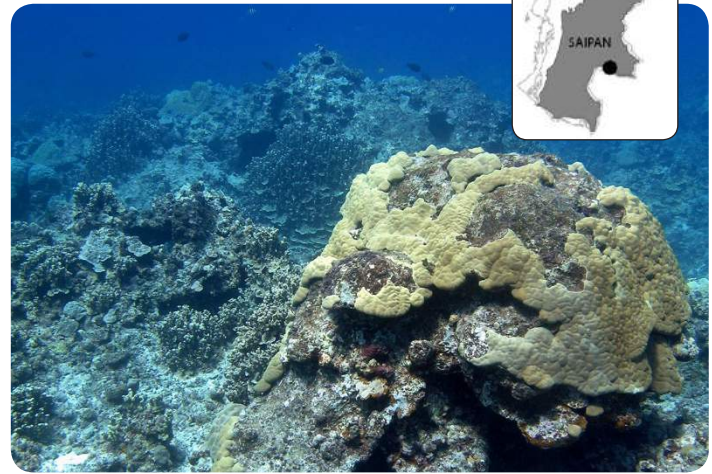
**Fish SPCs:** *Acanthurus lineatus*, *Acanthurus nigricans*, *Acanthurus nigricauda*, *Acanthurus nigrofusus*, *Acanthurus olivaceus*, *Acanthurus sp.*, *Anampses twistii*, *Balistapus undulatus*, *Bodianus axillaris*, *Caesio caeruleaurea*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon lunula*, *Chaetodon lunulatus*, *Chaetodon reticulatus*, *Cheilinus oxycephalus*, *Chlorurus sordidus*, *Chromis agilis*, *Chromis margaritifer*, *Chromis xanthurus*, *Chrysiptera traceyi*, *Cirripectes variolosus*, *Ctenochaetus cyanocheilus*, *Ctenochaetus striatus*, *Dascyllus trimaculatus*, *Epibulus insidiator*, *Gomphosus varius*, *Gymnothorax javanicus*, *Halichoeres hortulanus*, *Halichoeres ornatissimus*, *Labroides bicolor*, *Labroides dimidiatus*, *Macroparyngodon meleagris*, *Melichthys vidua*, *Myripristis kuntee*, *Nemateleotris magnifica*, *Oxycheilinus unifasciatus*, *Paracirrhites forsteri*, *Parupeneus multifasciatus*, *Pempheris oualensis*, *Plectroglyphidodon lacrymatus*, *Pomacentrus vaiuli*, *Pygoplites diacanthus*, *Sargocentron tere*, *Scarus psittacus*, *Scarus schlegelii*, *Stegastes fasciolatus*, *Stethojulis bandanensis*, *Synodus sp.*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*

**Fish Swim:** *Acanthurus guttatus*, *Acanthurus thompsoni*, *Acanthurus triostegus*, *Acanthurus xanthopterus*, *Amphiprion melanopus*, *Anampses caeruleopunctatus*, *Anampses sp.*, *Aphareus furca*, *Arothron nigropunctatus*, *Cantherbines dumerilii*, *Chaetodon auriga*, *Chaetodon ephippium*, *Chaetodon quadrimaculatus*, *Chrysiptera brownriggii*, *Coris aygula*, *Epinephelus hexagonatus*, *Gobiid sp.*, *Hemigymnus fasciatus*, *Monotaxis grandoculis*, *Naso lituratus*, *Oxycheilinus digrammus*, *Parupeneus barberinus*, *Plagiotremus tapeinosoma*, *Plectroglyphidodon dickii*, *Pomacanthus imperator*, *Rhinecanthus rectangulus*, *Siganus argenteus*, *Stethojulis strigiventer*, *Sufflamen bursa*, *Thalassoma purpuraceum*

OVERALL SCORE: MED-HIGH

# 11 - Laolao Bay East, Saipan

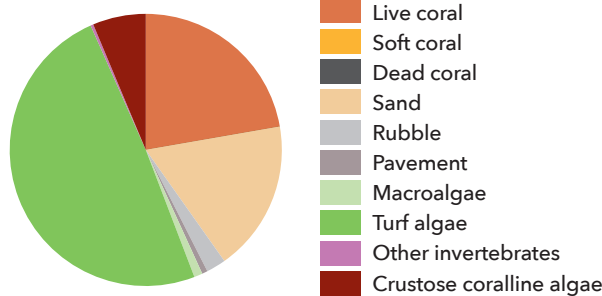
Laolao Bay East (*Laolao* is the Chamorro word for “shake”) also goes by the name “Magicienne Bay” from Spanish explorers who came to the islands in the 1500s. This is the easternmost site located in the Bay. This site is one of the most popular fishing spots around Saipan, due to its calm water almost year round. This site has high bleaching resistance. The benthic community on this reef is dominated primarily by turfing algae (49.33%). Greater than 75% of the total herbivorous fish biomass is comprised of grazers/ detritivores. This site is a target for land-based sources of pollution reduction. Examples of actions that can be implemented to reduce LBSP near the identified sites include: stream bank stabilization, road and storm drain improvement, other erosion control practices and sewage treatment upgrades.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	11/78	0.86	0.99	0.82	0.19	0.96	0.76	0.37	0.24	0.30
Intra-Island	6/29	0.88	0.99	0.95	0.19	0.96	0.79	0.39	0.19	0.30

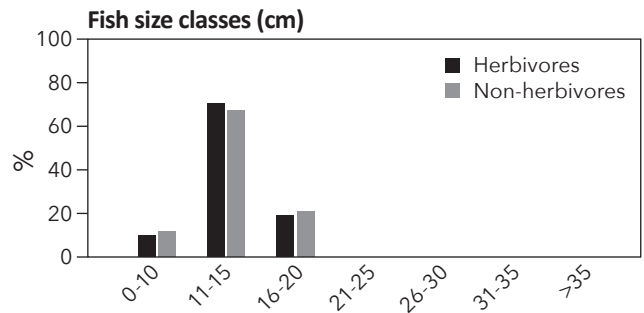
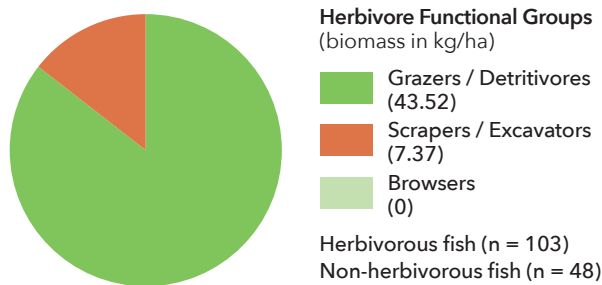
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



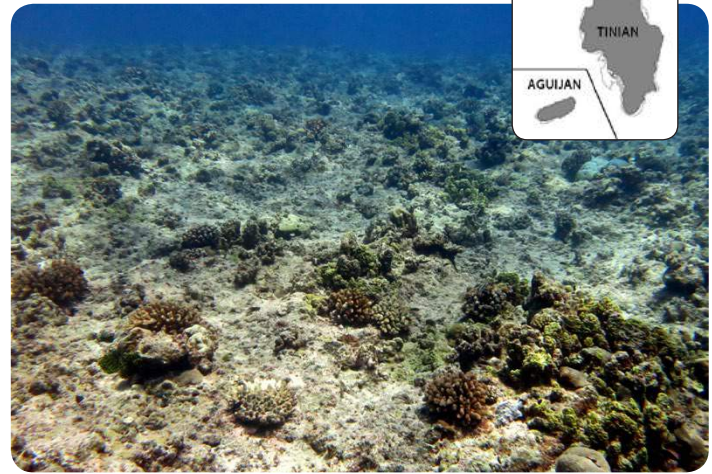
**Coral Quads:** *Favia stelligera, Favites abdita, Favites russelli, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea retiformis, Leptastrea purpurea, Leptoria Phrygia, Montipora grisea, Montipora hoffmeisteri, Montipora monasteriata, Pavona varians, Platygyra pini, Pocillopora damicornis, Porites lichen, Porites lobata, Porites rus, Porites vaughani, Stylocoeniella armata, Stylophora mordax*

**Coral Swim:** *Goniopora fruticosa, Heliopora coerulea, Millepora tuberosa, Porites australiensis, Porites cylindrical, Porites lutea*

**Fish SPCs:** *Abudefduf vaigiensis, Acanthurus nigricans, Acanthurus nigrofuscus, Balistapus undulatus, Centropyge flavissima, Cephalopholis urodeta, Chaetodon punctatofasciatus, Chaetodon reticulatus, Chaetodon trifascialis, Chromis xanthurus, Ctenochaetus striatus, Dascyllus trimaculatus, Halichoeres hortulanus, Sargocentron tere, Scarus ghobban, Scarus psittacus, Sufflamen fraenatum, Thalassoma lutescens, Thalassoma quinquevittatum, Zanclus cornutus*

## 12 - Tahgong Point, Tinian

Tahgong Point (*tabgong* is the Chamorro word for the part of a shell on a crustacean) received its name because it is known for having an abundance of crab and lobster. This site has high scores for coral recruitment and temperature variability. The benthic community is dominated by turfing algae (43.67%), but also has a lot of reef-accreting substrate; live coral and crustose coralline algae (22.67% and 15.33%, respectively). Greater than 90% of the total herbivorous fish biomass was comprised of grazers/detritivores. Bring your camera if you visit this site as you can find anemonefish and adult Napoleon wrasse (*Cheilinus undulatus*). This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.



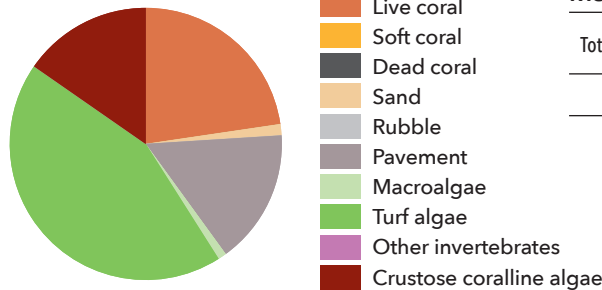
ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	12/78	0.86	0.99	0.69	0.37	0.97	0.99	0.09	0.29	0.19
Intra-Island	10/25	0.90	0.98	0.74	0.65	0.97	0.99	0.11	0.06	0.56

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg + 1 SD) ● High (>avg + 1 SD)

● Low ● Med-High  
● Med-Low ● High

### Benthic community

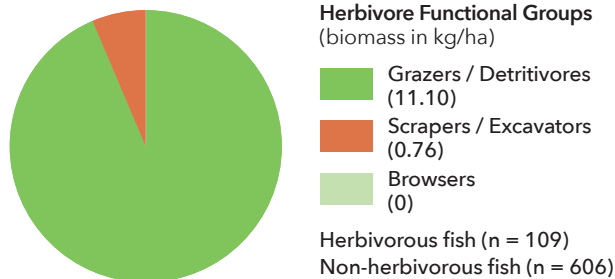


### Mean disease prevalence (%)

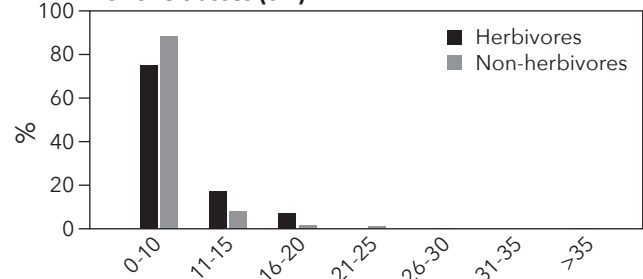
Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
0.81	0.81	0	0	0

Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

### Fish community



### Fish size classes (cm)



**Coral Quads:** *Acanthastrea c.f. regularis*, *Acropora gemmifera*, *Acropora verweyi*, *Astreopora listeri*, *Cyphastrea serailia*, *Favia favus*, *Favia helianthoides*, *Favia matthai*, *Favia stelligera*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniopora fruticosa*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Millepora platyphylla*, *Montastrea valenciennesi*, *Montipora calculata*, *Montipora efflorescens*, *Montipora nodosa*, *Montipora tuberculosa*, *Pavona duerdeni*, *Pavona varians*, *Platygyra pini*, *Pocillopora elegans*, *Pocillopora woodjonesi*, *Porites lichen*, *Porites lobata*, *Psammocora haimeana*, *Stylophora mordax*

**Coral Swim:** *Acropora digitifera*, *Acropora humilis*, *Acropora tenuis*, *Astreopora myriophthalma*, *Favia pallida*, *Goniastrea retiformis*, *Heliopora coerulea*, *Hydnophora microconos*, *Pocillopora eydouxi*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites lutea*, *Turbinaria stellulata*

**Fish SPCs:** *Acanthurus lineatus*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus sp.*, *Anampses caeruleopunctatus*, *Aphareus furca*, *Caranx melampygus*, *Cephalopolis urodeta*, *Chaetodon ephippium*, *Chaetodon punctatofasciatus*, *Chaetodon quadrimaculatus*, *Chaetodon ulietensis*, *Chlorurus sordidus*, *Chromis acares*, *Chromis margaritifer*, *Chrysiptera brownriggii*, *Cirripectes variolosus*, *Ctenochaetus striatus*, *Gomphosus varius*, *Halichoeres hortulanus*, *Heniochus chrysostomus*, *Labroides dimidiatus*, *Lutjanus fulvus*, *Macropharyngodon meleagris*, *Malacanthus latovittatus*, *Melichthys niger*, *Melichthys vidua*, *Neocirrhites armatus*, *Oxycheilinus digrammus*, *Paracanthurus hepatus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Paracirrhites hemisticus*, *Parupeneus insularis*, *Plectroglyphidodon johnstonianus*, *Pomacanthus imperator*, *Pomacentrus vaiuli*, *Pomacromis guamensis*, *Rbinecanthus rectangulus*, *Stegastes fasciolatus*, *Sufflamen bursa*, *Thalassoma amblycephalum*, *Thalassoma purpurum*, *Thalassoma quinquevittatum*, *Valenciennesia strigata*

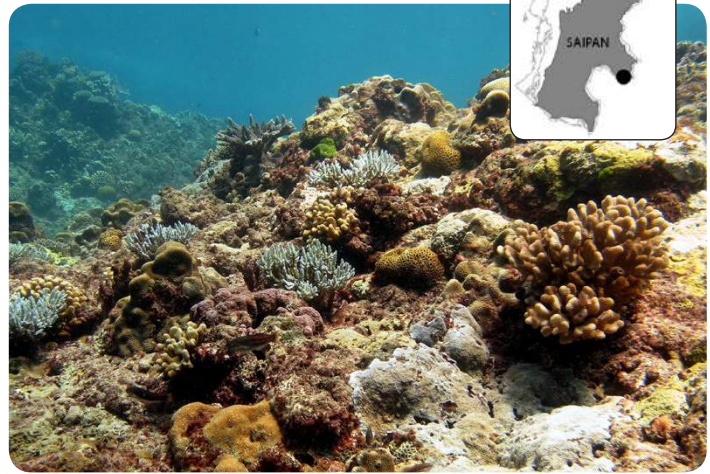
**Fish Swim:** *Acanthurus olivaceus*, *Amphiprion clarkia*, *Balistoides viridescens*, *Chaetodon auriga*, *Chaetodon reticulatus*, *Cheilinus undulatus*, *Coris aygula*, *Letbrinus olivaceus*, *Letbrinus xanthochilus*, *Myripristis berndti*, *Myripristis sp.*, *Naso lituratus*, *Ptereleotris zebra*, *Pterocaesio tile*, *Sargocentron caudimaculatum*, *Sargocentron spiniferum*, *Scarus forsteni*, *Scarus rubroviolaceus*, *Zanclus cornutus*

OVERALL SCORE: MED-HIGH



# 13 - Forbidden Island, Saipan

Forbidden Island gets its name for the difficult hike to access the island, which follows a trail along shores where strong waves can be hazardous to swimmers. Forbidden Island is one of three no-take marine protected areas on the island of Saipan. This site received a high score for herbivore biomass. The benthic community is dominated by two categories – live coral and turfing algae (49% and 44.33%, respectively). Greater than 80% of the total herbivorous fish biomass was comprised in near equal parts by grazers/detritivores and scrapers/excavators (each ~40%). This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results.

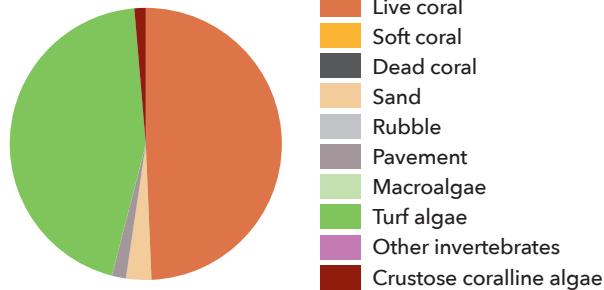


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	13/78	0.86	1.00	0.65	0.22	0.96	0.76	0.54	N/A - MPA	0.19
Intra-Island	8/29	0.87	1.00	0.76	0.22	0.96	0.79	0.54	N/A - MPA	0.19

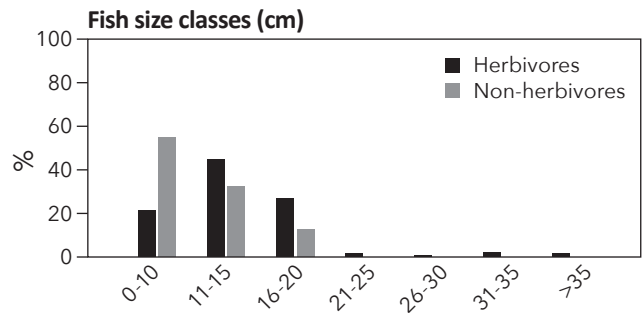
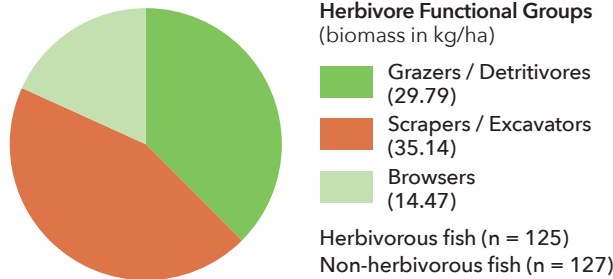
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg + 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acanthastrea echinata, Acropora digitifera, Acropora tenuis, Acropora vaughani, Acropora verweyi, Astreopora listeri, Astreopora myriophthalma, Astreopora randalli, Cyphastrea chalcidicum, Cyphastrea ocellina, Cyphastrea serailia, Favia favus, Favia matthaii, Favia speciosa, Favites abdita, Favites russelli, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea retiformis, Leptastrea purpurea, Leptastrea transversa, Leptoria Phrygia, Millepora tuberosa, Montastrea curta, Montipora efflorescens, Montipora floweri, Montipora grisea, Montipora hoffmeisteri, Montipora nodosa, Pavona varians, Platygyra pini, Pocillopora verrucosa, Porites lichen, Porites lutea, Stylophora mordax*

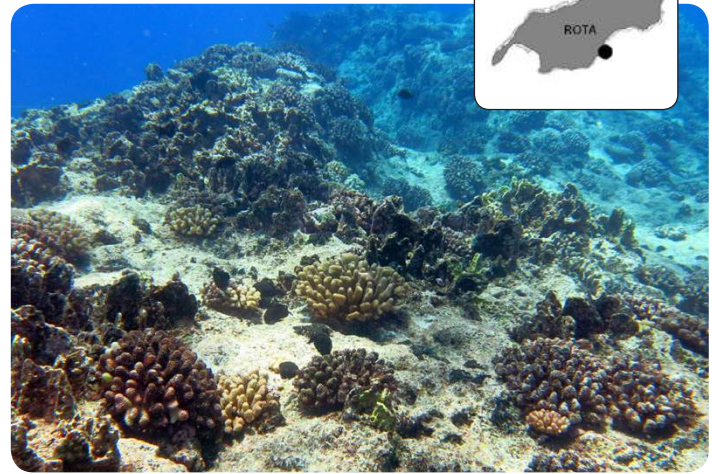
**Coral Swim:** *Acanthastrea brevis, Acropora azurea, Acropora gemmifera, Acropora humilus, Acropora monticulosa, Acropora secale, Favia stelligera, Gardineroseris planulata, Goniopora fruticosa, Hydnoophora microconos, Lobophyllia bempriichii, Millepora dichodon, Millepora platyphyllia, Montipora caliculata, Platygyra daedalea, Pocillopora danae*

**Fish SPCs:** *Acanthurus lineatus, Acanthurus nigricans, Acanthurus nigrofuscus, Acanthurus triostegus, Aphareus furca, Balistapus undulatus, Canthigaster solandri, Caranx melampygus, Centropyge flavissima, Cephalopholis urodeta, Chaetodon meyeri, Cheilinus chlorurus, Chlorurus sordidus, Coris gaimard, Ctenochaetus striatus, Epibulus insidiator, Epinephelus sp., Forcipiger longirostris, Halichoeres hortulanus, Labroides dimidiatus, Macolor macularis, Macolor niger, Melichthys vidua, Naso lituratus, Naso unicornis, Oxycheilinus unifasciatus, Parupeneus insularis, Pomacanthus imperator, Rhinacanthus rectangulus, Scarus forsteni, Scarus rubroviolaceus, Sufflamen bursa, Sufflamen chrysopterum, Sufflamen fraenatum, Thalassoma amblycephalum, Thalassoma quinquevittatum*

OVERALL SCORE: MED-HIGH

# 14 - Haiña Point, Rota

Haiña Point is a site known for its large fish. Several species of sharks, large parrotfish and even Giant groupers have all been sighted here. This site received a high score for coral recruitment. Considering the low coral cover at the site (11%) and that there is no macroalgae and minimal turfing algae (6.67%), the high score for recruitment implies the site is recovering. Uniquely, 100% of the herbivorous fish biomass was comprised of grazers/detritivores. This site boasted some of the largest blunthead parrotfish (*Chlorurus microrhinos*) seen on any of the surveys. Haina Point received one of the highest scores for LBSP. This site is a target for land-based sources of pollution reduction and reef restoration/coral translocation. Examples of actions that can be implemented to reduce LBSP near the identified site include: stream bank stabilization, road and storm drain improvement, other erosion control practices and sewage treatment upgrades. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

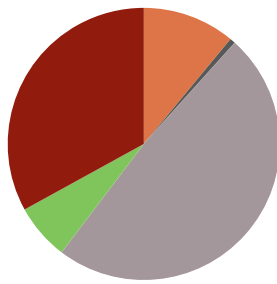


ISLAND SCORE: HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	14/78	0.86	1.00	0.74	0.53	0.99	0.72	0.13	0.14	0.27
Intra-Island	1/24	1.00	1.00	0.74	1.00	1.00	0.78	0.21	0.26	0.20

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community



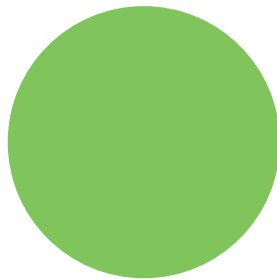
- Live coral
- Soft coral
- Dead coral
- Sand
- Rubble
- Pavement
- Macroalgae
- Turf algae
- Other invertebrates
- Crustose coralline algae

## Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
7.31	5.99	1.32	0	0

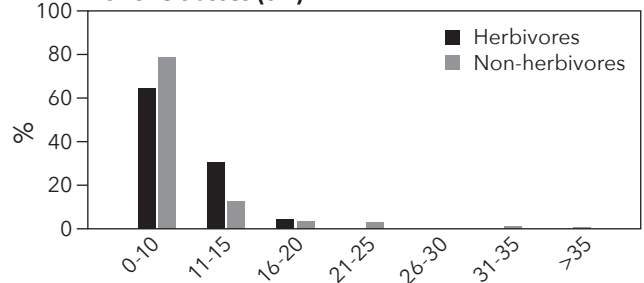
Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



- Herbivore Functional Groups (biomass in kg/ha)**
- Grazers / Detritivores (16.86)
  - Scrapers / Excavators (0)
  - Browsers (0)
- Herbivorous fish (n = 91)  
Non-herbivorous fish (n = 167)

## Fish size classes (cm)



**Coral Quads:** *Acanthastrea echinata*, *Acropora surculosa*, *Astreopora myriophthalma*, *Favia fava*, *Favia pallida*, *Favia stelligera*, *Favites abdita*, *Goniastrea retiformis*, *Hydnophora microconos*, *Leptastrea purpurea*, *Millepora platyphylla*, *Montipora efflorescens*, *Montipora grisea*, *Pavona varians*, *Platygyra pini*, *Pocillopora danae*, *Pocillopora elegans*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites australiensis*, *Porites lobata*, *Porites lutea*, *Psammocora haimeana*

**Coral Swim:** *Acropora digitifera*, *Acropora gemmifera*, *Acropora humilis*, *Acropora tenuis*, *Cyphastrea micropthalma*, *Cyphastrea serailia*, *Favia helianthoides*, *Favites flexuosa*, *Heliopora coerulea*, *Montastrea curta*, *Pocillopora eydouxi*, *Pocillopora woodjonesi*

**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus olivaceus*, *Acanthurus pyroferus*, *Acanthurus sp.*, *Acanthurus triostegus*, *Caranx melampygus*, *Centropyge flavissima*, *Cephalopolis argus*, *Chaetodon auriga*, *Chaetodon citrinellus*, *Chaetodon quadrimaculatus*, *Chrysiptera browriggii*, *Chrysiptera traceyi*, *Cirripectes variolosus*, *Coris gaimard*, *Ctenochaetus striatus*, *Dascyllus reticulatus*, *Decapterus macarellus*, *Forcipiger longirostris*, *Labroides dimidiatus*, *Neocirrhites armatus*, *Paracanthurus hepatus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Parupeneus multifasciatus*, *Plectroglyphidodon dickii*, *Pomacanthus imperator*, *Pomachromis guamensis*, *Ptereleotris zebra*, *Rhinecanthus rectangulus*, *Stegastes fasciolatus*, *Sufflamen bursa*, *Thalassoma amblycephalum*, *Thalassoma quinquevittatum*

**Fish Swim:** *Acanthurus guttatus*, *Apolemichthys trimaculatus*, *Chaetodon reticulatus*, *Chlorurus frontalis*, *Chlorurus microrhinos*, *Coris aygula*, *Epinephelus lanceolatus*, *Lethrinus sp.*, *Malacanthus brevivirostris*, *Melichthys vidua*, *Monotaxis grandoculis*, *Naso tonganus*, *Scarus forsteni*, *Scarus oviceps*, *Scarus rubroviolaceus*, *Variola louti*, *Zanclus cornutus*

Observers: S. McKagan, J. Maynard, S. Johnson, and L. Raymundo

OVERALL SCORE: MED-HIGH

# 15 - Lamanibot, Tinian

Lamanibot is known for the adjacent steep cliffs. While there is a nice stretch of beach at the bottom of the cliffs, the area is nearly inaccessible. Resilience indicator scores are mostly medium-high and the site has low macroalgae cover. This reef is dominated by live coral (47.67%) and crustose coralline algae (14%). Greater than half of the total herbivorous fish biomass was comprised of grazers/detritivores. This site is a great place to find photogenic anemonefishes. This site is a target for fishery regulations and enforcement and reef restoration/coral translocation activities. Examples of actions that can be considered for implementation at this location include increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas.

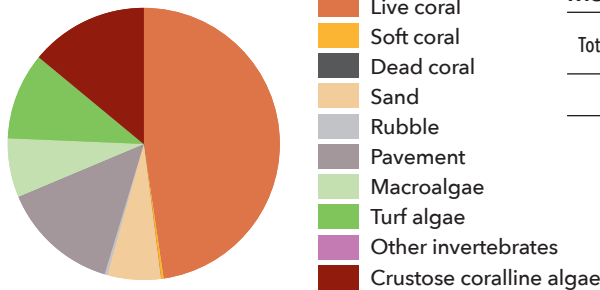


ISLAND SCORE: HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	15/78	0.86	0.90	0.81	0.46	0.90	0.78	0.23	0.43	0.20
Intra-Island	3/25	0.96	0.86	0.87	0.80	0.90	0.78	0.59	0.25	0.57

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-Low ● Med-High ● High

## Benthic community

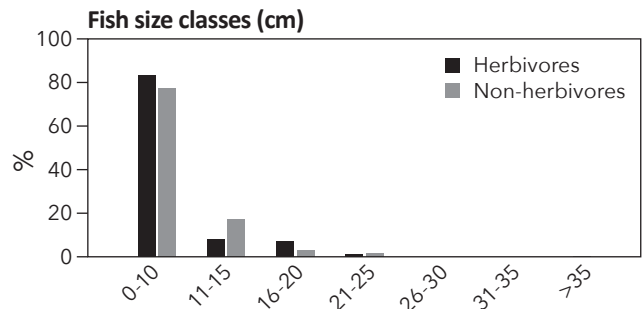
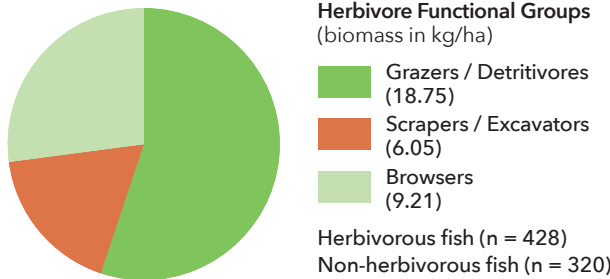


## Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
7.04	7.04	0	0	0

Observed coral species listed under the NMFS ESA listing of 2014: **NONE**.

## Fish community



**Coral Quads:** *Acropora digitifera*, *Cyphastrea agassizi*, *Cyphastrea microphthalma*, *Echinopora lamellosa*, *Favia matthaii*, *Favia* sp., *Favia* sp. A (grl), *Favia stelligera*, *Favites russelli*, *Fungia scutaria*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Lobophyllia hemprichii*, *Montastrea valenciennesi*, *Montipora tuberculosa*, *Montipora venosa*, *Pavona duerdeni*, *Pavona maldiviensis*, *Pavona varians*, *Platygyra pini*, *Porites australiensis*, *Porites lobata*, *Porites lutea*, *Porites* sp.

**Coral Swim:** *Acropora* cf. *cerialis*, *Acropora gemmifera*, *Favia favus*, *Favia pallida*, *Favites flexuosa*, *Herpolitha limax*, *Lobophyllia corymbosa*, *Pavona venosa*, *Platygyra daedalea*, *Psammocora digitata*, *Stylophora mordax*

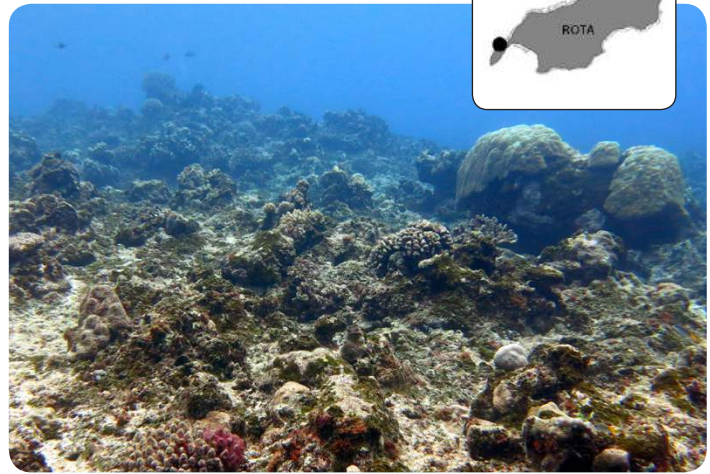
**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus* sp., *Balistapus undulatus*, *Centropyge flavissima*, *Cephalopholis argus*, *Cephalopholis urodeta*, *Chaetodon lunula*, *Chaetodon ornatissimus*, *Chaetodon quadrimaculatus*, *Chaetodon reticulatus*, *Cheilinus oxycephalus*, *Cheilinus trilobatus*, *Cblorurus sordidus*, *Chromis acares*, *Chromis agilis*, *Chromis margaritifer*, *Chromis xanthurus*, *Ctenochaetus hawaiiensis*, *Ctenochaetus striatus*, *Dascyllus trimaculatus*, *Forcipiger flavissimus*, *Gnathodentex aureolineatus*, *Gomphosus varius*, *Halichoeres hortulanus*, *Halichoeres hortulanus*, *Heniochus chrysostomus*, *Labrid* sp., *Labroides dimidiatus*, *Labroides pectoralis*, *Macropharyngodon meleagris*, *Meiacanthus atrodorsalis*, *Melichthys vidua*, *Myripristis bernardi*, *Myripristis kuntee*, *Myripristis violacea*, *Naso lituratus*, *Oxycheilinus digrammus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Paracirrhites hemistictus*, *Plectroglyphidodon lacrymatus*, *Pomacentrus vaiuli*, *Ptereleotris evides*, *Sargocentron caudimaculatum*, *Sargocentron tere*, *Scarus forsteri*, *Stegastes fasciolatus*, *Stethojulis bandanensis*, *Thalassoma hardwicke*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*

**Fish Swim:** *Acanthurus lineatus*, *Amphiprion chrysopterus*, *Anampses twistii*, *Aphareus furca*, *Bodianus axillaris*, *Chaetodon auriga*, *Chaetodon ephippium*, *Chaetodon lunulatus*, *Chaetodon punctatofasciatus*, *Chaetodon ulietensis*, *Cheilodipterus macrodon*, *Chrysiptera traceyi*, *Coris aygula*, *Epibulus insidiator*, *Halichoeres ornatissimus*, *Hemigymnus fasciatus*, *Kyphosus* sp., *Lethrinus xanthochilus*, *Lutjanus bohar*, *Mulloidichthys vanicolensis*, *Oxycheilinus unifasciatus*, *Parupeneus insularis*, *Pempheris ovalensis*, *Scarus niger*, *Scarus rubrovioleaceus*

OVERALL SCORE: MED-HIGH

# 16 - West Harbor\_MMT, Rota

West Harbor\_MMT is located just outside of the West Harbor on Rota and is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. This site received a high score for coral recruitment but medium-low scores for temperature variability and herbivore biomass. This reef is dominated by crustose coralline algae (42.67%) and live coral (26.33%). Greater than 50% of the total herbivorous fish biomass was comprised of browsers. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results.

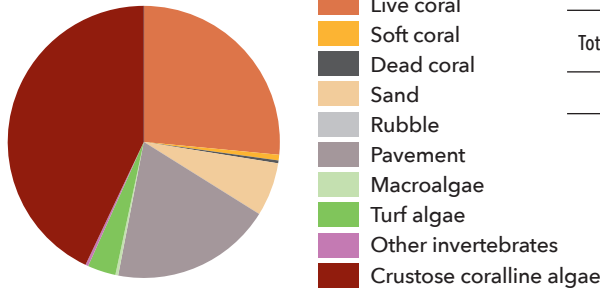


ISLAND SCORE: HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	16/78	0.85	1.00	0.72	0.48	0.93	0.83	0.12	0.36	0.20
Intra-Island	2/24	0.99	0.99	0.72	0.89	0.94	0.89	0.22	0.36	0.71

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community

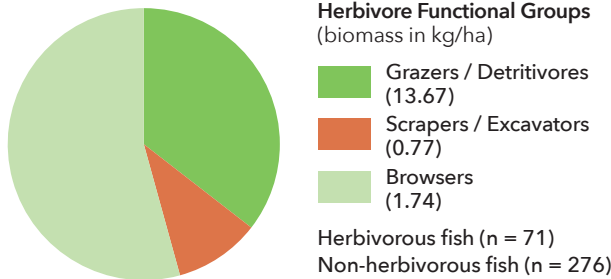


## Mean disease prevalence (%)

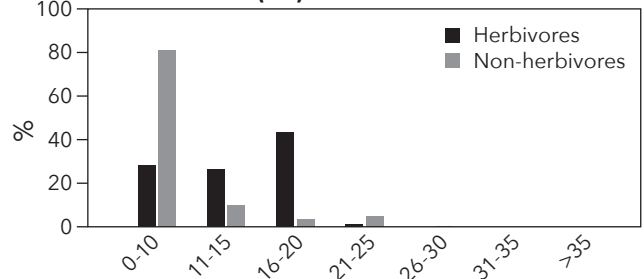
Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
2.74	2.74	0	0	0

Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



## Fish size classes (cm)



**Coral Quads:** *Acanthastrea echinata*, *Acropora surculosa*, *Astreopora myriophthalma*, *Cyphastrea microphthalma*, *Cyphastrea serailia*, *Favia danae*, *Favia stelligera*, *Favites abdita*, *Favites c.f. russelli*, *Favites russelli*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Heliopora coerulea*, *Hydnophora microconos*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Pavona varians*, *Platygyra pini*, *Pocillopora damicornis*, *Pocillopora elegans*, *Pocillopora verrucosa*, *Stylophora mordax*

**Coral Swim:** *Acropora gemmifera*, *Fungia repanda*, *Leptastrea transversa*, *Lobophyllia corymbosa*, *Montipora floweri*, *Montipora hoffmeisteri*, *Oulophyllia crispa*, *Pavona duerdeni*, *Pocillopora meandrina*, *Porites australiensis*, *Porites lobata*, *Psammocora nierstraszii*

**Fish SPCs:** *Acanthurus lineatus*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus* sp., *Anampses caeruleopunctatus*, *Aphareus furca*, *Bodianus anthoides*, *Bodianus axillaris*, *Caranx melampygus*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon citrinellus*, *Chaetodon lunula*, *Chaetodon ornatissimus*, *Chromis agilis*, *Chromis margaritifer*, *Chrysiptera brownriggii*, *Chrysiptera traceyi*, *Cirripectes variolosus*, *Ctenochaetus cyanocheilus*, *Ctenochaetus striatus*, *Forcipiger flavissimus*, *Gobiid* sp., *Halichoeres biocellatus*, *Halichoeres hortulanus*, *Hemigymnus fasciatus*, *Heniochus chrysostomus*, *Labroides bicolor*, *Labroides dimidiatus*, *Macolor niger*, *Melichthys vidua*, *Naso lituratus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Plagiotremus tapeinosoma*, *Plectroglyphidodon johnstonianus*, *Pomacanthus imperator*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Ptereleotris evides*, *Sargocentron tiere*, *Scarus rubroviolaceus*, *Stegastes fasciolatus*, *Sufflamen bursa*, *Sufflamen fraenatum*, *Thalassoma ambycephalum*, *Thalassoma quinquevittatum*, *Zebriasoma flavescens*

**Fish Swim:** *Acanthurus olivaceus*, *Acanthurus xanopterus*, *Chaetodon auriga*, *Chaetodon ephippium*, *Chaetodon melannotus*, *Chaetodon quadrimaculatus*, *Cheilinus trilobatus*, *Lethrinus* sp., *Lethrinus xanthochilus*, *Macropharyngodon meleagris*, *Malacanthus latovittatus*, *Myripristis berndti*, *Naso hexacanthus*, *Neoniphon opercularis*, *Oxycheilinus digrammus*, *Parupeneus multifasciatus*, *Rhinacanthus rectangulus*, *Sargocentron caudimaculatum*, *Scarus forsteni*, *Scarus oviceps*, *Scarus psittacus*, *Thalassoma lutescens*, *Zanclus cornutus*

OVERALL SCORE: MED-HIGH

# 17 - Laolao Bay Mids, Saipan

Laolao Bay Mids is located within central Laolao Bay. This site lies just outside the the Laolao Bay Sea Cucumber Sanctuary, which was established to address overharvesting issues. Bring your camera if you visit this site as you can find anemonefish and large bluespine unicorn fish (*Naso unicornis*, Chamorro = *tataga*) here. This site received a high score in the herbivore biomass indicator, due in large part to the school of *tataga* seen at this site. The reef at this site is dominated primarily by turfing algae (72.5%). Roughly 75% of the total herbivorous fish biomass was comprised in near equal parts by grazers/detritivores and scrapers/excavators. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results.

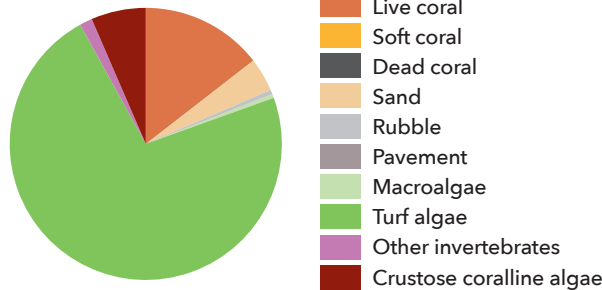


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	17/78	0.85	0.99	0.64	0.31	0.94	0.76	0.44	0.26	0.21
Intra-Island	10/29	0.86	0.99	0.74	0.31	0.94	0.79	0.45	0.21	0.21

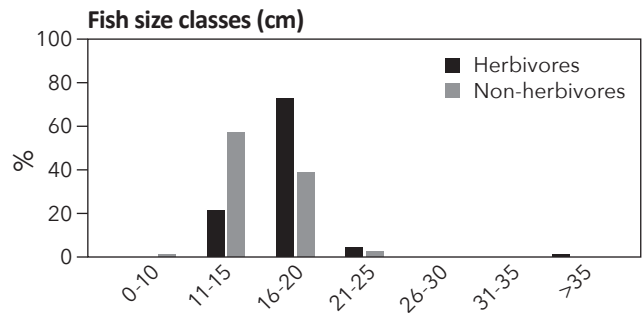
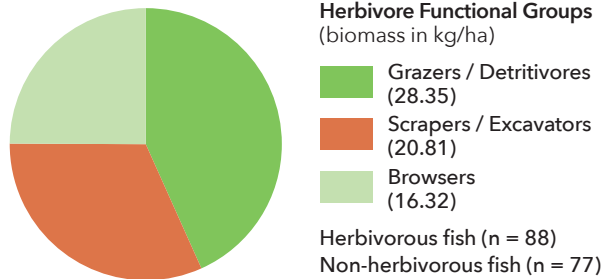
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acanthastrea brevis*, *Acanthastrea echinata*, *Acropora digitifera*, *Acropora humilus*, *Astreopecten listeri*, *Astreopecten myriophthalma*, *Astreopecten randalli*, *Cyphastrea chalcidicum*, *Cyphastrea serailia*, *Echinopora lamellosa*, *Favia fava*, *Favia matthaii*, *Favia speciosa*, *Favites abdita*, *Favites russelli*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Lobophyllia hemprichii*, *Montipora efflorescens*, *Montipora grisea*, *Montipora hoffmeisteri*, *Montipora nodosa*, *Pavona duerdeni*, *Pocillopora damicornis*, *Pocillopora danae*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites lobata*, *Porites rus*, *Stylocoeniella armata*, *Stylophora mordax*

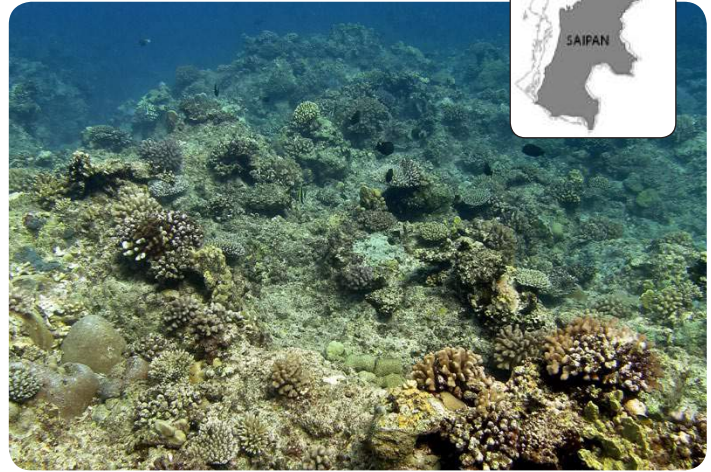
**Coral Swim:** *Acropora azurea*, *Acropora gemmifera*, *Acropora robusta*, *Acropora secale*, *Acropora surculosa*, *Acropora tenuis*, *Acropora vaughani*, *Cyphastrea japonica*, *Favia stelligera*, *Goniastrea retiformis*, *Goniopora minor*, *Hydnophora microconos*, *Montastrea curta*, *Pavona varians*, *Pocillopora eydouxi*, *Pocillopora woodjonesi*, *Porites lutea*

**Fish SPCs:** *Abudefduf vaigiensis*, *Acanthurus lineatus*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Amphiprion chrysopterus*, *Balistapus undulatus*, *Canthigaster solandri*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon auriga*, *Chaetodon citrinellus*, *Chaetodon lunula*, *Chaetodon mertensii*, *Chaetodon trifascialis*, *Chaetodon unimaculatus*, *Cheilinus chlorourus*, *Chlorurus sordidus*, *Ctenochaetus striatus*, *Forcipiger longirostris*, *Halichoeres hortulanus*, *Halichoeres ornatus*, *Hemigymnus melapterus*, *Labroides dimidiatus*, *Macropharyngodon meleagris*, *Naso lituratus*, *Naso unicornis*, *Novaculichthys taeniourus*, *Oxycheilinus unifasciatus*, *Scarus psittacus*, *Scolopsis lineata*, *Siganus spinus*, *Stethojulis bandanensis*, *Stethojulis strigiventer*, *Sufflamen bursa*, *Sufflamen chrysopterus*, *Sufflamen fraenatum*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Zanclus cornutus*

OVERALL SCORE: MED-HIGH

# 18 - Lanyas\_MMT, Saipan

'Laña' is a Chamorro word used to express feelings ranging from mild surprise to complete disgust. Local surfers chose this name due to feeling the need to express this feeling after surviving riding waves here. This site is within the Managaha Marine Conservation Area. This reef scored high for the temperature variability indicator and also has high coral diversity and temperature variability. 99% of the benthic community is made up by bare pavement (54%) and live coral (45%). Greater than 80% of the total herbivorous fish biomass was comprised in near equal parts by grazers/detritivores and scrapers/excavators. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2012. This site may warrant management attention for reasons distinct from the resilience assessment results.

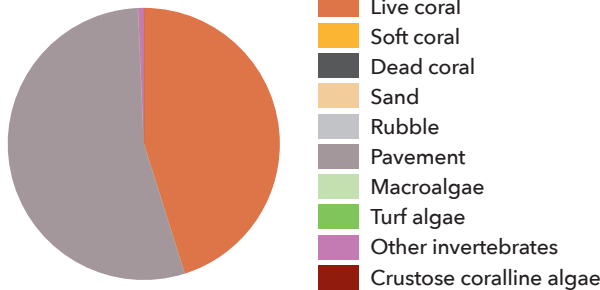


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	18/78	0.85	1.00	0.60	0.24	0.98	0.96	0.29	N/A - MPA	0.19
Intra-Island	11/29	0.86	1.00	0.69	0.24	0.98	1.00	0.29	N/A - MPA	0.19

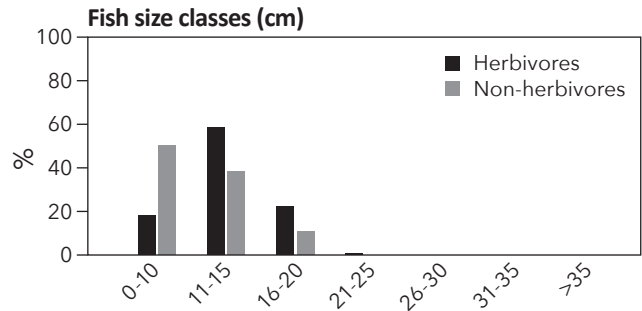
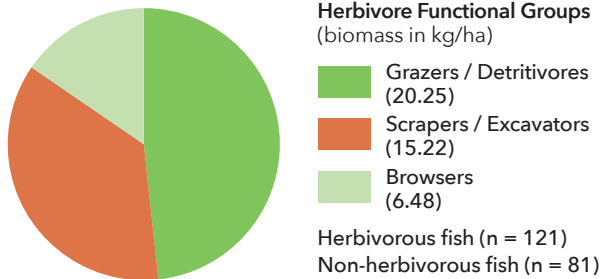
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg + 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



**Coral Quads:** *Acropora digitifera, Acropora gemmifera, Acropora humilis, Acropora surculosa, Acropora tenuis, Acropora vaughani, Acropora verweyi, Astreopora listeri, Astreopora myriophthalma, Cyphastrea ocellina, Cyphastrea serailia, Favia favaus, Favia matthaii, Favia speciosa, Favia stelligera, Favites abdita, Favites russelli, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea retiformis, Leptastrea purpurea, Millepora platyphyllia, Montipora efflorescens, Montipora floweri, Montipora grisea, Montipora hoffmeisteri, Pavona varians, Platygyra pini, Pocillopora danae, Pocillopora elegans, Pocillopora meandrina, Pocillopora verrucosa, Porites lobata, Porites vaughani, Stylophora mordax*

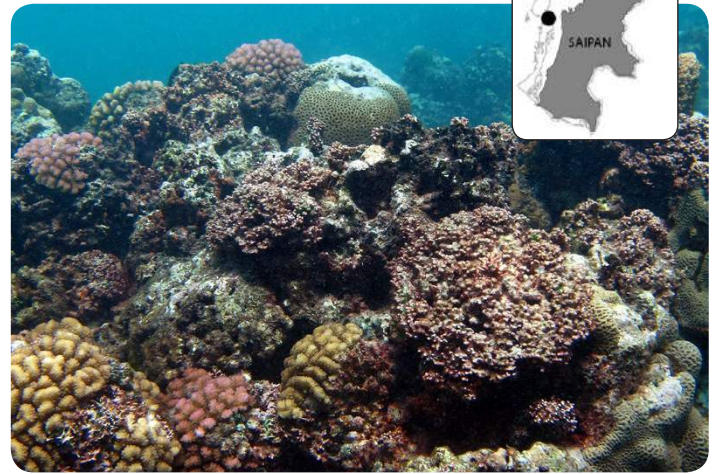
**Coral Swim:** *Acropora globiceps, Acropora Millepora, Acropora monticulosa, Acropora nasuta, Acropora robusta, Acropora secale, Astreopora randalli, Cyphastrea chalcidicum, Heliopora coerulea, Hydnothpora microconos, Leptoria Phrygia, Millepora dichodon, Millepora tuberosa, Montastrea curta, Montipora monasteriata, Montipora nodosa, Montipora tuberculosa, Pavona duerdeni, Pocillopora eydouxi, Pocillopora woodjonesi, Porites australiensis, Porites lichen, Porites lutea, Porites rus*

**Fish SPCs:** *Acanthurus lineatus, Acanthurus nigricans, Acanthurus nigrofuscus, Balistapus undulatus, Cantherhines pardalis, Centropyge flavissima, Cephalopholis wrodeti, Chaetodon auriga, Chaetodon citrinellus, Chlorurus sordidus, Ctenochaetus striatus, Halichoeres hortulanus, Halichoeres ornatus, Halichoeres sp., Labroides dimidiatus, Melichthys vidua, Naso lituratus, Parupeneus multifasciatus, Ptereleotris euides, Scarus forsteni, Scarus psittacus, Sufflamen chrysopterum, Sufflamen fraenatum, Thalassoma quinquevittatum, Zanclus cornutus*

OVERALL SCORE: MED-HIGH

# 19 - Peysonnelia Reef, Saipan

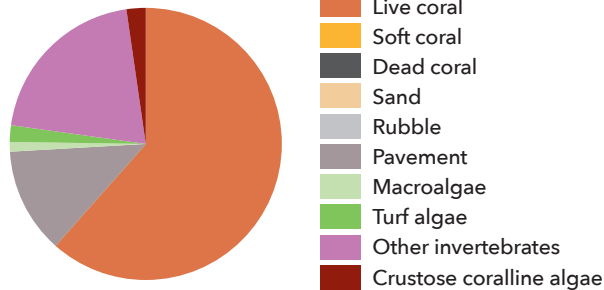
Peysonnelia Reef is a reef dominated by *Peysonnelia*, a genus of encrusting fleshy macroalgae. This site is a great spot to find photogenic anemonefishes. This site has high scores for bleaching resistance and temperature variability. The site has high coral cover (>60%). However, this site is also highly accessible to fishers and has high scores for LBSP. This site is a target for LBSP reduction, fishery regulations & enforcement and reef restoration/coral translocation strategies. Examples of actions that can be considered for implementation at this location include road & storm drain improvements and size regulations & bag/catch limits.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	19/78	0.85	1.00	0.86	0.29	0.81	0.96	0.07	0.68	1.00
Intra-Island	9/29	0.87	1.00	1.00	0.29	0.81	1.00	0.07	0.66	1.00

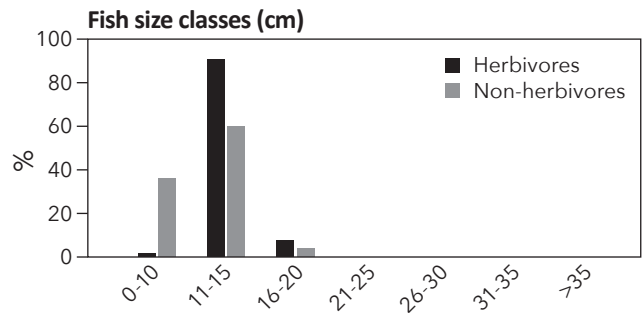
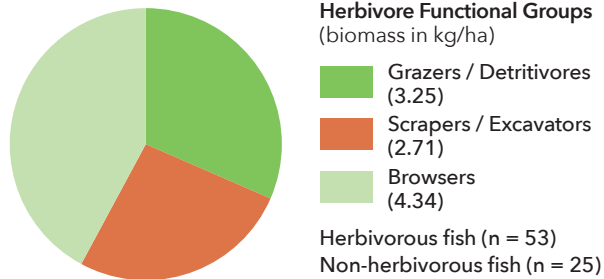
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



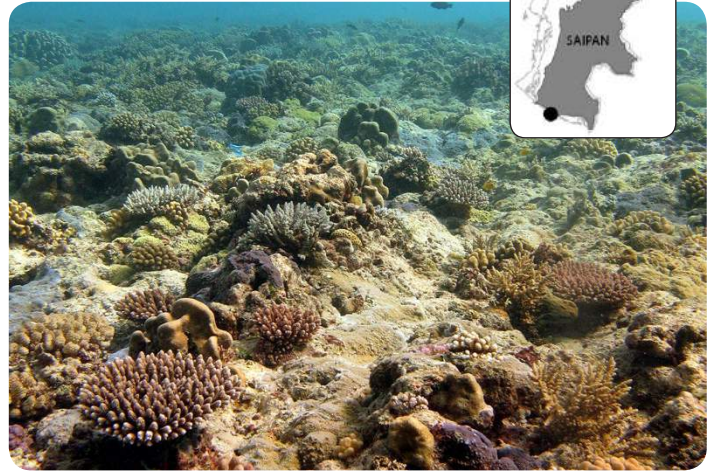
**Coral Quads:** *Acanthastrea echinata*, *Acanthastrea hillae*, *Echinopora lamellosa*, *Favia favaus*, *Favia matthaii*, *Favia rotumana*, *Favites abdita*, *Favites flexuosa*, *Favites russelli*, *Goniastrea aspera*, *Goniastrea pectinata*, *Goniastrea retiformis*, *Leptastrea purpurea*, *Leptoseris mycetoseroides*, *Montastrea curta*, *Pavona divaricata*, *Pavona duerdeni*, *Pavona varians*, *Platygyra pini*, *Pocillopora damicornis*, *Porites lichen*, *Porites rus*, *Stylocoeniella armata*, *Stylophora mordax*

**Coral Swim:** *Acropora gemmifera*, *Acropora vaughani*, *Cyphastrea chalcidicum*, *Goniastrea edwardsi*, *Goniopora fruticosa*, *Isopora palifera*, *Leptoria Phrygia*, *Platygyra daedalea*

**Fish SPCs:** *Acanthurus nigricans*, *Amphiprion melanopus*, *Chaetodon melanotus*, *Chaetodon quadrimaculatus*, *Chaetodon reticulatus*, *Cheilinus trilobatus*, *Chlorurus sordidus*, *Ctenochaetus striatus*, *Halichoeres* sp., *Hemigymnus melapterus*, *Naso lituivatus*, *Oxyrrhites typus*, *Parupeneus insularis*, *Scarus rubroviolaceus*, *Stethojulis bandanensis*, *Thalassoma Hardwicke*, *Thalassoma quinquevittatum*, *Zanclus cornutus*

## 20 - Coral Ocean Point, Saipan

Coral Ocean Point is located on the southern shores of Saipan. This site is a great spot to find photogenic anemonefishes. Coral Ocean Point has a high score for coral recruitment and temperature variability. Greater than 90% of the benthic community at the site is made up by either live coral or turfing algae (57.33% and 36.67%, respectively). Greater than 50% of the total herbivorous fish biomass is comprised of grazers. This site is highly accessible to fishers and has a medium-high score for LBSP. This site is a target for land-based sources of pollution reduction, fishery regulations & enforcement, bleaching monitoring and supporting recovery as well as tourism outreach and stewardship activities. This is the only site that met 4 (or more) of the criteria set to identify targets for management actions. Example of actions that can be considered for implementation at this location include road & storm drain improvements, size regulations & bag/catch limits, increased monitoring during warm seasons or developing targeted outreach and stewardship programs.

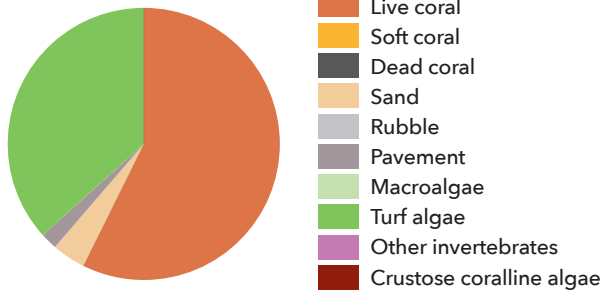


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	20/78	0.85	1.00	0.51	0.45	1.00	0.94	0.19	0.61	0.27
Intra-Island	14/29	0.85	1.00	0.60	0.45	1.00	0.97	0.19	0.58	0.27

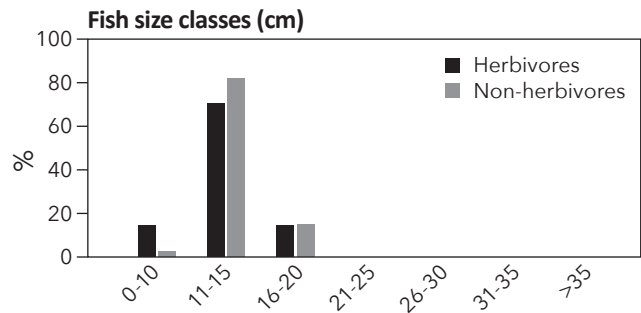
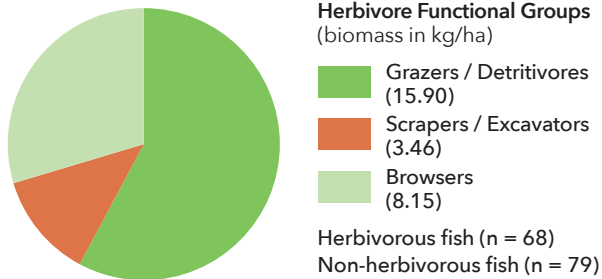
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE**.

### Fish community



**Coral Quads:** *Acropora azurea*, *Acropora digitifera*, *Acropora gemmifera*, *Acropora surculosa*, *Acropora tenuis*, *Acropora verweyi*, *Astreopora myriophthalma*, *Astreopora randalli*, *Cyphastrea chalcidicum*, *Cyphastrea serailia*, *Favia favus*, *Favia matthaii*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Hydnophora microconos*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Millepora tuberosa*, *Montipora calculata*, *Montipora efflorescens*, *Montipora floweri*, *Montipora grisea*, *Montipora boffmeisteri*, *Montipora monasteriata*, *Montipora verrilli*, *Pavona duerdeni*, *Pavona varians*, *Platgyra pini*, *Pocillopora eydouxi*, *Porites lichen*, *Porites vaughani*, *Stylocoenelia armata*, *Stylophora mordax*

**Coral Swim:** *Acropora humilis*, *Acropora robusta*, *Favia speciosa*, *Lobophyllia hemprichii*, *Pocillopora danae*, *Pocillopora elegans*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Pocillopora woodjonesi*, *Porites lobata*

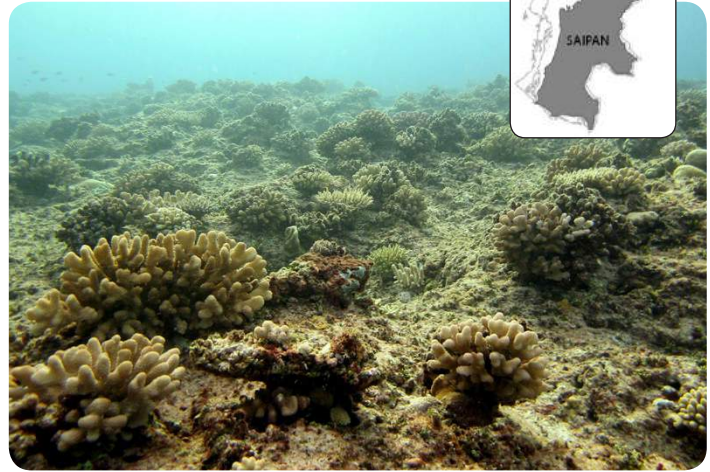
**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Amphiprion chrysopterus*, *Balistapus undulatus*, *Canthigaster solandri*, *Centropyge flavissima*, *Centropyge heraldi*, *Cephalopholis urodeta*, *Chaetodon citrinellus*, *Chaetodon reticulatus*, *Chaetodon unimaculatus*, *Chlorurus sordidus*, *Ctenochaetus striatus*, *Halichoeres hortulanus*, *Halichoeres marginatus*, *Halichoeres ornatissimus*, *Halichoeres trimaculatus*, *Labrid sp.*, *Macolor niger*, *Naso lituratus*, *Oxycheilinus unifasciatus*, *Scarus psittacus*, *Sufflamen bursa*, *Sufflamen chrysopterus*, *Sufflamen fraenatum*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*

OVERALL SCORE: MED-HIGH



## 21 - Elbow Reef, Saipan

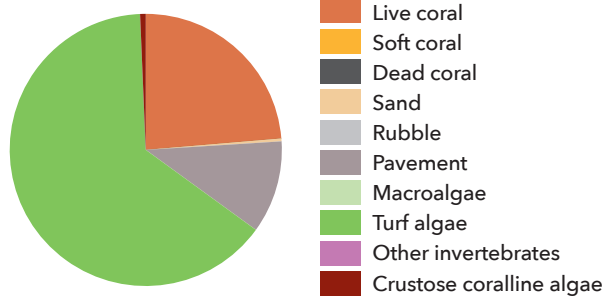
Elbow Reef is located just inside the Managaha Marine Conservation Area. This part of the barrier reef surrounding the Saipan lagoon has high wave exposure and very strong currents. Elbow reef scored high for the coral recruitment indicator but has medium-low scores for bleaching resistance, temperature variability and herbivore biomass. The benthic community was dominated by turfing algae (64.33%). Greater than 80% of the total herbivorous fish biomass was comprised of grazers/detritivores. This site is a great spot to find photogenic anemonefish and large yellowlip emperors. This site is a target for bleaching monitoring and supporting recovery so should be monitored during upcoming warm seasons.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	21/78	0.85	1.00	0.64	0.52	0.99	0.79	0.13	N/A - MPA	0.19
Intra-Island	12/29	0.85	1.00	0.74	0.52	0.99	0.82	0.13	N/A - MPA	0.19

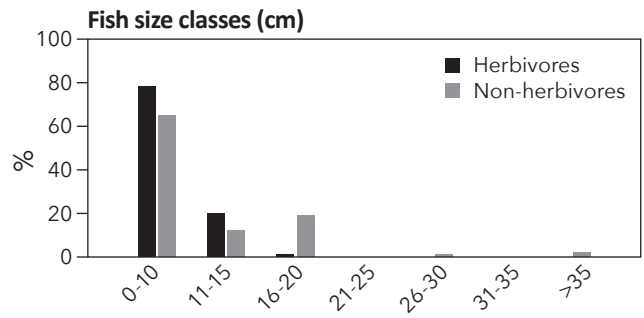
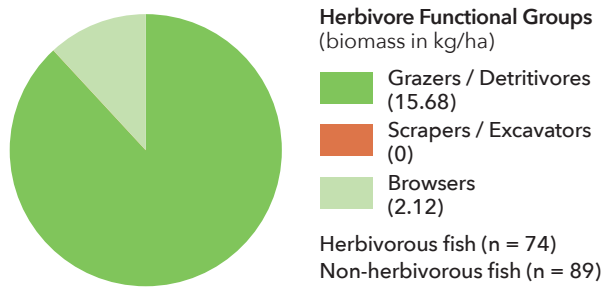
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



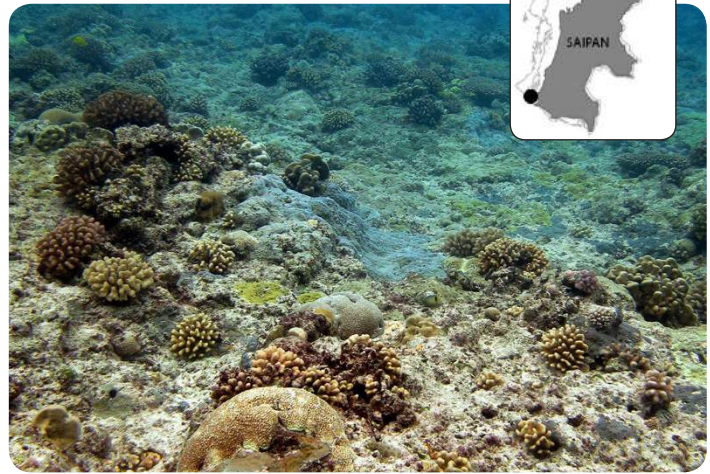
**Coral Quads:** *Acropora humilis, Acropora secale, Acropora tenuis, Acropora verweyi, Astreopora listeri, Astreopora myriophthalma, Astreopora randalli, Cyphastrea serailia, Favia favius, Favia matthaii, Favia stelligera, Favites abdita, Favites russelli, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea retiformis, Leptastrea purpurea, Millepora tuberosa, Montipora hoffmeisteri, Montipora nodosa, Pavona varians, Pocillopora ankei, Pocillopora elegans, Pocillopora meandrina, Pocillopora verrucosa, Porites lichen, Porites lobata, Porites lutea, Psammocora haimeana, Stylocoeniella armata, Stylophora mordax*

**Coral Swim:** *Acropora digitifera, Acropora nasuta, Acropora vaughani, Millepora platyphyllia, Montipora grisea, Pavona duerdeni, Pocillopora danae, Pocillopora eydouxi, Pocillopora woodjonesi*

**Fish SPCs:** *Acanthurus nigrofusus, Acanthurus olivaceus, Amphiprion chrysopterus, Aprion virescens, Balistapus undulatus, Cantherhines pardalis, Centropyge flavissima, Cephalopholis urodeta, Cheilinus chlorourus, Forcipiger longirostris, Halichoeres margaritaceus, Labroides dimidiatus, Lethrinus rubrioperculatus, Lethrinus xanthochilus, Melichthys vidua, Naso lituratus, Paracanthurus hepatus, Parupeneus multifasciatus, Sufflamen chrysopterygum*

## 22 - Point Break Reef, Saipan

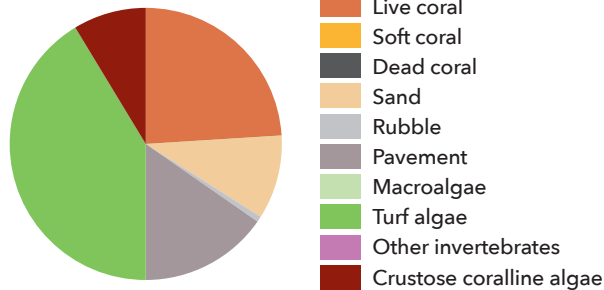
Point Break Reef is one of the southeastern reefs on Saipan. The reef here is adjacent to the island's most consistent breaking 'wave' — the Point Break flowrider mechanical wave at the Pacific Islands Club resort. This site is a great spot to find photogenic anemonefish. This site has a high score for temperature variability and medium-high scores for all other indicators excepting bleaching resistance, which is medium-low. The benthic community is dominated by turfing algae (41.33) and coral cover is 24%. Greater than 80% of the total herbivorous fish biomass was comprised of grazers/detritivores. Point Break Reef is highly accessible to fishers and has a medium-high score for LBSP. This site is a target for land-based sources of pollution reduction and fishery regulations and enforcement activities. Examples of actions that can be considered for implementation at this location include road and storm drain improvements and size regulations & bag/catch limits.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>22/78</b>	0.84	1.00	0.62	0.30	0.95	0.92	0.24	0.68	0.31
Intra-Island	<b>13/29</b>	0.85	1.00	0.72	0.30	0.95	0.96	0.25	0.66	0.31

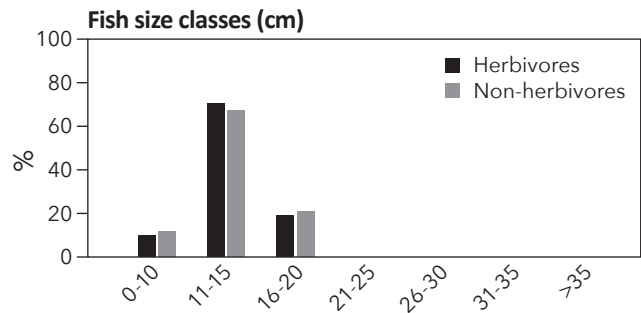
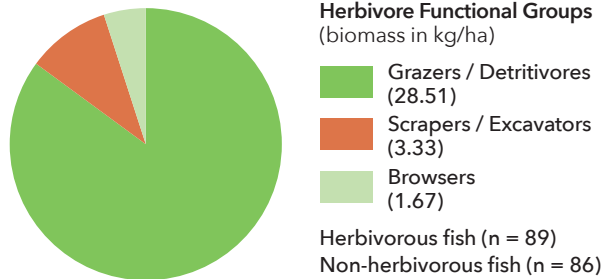
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Acanthastrea echinata, Acropora digitifera, Acropora surculosa, Acropora tenuis, Astreopora myriophthalma, Astreopora randalli, Cyphastrea chalcidicum, Cyphastrea serailia, Favia matthaii, Favia stelligera, Favites abdita, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea retiformis, Hydnothra microconos, Leptastrea purpurea, Leptoria Phrygia, Montastrea curta, Montipora caliculata, Montipora floweri, Montipora grisea, Montipora hoffmeisteri, Montipora monasteriata, Montipora verrilli, Pavona duerdeni, Pavona varians, Platygyra pini, Pocillopora danae, Pocillopora meandrina, Porites australiensis, Porites lichen, Porites lobata, Porites vaughani*

**Fish SPCs:** *Acanthurus nigricans, Acanthurus nigrofuscus, Amphiprion chrysopterus, Aphareus furca, Balistapus undulatus, Centropyge flavissima, Cephalopholis wrodetta, Chaetodon auriga, Chaetodon lunula, Chaetodon ornatissimus, Chaetodon reticulatus, Chaetodon ulietensis, Chlorurus sordidus, Ctenochaetus striatus, Forcipiger longirostris, Halichoeres hortulanus, Labroides dimidiatus, Melichthys vidua, Naso lituratus, Oxycheilinus unifasciatus, Parupeneus insularis, Parupeneus multifasciatus, Ptereleotris evides, Sargocentron caudimaculatum, Scarus psittacus, Stethojulis strigiventer, Sufflamen fraenatum, Thalassoma lutescens, Thalassoma quinquevittatum, Zanclus cornutus, Zebrasoma flavescens*

## 23 - Unai Chulu, Tinian

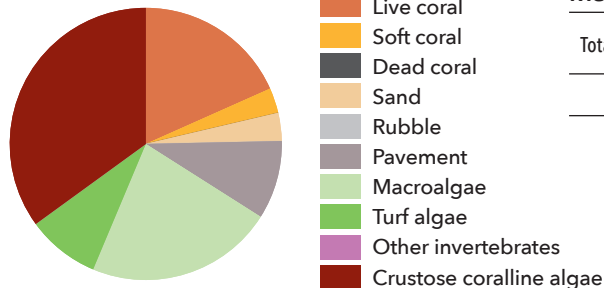
Unai Chulu, along with Unai Babui (see p. 10), was used by US forces as an invasion beach during World War II. These beaches were strategically selected for their small size making them an unlikely place to stage an amphibious landing. A rare daylight squid sighting occurred at this site, the only one in all of our surveys. This site has high scores for coral recruitment and medium-high scores for bleaching resistance, coral diversity and herbivore biomass. The benthic community is dominated by reef accreting substrate; crustose coralline algae (35%) and live coral (18.33%). This site has high macroalgae cover when compared to the other sites near Tinian. Roughly 75% of the total herbivorous fish biomass was comprised of scrapers/excavators. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results. The Threatened coral species *Acropora globiceps* was seen in the shallow waters (<4 m) adjacent to this site during our surveys in May/June of 2014.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	23/78	0.84	0.69	0.80	0.48	0.98	0.78	0.25	0.35	0.19
Intra-Island	5/25	0.94	0.56	0.87	0.83	0.98	0.78	0.62	0.14	0.56

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

### Benthic community

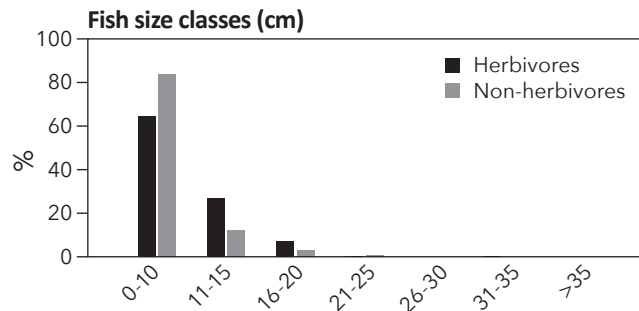
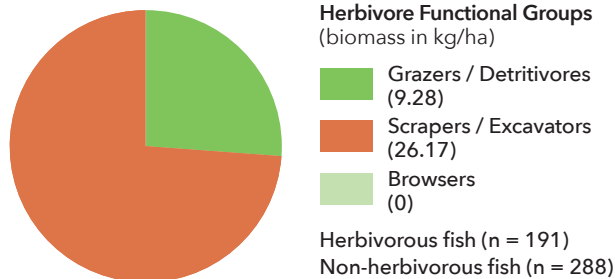


### Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
2.92	2.92	0	0	0

Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Acanthastrea brevis*, *Acanthastrea echinata*, *Astreopora listeri*, *Cyphastrea chalcidicum*, *Cyphastrea microphthalmalma*, *Cyphastrea serailia*, *Favia danae*, *Favia fava*, *Favia matthaii*, *Favia stelligera*, *Favites russelli*, *Fungia scutaria*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Hydnophora microconos*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Lobophyllia hemprichii*, *Montastrea valenciennesi*, *Montipora nodosa*, *Pavona varians*, *Platygyra daedalea*, *Platygyra pini*, *Plesiastrea versipora*, *Porites australiensis*, *Porites lobata*, *Porites* sp. 2648, *Psammocora haimeana*, *Psammocora* sp. 2627

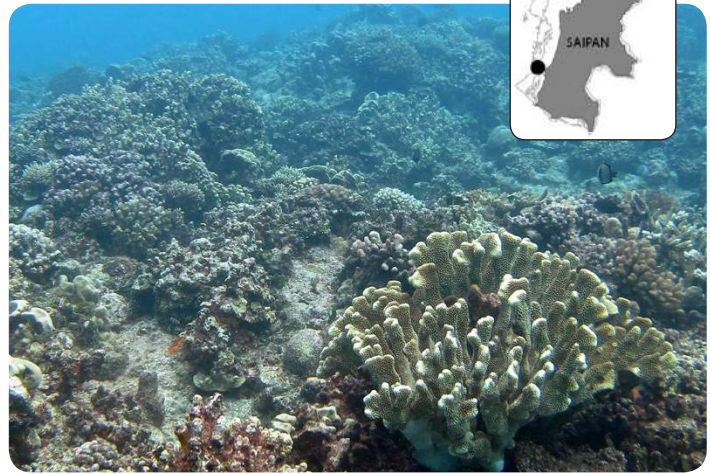
**Coral Swim:** *Lobophyllia corymbosa*, *Pavona maldiviensis*, *Porites rus*, *Stylophora mordax*

**Fish SPCs:** *Acanthurus lineatus*, *Acanthurus nigricans*, *Acanthurus nigrofasciatus*, *Acanthurus* sp., *Anampses caeruleopunctatus*, *Aphareus furca*, *Balistapus undulatus*, *Canthigaster solandri*, *Centropyge flavissima*, *Cephalopholis wrodeti*, *Chaetodon punctatofasciatus*, *Cheilinus oxycephalus*, *Chlorurus sordidus*, *Chromis acares*, *Chromis agilis*, *Chromis margaritifer*, *Coris aygula*, *Coris gaimard*, *Ctenochaetus cyanocheilus*, *Ctenochaetus striatus*, *Gnathodentex aureolineatus*, *Halichoeres hortulanus*, *Labroides dimidiatus*, *Macropharyngodon meleagris*, *Melichthys vidua*, *Oxycheilinus digrammus*, *Oxycheilinus unifasciatus*, *Paracirrhites arcatus*, *Parupeneus insularis*, *Plectroglyphidodon lacrymatus*, *Pomacentrus vaiuli*, *Ptereleotris evides*, *Pygoplites diacanthus*, *Sargocentron caudimaculatum*, *Sargocentron tiere*, *Scarus niger*, *Scarus oviceps*, *Scarus psittacus*, *Stegastes fasciolatus*, *Stethojulis bandanensis*, *Sufflamen fraenatum*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*

**Fish Swim:** *Abudefduf vaigiensis*, *Acanthurus guttatus*, *Anampses twistii*, *Bodianus axillaris*, *Cephalopholis argus*, *Chaetodon ephippium*, *Chaetodon lunula*, *Chaetodon lunulatus*, *Chaetodon ornatissimus*, *Chaetodon quadrimaculatus*, *Chaetodon reticulatus*, *Cheilinus chlorourus*, *Chromis xanthurus*, *Chrysiptera brownriggii*, *Cirripectes variolosus*, *Forcipiger longirostris*, *Gobiid* sp., *Gomphosus varius*, *Hemigymnus fasciatus*, *Kyphosus cinerascens*, *Lethrinus xanthurus*, *Lutjanus bohar*, *Melichthys niger*, *Naso lituratus*, *Order Teuthida*, *Paracirrhites forsteri*, *Paracirrhites bemistictus*, *Parupeneus cyclostomus*, *Pempheris oualensis*, *Plectroglyphidodon dickii*, *Plectroglyphidodon phoenixensis*, *Rhinecanthus rectangulus*, *Scarus rubroviolaceus*, *Siphamia* sp., *Thalassoma purpuraceum*, *Zanclus cornutus*

## 24 - Grand Hotel\_MMT, Saipan

Grand Hotel\_MMT is adjacent to the Kanoa Resort (formerly known as the Saipan Grand Hotel) and is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. This site has a high score for temperature variability and medium high scores for all other indicators excepting herbivore biomass, which is medium-low. The benthic community at this site is dominated by live coral (37%) and pavement (37.67%). The total herbivorous fish biomass was comprised in near equal parts by grazers/detritivores and scrapers/excavators. Grand Hotel\_MMT has high fishing access and a medium-high score for LBSP. This site is a target for land-based sources of pollution reduction and fishery regulations and enforcement activities. Examples of actions that can be considered for implementation at this location include road & storm drain improvements and size regulations & bag/catch limits.

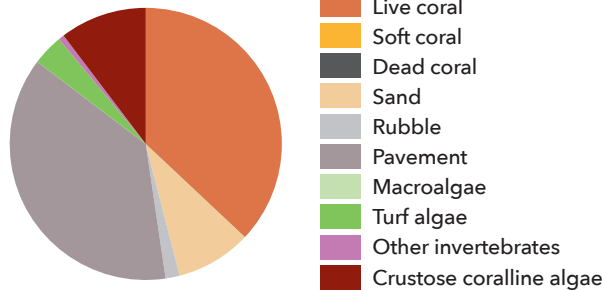


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	24/78	0.84	1.00	0.70	0.27	0.98	0.92	0.12	0.71	0.27
Intra-Island	15/29	0.85	1.00	0.81	0.27	0.98	0.96	0.12	0.69	0.27

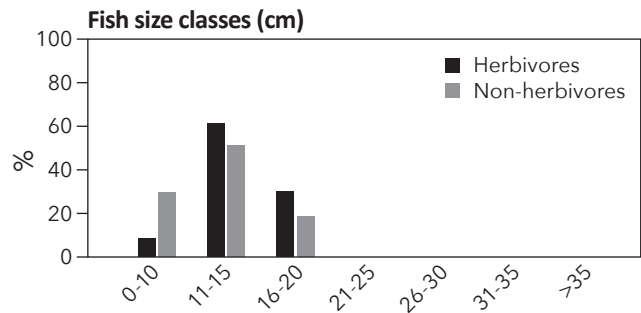
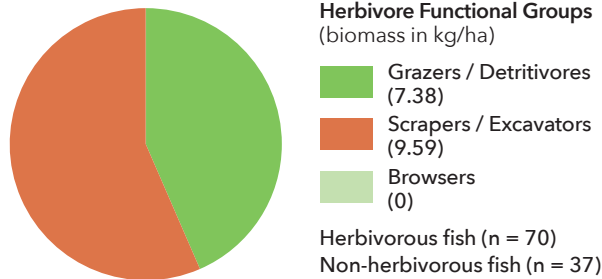
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg + 1 SD) ● High (>avg + 1 SD) ● Low ● Med-Low ● Med-High ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Acanthastrea echinata, Acropora azurea, Acropora monticulosa, Acropora palifera, Acropora tenuis, Acropora verweyi, Astreopora myriophthalma, Cyphastrea senalia, Favia matthaii, Favia stelligera, Favites abdita, Favites russelli, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea retiformis, Hydnothya microconos, Leptastrea purpurea, Leptoria Phrygia, Millepora foveolata, Montipora grisea, Pavona varians, Platygyra daedalea, Platygyra pini, Porites lichen, Porites lobata, Porites rus, Porites vaughani, Stylocoeniella armata, Stylophora mordax*

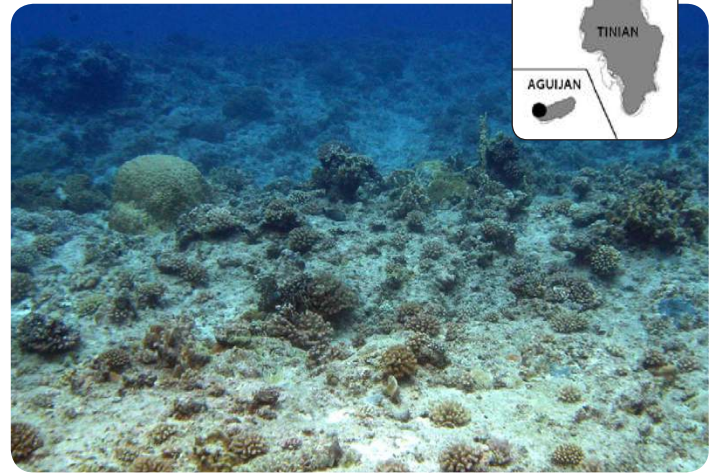
**Coral Swim:** *Acropora gemmifera, Acropora robusta, Echinopora lamellosa, Goniopora fruticosa, Isopora palifera, Millepora platyphyllia, Millepora tuberosa, Pavona duerdeni, Pocillopora danae, Pocillopora verrucosa*

**Fish SPCs:** *Acanthurus nigricans, Centropyge flavissima, Cephalopholis urodeta, Chaetodon mertensii, Chaetodon reticulatus, Cheilinus chlorourus, Chlorurus sordidus, Ctenochaetus striatus, Gomphosus varius, Halichoeres hortulanus, Labroides dimidiatus, Novaculichthys taeniourus, Scarus psittacus, Thalassoma lutescens, Thalassoma quinquevittatum, Zebrasoma flavescens*

OVERALL SCORE: MED-HIGH

## 25 - Aguigan Island\_MMT, Tinian

Aguigan Island\_MMT is located just a few miles west of Tinian and is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. The island is small and has no beaches so is difficult to access. The island is currently uninhabited. This site received a high score for the temperature variability resilience indicator compared to all sites surveyed. This site has a high score for temperature variability but medium-low scores for bleaching resistance and herbivore biomass. The benthic community is made up by greater than 50% reef accreting substrate; live coral (43%) and crustose coralline algae (11.67%). Greater than 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site is a target for bleaching monitoring and supporting recovery so should be monitored during upcoming warm seasons. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

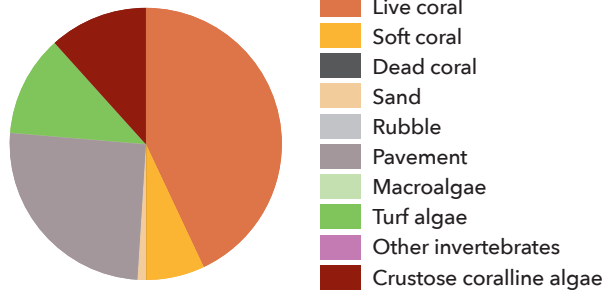


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	25/78	0.84	1.00	0.63	0.25	0.99	0.95	0.19	0.34	0.19
Intra-Island	12/25	0.87	1.00	0.68	0.43	0.99	0.95	0.27	0.12	0.56

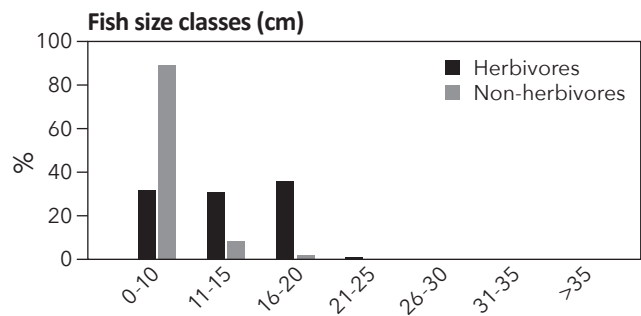
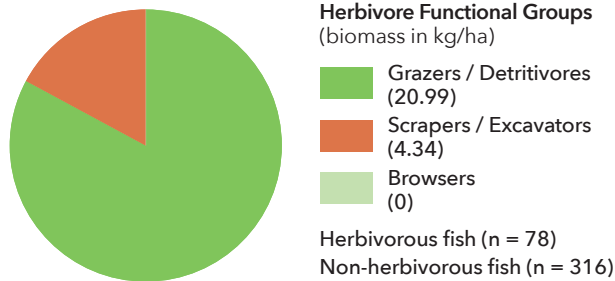
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

### Fish community



**Coral Quads:** *Acanthastrea echinata*, *Acropora humilis*, *Acropora selago*, *Acropora tenuis*, *Astreopora listeri*, *Astreopora myriophthalma*, *Astreopora randalli*, *Cyphastrea chalcidicum*, *Cyphastrea microphthalma*, *Cyphastrea serailia*, *Favia danae*, *Favia fava*, *Favia helianthoides*, *Favia pallida*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Heliopora coerulea*, *Hydnophora microconos*, *Leptastrea purpurea*, *Leptastrea transversa*, *Leptoria Phrygia*, *Montipora caliculata*, *Montipora monticulosa*, *Montipora nodosa*, *Montipora venosa*, *Pavona duerdeni*, *Pavona varians*, *Pocillopora danae*, *Pocillopora elegans*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites australiensis*, *Porites lichen*, *Porites lobata*, *Porites lutea*, *Porites rus*, *Porites vaughani*, *Psammocora haimeana*, *Psammocora nierstraszi*, *Stylophora mordax*

**Coral Swim:** *Acropora gemmifera*, *Acropora globiceps*, *Acropora secale*, *Acropora surculosa*, *Echinopora lamellosa*, *Favia matthaii*, *Millepora platyphylla*, *Millepora tuberosa*, *Montastrea curta*, *Montipora aequituberculata*, *Montipora grisea*, *Pocillopora eydouxi*, *Pocillopora woodjonesi*

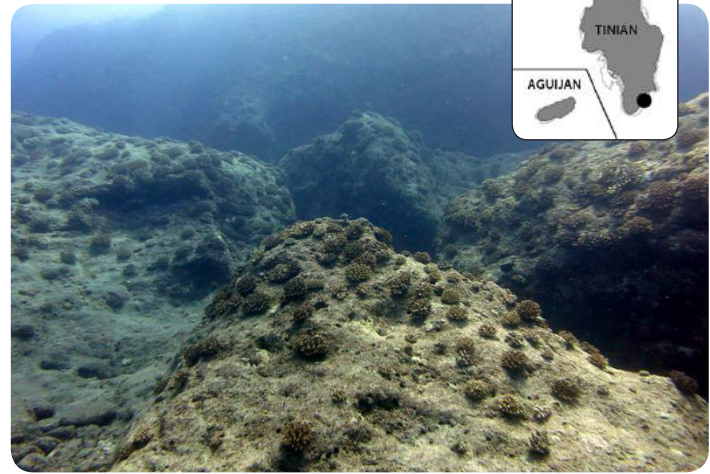
**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Balistapus undulatus*, *Centropyge flavissima*, *Centropyge shepardi*, *Cephalopholis urodeta*, *Chaetodon punctatofasciatus*, *Chaetodon quadrimaculatus*, *Chlorurus sordidus*, *Chromis agilis*, *Chromis margaritifer*, *Chromis vanderbilti*, *Cirripectes variolosus*, *Coris gaimard*, *Ctenochaetus striatus*, *Dascyllus reticulatus*, *Gomphosus varius*, *Halichoeres biocellatus*, *Halichoeres ornatissimus*, *Hemigymnus fasciatus*, *Labrid sp.*, *Labroides dimidiatus*, *Macropharyngodon meleagris*, *Melichthys vidua*, *Nemateleotris magnifica*, *Neocirrhites armatus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Parupeneus multifasciatus*, *Plectroglyphidodon dickii*, *Plectroglyphidodon johnstonianus*, *Plectroglyphidodon lacrymatus*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Ptereleotris evides*, *Scarus forsteri*, *Scarus psittacus*, *Stegastes fasciolatus*, *Sufflamen chrysopterum*, *Thalassoma amblycephalum*, *Thalassoma quinquevittatum*

**Fish Swim:** *Acanthurus olivaceus*, *Aphareus furca*, *Apolemichthys trimaculatus*, *Arothron meleagris*, *Chaetodon citrinellus*, *Chaetodon ornatissimus*, *Chromis xanthurus*, *Coris aygula*, *Forcipiger flavissimus*, *Forcipiger longirostris*, *Malacanthus latovittatus*, *Naso lituratus*, *Oxycheilinus digrammus*, *Thalassoma lutescens*, *Valenciennea strigata*, *Zebriasoma flavescens*

OVERALL SCORE: MED-HIGH

## 26 - Suicide Cliff, Tinian

Suicide Cliff is located on the southeastern coast of Tinian where many Japanese civilians leapt to their deaths during World War II. This is one of three sites where suicides occurred in CNMI. Large bluefin trevallies swam through our surveys at this site. This site has high scores for coral recruitment and herbivore biomass but a low score for bleaching resistance and medium-low scores for coral diversity and temperature variability. Roughly 75% of the benthic community is made up in near equal parts by bare pavement and live coral. Greater than 80% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site is a target for fishery regulations and enforcement and reef restoration/coral translocation activities. Examples of actions that can be considered for implementation at this location include increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas.

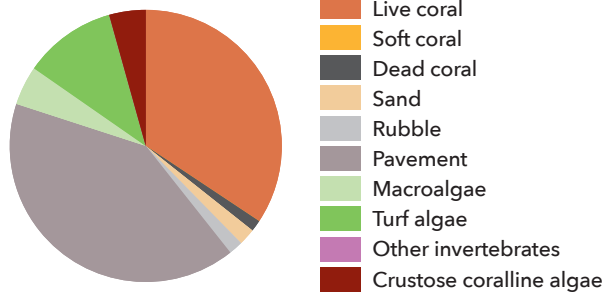


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	26/78	0.84	0.94	0.45	0.48	0.90	0.80	0.52	0.51	0.19
Intra-Island	8/25	0.92	0.91	0.49	0.84	0.90	0.80	0.77	0.36	0.56

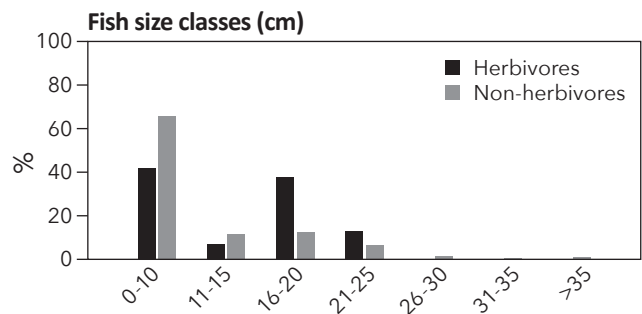
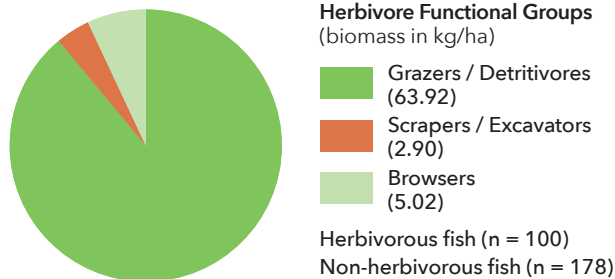
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Acropora digitifera*, *Acropora surculosa*, *Astreopora listeri*, *Cyphastrea serailia*, *Favia helianthoides*, *Favia matthaii*, *Favia stelligera*, *Leptastrea purpurea*, *Leptastrea transversa*, *Leptoria Phrygia*, *Montastrea curta*, *Montipora foveolata*, *Montipora tuberculosa*, *Montipora venosa*, *Pocillopora elegans*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites australiensis*, *Porites lobata*, *Porites lutea*, *Psammocora haimeana*

**Coral Swim:** *Acropora gemmifera*, *Acropora humilis*, *Acropora latistella*, *Acropora tenuis*, *Astreopora myriophthalma*, *Favia danae*, *Favia pallida*, *Favites russelli*, *Goniastrea pectinata*, *Hydnophora microconos*, *Millepora platyphylla*, *Millepora tuberosa*, *Montipora acquituberculata*, *Montipora grisea*, *Pavona duerdeni*, *Pavona varians*, *Platygyra pini*, *Pocillopora ankelei*, *Pocillopora eydouxi*, *Stylophora mordax*

**Fish SPCs:** *Acanthurus blochii*, *Acanthurus lineatus*, *Acanthurus nigricans*, *Acanthurus nigrofasciatus*, *Acanthurus olivaceus*, *Acanthurus* sp., *Anampses caeruleopunctatus*, *Aphareus furca*, *Caranx melampygus*, *Centropyge flavissima*, *Cephalopholis argus*, *Chaetodon ornatissimus*, *Chaetodon quadrimaculatus*, *Chaetodon reticulatus*, *Chlorurus sordidus*, *Chromis agilis*, *Chromis margaritifer*, *Coris aygula*, *Ctenochaetus striatus*, *Dascyllus reticulatus*, *Ecsenius bicolor*, *Forcipiger flavissimus*, *Forcipiger longirostris*, *Gnathodentex aureolineatus*, *Halichoeres biocellatus*, *Halichoeres hortulanus*, *Halichoeres ornatissimus*, *Kyphosus* sp., *Labrid* sp., *Labroides dimidiatus*, *Lutjanus fulvus*, *Melichthys vidua*, *Mulloidichthys vanicolensis*, *Myripristis bernati*, *Myripristis kuntee*, *Naso lituratus*, *Neocirrhites armatus*, *Neoniphon argenteus*, *Neoniphon opercularis*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Paracirrhites hemistictus*, *Parupeneus multifasciatus*, *Pempheris ovalensis*, *Plectroglyphidodon dickii*, *Plectroglyphidodon imparipennis*, *Plectroglyphidodon johnstonianus*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Ptereleotris evides*, *Ptereleotris heteroptera*, *Rhinecanthus rectangulus*, *Sargocentron tierre*, *Scarus niger*, *Sufflamen chrysopterum*, *Sufflamen fraenatum*, *Thalassoma amblycephalum*, *Thalassoma quinquevittatum*

**Fish Swim:** *Acanthurus guttatus*, *Apolemichthys trimaculatus*, *Aprion virescens*, *Bodianus anthoides*, *Cephalopholis urodeta*, *Chaetodon ephippium*, *Chaetodon mertensii*, *Dascyllus trimaculatus*, *Decapterus macarellus*, *Epiplatys insidiator*, *Gomphosus varius*, *Hemigymmus fasciatus*, *Paracanthurus hepatus*, *Pterocaesio marri*, *Sargocentron caudimaculatum*, *Scarus rubroviolaceus*, *Zanclus cornutus*

Observers: S. McKagan, J. Maynard, and S. Johnson

OVERALL SCORE: MED-HIGH

## 27 - Managaha MPA\_MMT, Saipan

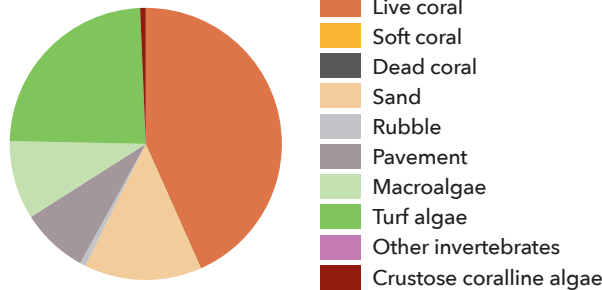
Managaha\_MMT is located in the Managaha Marine Conservation Area and is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. This site has high scores for temperature variability and herbivore biomass but a low score for coral diversity. The habitat here is primarily dominated by the coral *Isopora palifera*, which is shown in the photo to the right (this is the source photo for the covers of this and the main report). The benthic community is dominated by live coral (43.33%). Greater than half of the total herbivorous fish biomass is comprised of grazers/detritivores. This site is a target for fishery regulations and enforcement and reef restoration/coral translocation activities. Examples of actions that can be considered for implementation at this location include: increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	27/78	0.84	0.87	0.71	0.18	0.80	0.96	0.45	N/A - MPA	0.19
Intra-Island	16/29	0.85	0.87	0.83	0.18	0.80	1.00	0.45	N/A - MPA	0.19

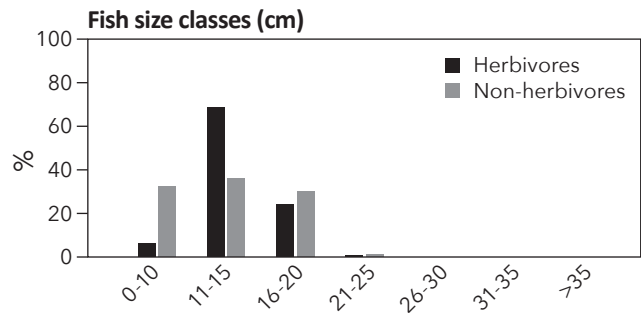
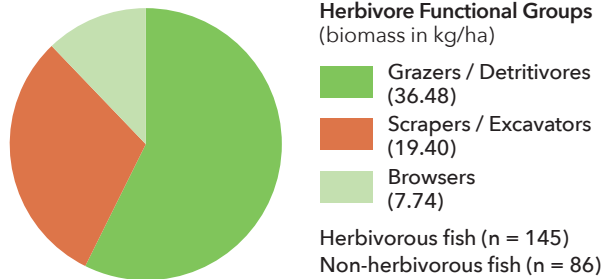
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-Low ● Med-High ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



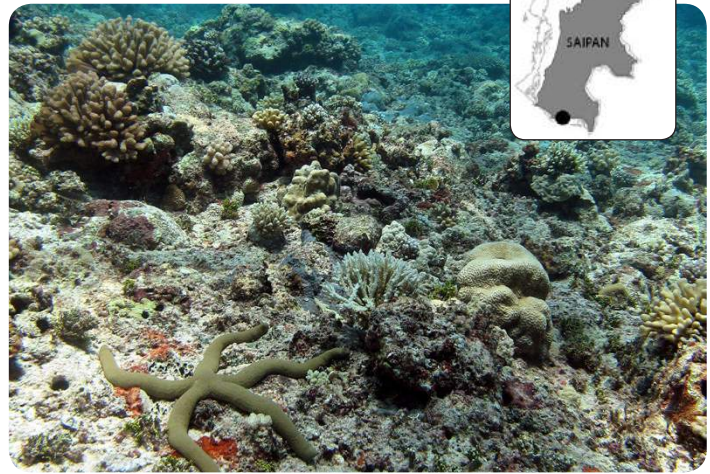
**Coral Quads:** *Acropora digitifera*, *Acropora tenuis*, *Favia matthaii*, *Favia speciosa*, *Favites abdita*, *Favites russelli*, *Goniastrea edwardsi*, *Goniastrea pectinata*, *Goniastrea retiformis*, *Goniopora minor*, *Heliopora coerulea*, *Hydnophora microconos*, *Isopora palifera*, *Leptastrea bottae*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Montipora caliculata*, *Montipora efflorescens*, *Montipora monasteriata*, *Montipora tuberculosa*, *Pavona varians*, *Platygyra daedala*, *Platygyra pini*, *Pocillopora damicornis*, *Pocillopora elegans*, *Stylocoenellia armata*, *Stylophora mordax*

**Coral Swim:** *Acanthastrea echinata*, *Acropora verweyi*, *Astreopora myriophthalma*, *Astreopora randalli*, *Favia favus*, *Favia stelligera*, *Galaxea fascicularis*, *Lobophyllia hemprichii*, *Millepora tuberosa*, *Montipora floweri*, *Montipora hoffmeisteri*, *Porites australiensis*, *Porites compressa*, *Porites lobata*, *Porites lutea*, *Porites vaughani*

**Fish SPCs:** *Abudefduf sexfasciatus*, *Abudefduf vaigiensis*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus nigroris*, *Centropyge flavissima*, *Chaetodon citrinellus*, *Chaetodon lumulatus*, *Chaetodon mertensii*, *Chaetodon punctatofasciatus*, *Chaetodon reticulatus*, *Cheilinus trilobatus*, *Chlorurus sordidus*, *Chromis viridis*, *Ctenochaetus striatus*, *Gomphosus varius*, *Halichoeres hortulanus*, *Halichoeres trimaculatus*, *Hemigymnus fasciatus*, *Hemigymnus melapterus*, *Heniochus chrysostomus*, *Labroides dimidiatus*, *Lethrinus harak*, *Mulloidichthys flavolineatus*, *Myripristis bernrdi*, *Myripristis violacea*, *Naso lituratus*, *Parupeneus cyclostomus*, *Scarus psittacus*, *Scolopsis lineata*, *Thalassoma Hardwicke*, *Thalassoma lutescens*, *Thalassoma sp.*, *Zanclus cornutus*, *Zebrasoma flavescens*

## 28 - Ladder Beach, Saipan

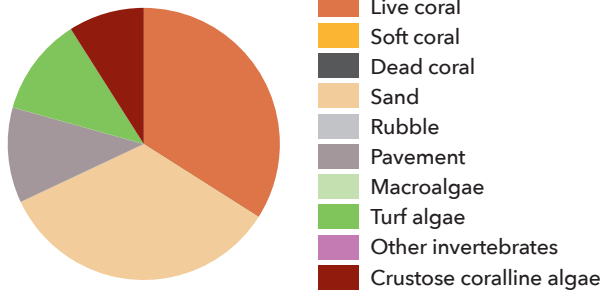
Ladder Beach is located on the southern coast of Saipan and is a popular beach for campers. This site has high scores for coral recruitment and temperature variability but a low score for bleaching resistance. Roughly 75% of the benthic community is made up in near equal parts by live coral and sand. Roughly 90% of the total herbivorous fish biomass is comprised in near equal parts by grazers/detritivores and browsers. Ladder Beach has high fishing access and a medium-high score for LBSP when compared to all sites surveyed. This site is a target for land-based sources of pollution reduction, fishery regulations and enforcement, and bleaching monitoring & supporting recovery. This site is one of only four sites that met at least 3 of the 6 criteria set to identify targets for management action. Examples of actions that can be considered for implementation at this location include road and storm drain improvements and size regulations and bag/catch limits, and increased monitoring during warm seasons.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>28/78</b>	0.84	1.00	0.54	0.49	1.00	0.94	0.05	0.57	0.29
Intra-Island	<b>18/29</b>	0.84	1.00	0.63	0.49	1.00	0.97	0.05	0.54	0.29

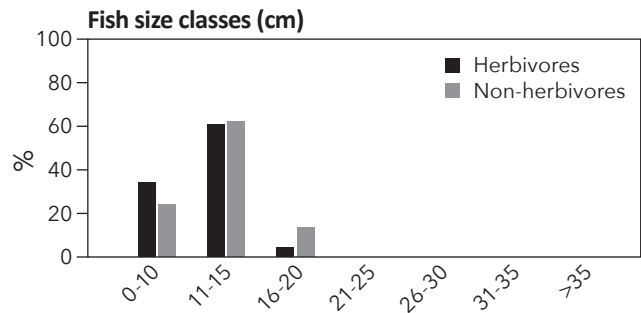
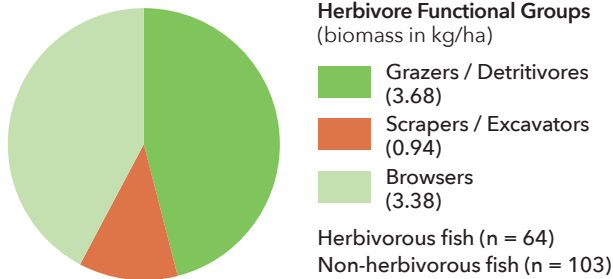
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg + 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE**.

### Fish community



**Coral Quads:** *Acropora digitifera*, *Acropora humilis*, *Acropora monticulosa*, *Acropora palifera*, *Acropora surculosa*, *Acropora vaughani*, *Acropora verweyi*, *Astreopora listeri*, *Astreopora myriophthalma*, *Astreopora randalli*, *Cyphastrea chalcidicum*, *Cyphastrea ocellina*, *Cyphastrea serailia*, *Echinopora lamellosa*, *Favia matthaii*, *Favia speciosa*, *Favia stelligera*, *Favites abdita*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Hydnophora microconos*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Millepora platyphyllia*, *Millepora tuberosa*, *Montastrea curta*, *Montipora calculata*, *Montipora floweri*, *Montipora grisea*, *Montipora boffmeisteri*, *Montipora nodosa*, *Pavona divaricate*, *Pavona duerdeni*, *Pavona varians*, *Platygyra pini*, *Pocillopora danae*, *Pocillopora elegans*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites australiensis*, *Porites lichen*, *Porites lobata*, *Porites lutea*, *Porites vaughani*, *Psammocora baimeana*, *Stylophora mordax*

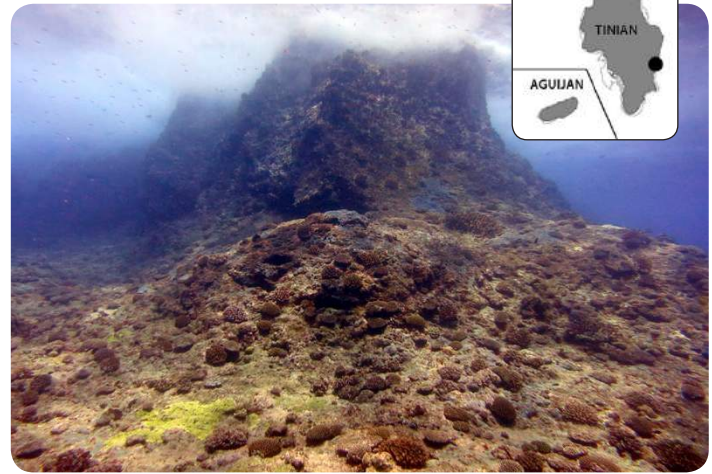
**Coral Swim:** *Acropora secale*, *Favites russelli*, *Fungia scutaria*

**Fish SPCs:** *Acanthurus olivaceus*, *Balistapus undulatus*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon ornatissimus*, *Coris gaimard*, *Ctenochaetus striatus*, *Gomphosus varius*, *Halichoeres margaritaceus*, *Halichoeres ornatissimus*, *Halichoeres sp.*, *Labroides dimidiatus*, *Melichthys vidua*, *Naso lituratus*, *Novaculichthys taeniourus*, *Oxycheilinus unifasciatus*, *Parupeneus insularis*, *Parupeneus multifasciatus*, *Rhinecanthus rectangularis*, *Scarus psittacus*, *Sufflamen bursa*, *Sufflamen chrysopterum*, *Sufflamen fraenatum*, *Thalassoma ambycephalum*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*



## 29 - Barangka, Tinian

Barangka (*barangka* — chamorro for rocky) has a rugged, rocky coastline with no beaches. This is one of the few sites where we saw a blacktip reef shark within our fish surveys. This site has a high score for coral recruitment and a low score for bleaching resistance. This is one of only a few sites where coral cover at the time of surveys was > 70%. Greater than 85% of the total herbivorous fish biomass was comprised of grazers/detritivores. This site is a target for fishery regulations and enforcement. Examples of actions that can be considered for implementation at this location include increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

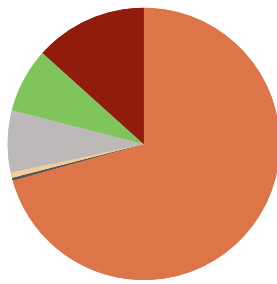


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	29/78	0.84	1.00	0.49	0.46	1.00	0.80	0.31	0.43	0.21
Intra-Island	9/25	0.90	1.00	0.52	0.80	1.00	0.80	0.46	0.24	0.62

● Low (<avg - 1 SD) 
 ● Med-Low (<avg and >avg - 1 SD) 
 ● Med-High (>avg and <avg - 1 SD) 
 ● High (>avg + 1 SD) 
 ● Low 
 ● Med-High 
 ● Med-Low 
 ● High

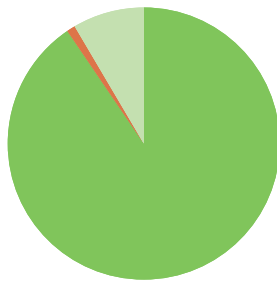
### Benthic community



- Live coral
- Soft coral
- Dead coral
- Sand
- Rubble
- Pavement
- Macroalgae
- Turf algae
- Other invertebrates
- Crustose coralline algae

Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community

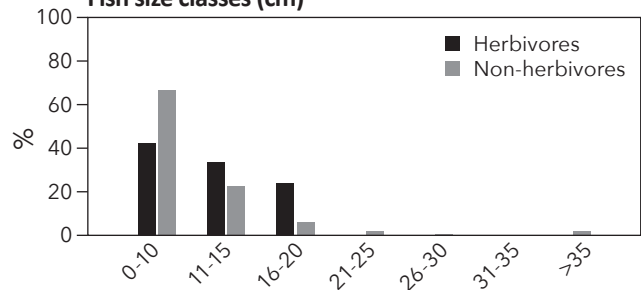


**Herbivore Functional Groups**  
(biomass in kg/ha)

- Grazers / Detritivores (38.95)
- Scrapers / Excavators (0.44)
- Browsers (3.65)

Herbivorous fish (n = 92)  
Non-herbivorous fish (n = 212)

### Fish size classes (cm)



**Coral Quads:** *Acanthastrea echinata, Acropora azurea, Acropora digitifera, Acropora gemmifera, Acropora humilis, Acropora nana, Acropora samoensis, Acropora surculosa, Acropora vaughani, Acropora verweyi, Acropora digitifera, Astreopora myriophthalma, Cyphastrea microphthalma, Cyphastrea serailia, Favia danae, Favia fava, Favia matthaii, Favia pallida, Favia speciosa, Favia stelligera, Favites abdita, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea retiformis, Hydnothra microconos, Leptastrea purpurea, Leptoria Phrygia, Montipora efflorescens, Montipora foveolata, Montipora grisea, Montipora monasteriata, Montipora nodosa, Montipora sp., Montipora tuberculosa, Montipora verrilli, Pavona duerdeni, Pavona varians, Platygyra pini, Pocillopora elegans, Pocillopora meandrina, Pocillopora verrucosa, Pocillopora woodjonesi, Porites australiensis, Porites lichen, Porites lobata, Porites lutea, Porites vaughani*

**Coral Swim:** *Acropora abrottenoides, Acropora globiceps, Acropora secale, Acropora tenuis, Astreopora listeri, Montastrea curta, Montipora aequituberculata, Stylophora mordax*

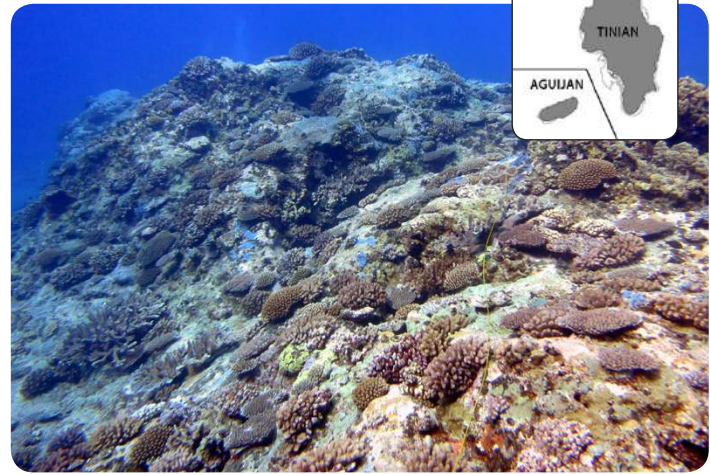
**Fish SPCs:** *Abudefduf vaigiensis, Acanthurus lineatus, Acanthurus nigricans, Acanthurus nigrofuscus, Amanes scopas, Anampses caeruleopunctatus, Apolemichthys trimaculatus, Aprion virescens, Balistapus undulatus, Carcharhinus melanopterus, Centropyge flavissima, Cephalopholis urodeta, Chaetodon citrinellus, Chaetodon lunula, Chaetodon ornatissimus, Chaetodon quadrimaculatus, Chaetodon reticulatus, Chlorurus sordidus, Chromis agilis, Chromis margaritifera, Chromis vanderbilti, Chrysiptera traceyi, Coris gaimard, Ctenochaetus striatus, Dascyllus reticulatus, Ecsenius bicolor, Forcipiger flavissimus, Halichoeres biocellatus, Halichoeres hortulanus, Labroides dimidiatus, Lutjanus bohar, Melichthys vidua, Naso lituratus, Neocirrhites armatus, Oxycheilinus digrammus, Paracirrhites arcatus, Paracirrhites forsteri, Paracirrhites hemistictus, Parupeneus barberinus, Parupeneus cyclostomus, Parupeneus multifasciatus, Plectroglyphidodon dickii, Plectroglyphidodon johnstonianus, Pomacanthus imperator, Pomacanthus guamensis, Stegastes fasciolatus, Stethojulis bandanensis, Sufflamen bursa, Sufflamen chrysopterum, Sufflamen fraenatum, Thalassoma quinquevittatum, Zanclus cornutus*

**Fish Swim:** *Acanthurus blochii, Acanthurus olivaceus, Cirrhitilabrus katherinae, Heniochus chrysostomus, Monotaxis grandoculis, Myripristis berndti, Oxycheilinus unifasciatus, Sargocentron microstoma, Sargocentron tiere, Scarus ghobban, Scarus rubroviolaceus, Siphamia sp., Variola louti*

OVERALL SCORE: MED-HIGH

## 30 - Asiga Point, Tinian

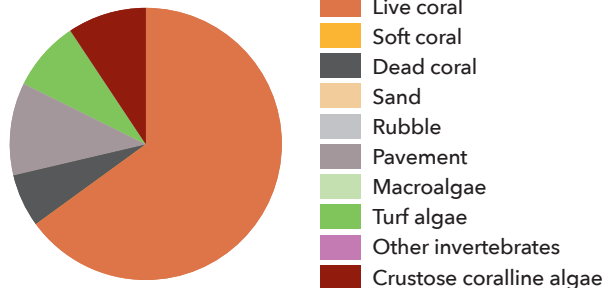
Asiga Point (*asiga* – salt) is located on the northeastern shore of Tinian. This point separates Unai Dangkulu from Unai Chiget. This point was a highlight for the survey team as we saw many sea turtles. This site is also a great spot to find photogenic anemonefishes. This site has medium-high scores for all resilience indicators excepting bleaching resistance, which is medium-low. This site is one of only a few sites where coral cover at the time of surveys was ~70%. Slightly more than half of the total herbivorous fish biomass was comprised of grazers/detritivores. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	30/78	0.84	1.00	0.55	0.26	0.98	0.86	0.37	0.24	0.19
Intra-Island	2/25	0.97	1.00	0.59	0.45	0.98	0.86	1.00	0.00	0.56

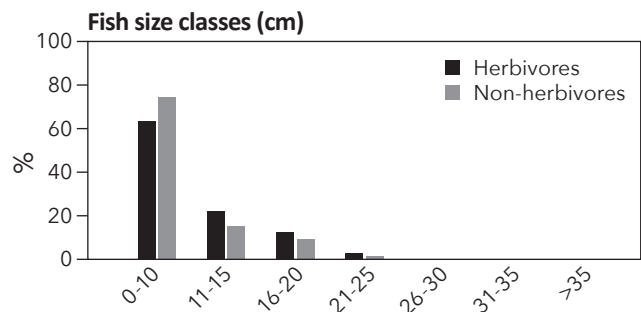
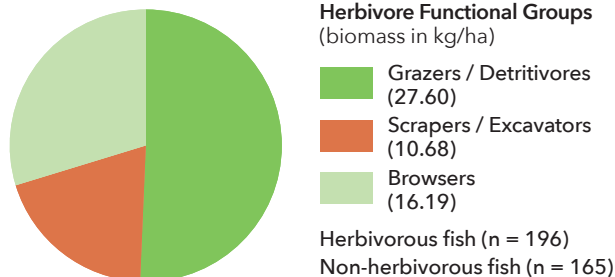
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

### Fish community



**Coral Quads:** *Acanthastrea echinata*, *Acropora digitifera*, *Acropora gemmifera*, *Acropora surculosa*, *Astreopora myriophthalma*, *Cyphastrea microphthalma*, *Cyphastrea serailia*, *Favia helianthoides*, *Favia matthaii*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Goniastrea edwardsi*, *Hydnophora microconos*, *Leptastrea purpurea*, *Leptoria Porygia*, *Montipora tuberculosa*, *Montipora aequituberculata*, *Montipora grisea*, *Montipora hoffmeisteri*, *Montipora sp. 2*, *Pavona varians*, *Pocillopora elegans*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Pocillopora woodjonesi*, *Porites australiensis*, *Porites lobata*, *Porites lutea*, *Porites vaughani*, *Stylophora mordax*

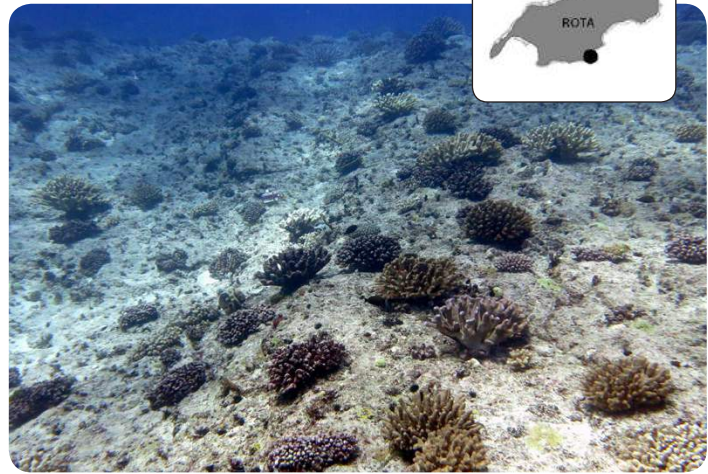
**Coral Swim:** *Acropora cf. cuneata*, *Acropora globiceps*, *Acropora latistella*, *Acropora robusta*, *Acropora tenuis*, *Acropora verweyi*, *Millepora platyphylla*, *Montastrea curta*, *Montipora caliculata*, *Pavona duerdeni*, *Platygyra pini*, *Pocillopora danae*, *Pocillopora eydouxi*, *Psammocora nierstraszi*

**Fish SPCs:** *Acanthurus blochii*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus olivaceus*, *Amanes scopas*, *Amphiprion chrysopterus*, *Anampes caeruleopunctatus*, *Apolemichthys trimaculatus*, *Balistapus undulatus*, *Blenniid sp.*, *Centropyge flavissima*, *Cephalopholis argus*, *Chaetodon auriga*, *Chaetodon citrinellus*, *Chaetodon lunula*, *Chaetodon quadrimaculatus*, *Chaetodon reticulatus*, *Chaetodon unimaculatus*, *Cheilinus trilobatus*, *Chlorurus sordidus*, *Chromis agilis*, *Chromis margaritifer*, *Chrysiptera traceyi*, *Cirrhitilabrus katherinae*, *Ctenochaetus striatus*, *Dascyllus reticulatus*, *Dascyllus trimaculatus*, *Eisenius bicolor*, *Epinephelus hexagonatus*, *Forcipiger flavissimus*, *Gomphosus varius*, *Halichoeres biocellatus*, *Halichoeres hortulanus*, *Labroides dimidiatus*, *Macolor niger*, *Melichthys niger*, *Melichthys vidua*, *Naso lituatus*, *Neocirrhites armatus*, *Paracanthurus hepatus*, *Paracirrhites arcatus*, *Paracirrhites hemistictus*, *Parupeneus multifasciatus*, *Plectroglyphidodon dickii*, *Scarus forsteni*, *Scarus psittacus*, *Scarus rubroviolaceus*, *Stegastes fasciolatus*, *Sufflamen chrysopteron*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*

**Fish Swim:** *Coris gaimard*, *Macolor macularis*, *Oxycheilinus digrammus*, *Siganus argenteus*, *Zanclus cornutus*

# 31 - Agatasi, Rota

Agatasi is on the southeastern coast of Rota. This site has historically been known to be a preferred nesting area of the endangered Marianas Crow (*aga* — crow, *tasi* — ocean). This site has medium-high scores for all resilience indicators excepting temperature variability, which has a low score. Roughly 80% of the benthic community was made up in near equal parts by live coral, crustose coralline algae, and bare pavement. Uniquely, 100% of the herbivorous fish biomass was comprised of grazers/detritivores. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

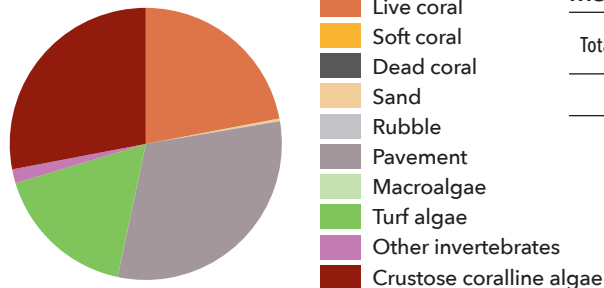


ISLAND SCORE: HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	31/78	0.83	1.00	0.73	0.31	0.95	0.72	0.27	0.17	0.19
Intra-Island	4/24	0.95	1.00	0.73	0.58	0.95	0.78	0.45	0.17	0.67

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community

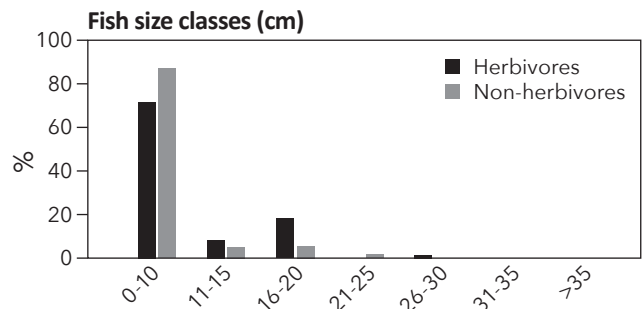
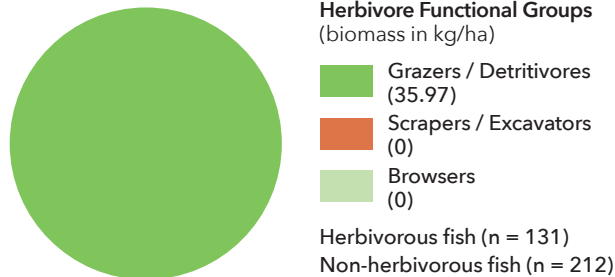


## Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
7.78	5.59	2.19	0	0

Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



**Coral Quads:** *Acanthastrea echinata*, *Acropora cophyactyla*, *Acropora gemmifera*, *Acropora monticulosa*, *Astreopora myriophthalma*, *Cyphastrea microphthalma*, *Cyphastrea serailia*, *Favia danae*, *Favia helianthoides*, *Favia pallida*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Goniastrea retiformis*, *Hydnophora microconos*, *Leptastrea purpurea*, *Pavona varians*, *Platygyra pini*, *Pocillopora elegans*, *Pocillopora eydouxi*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites australiensis*, *Porites lobata*, *Porites lutea*

**Coral Swim:** *Acropora digitifera*, *Astreopora listeri*, *Astreopora randalli*, *Favia favus*, *Goniastrea edwardsi*, *Heliopora coerulea*, *Isopora palifera*, *Leptoria Phrygia*, *Millepora platyphylla*, *Montipora efflorescens*, *Montipora monasteriata*, *Pavona duerdeni*, *Porites vaughani*, *Psammocora baimeana*

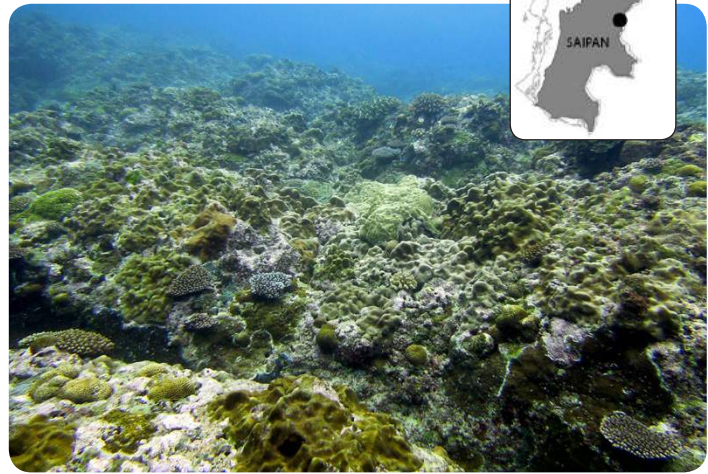
**Fish SPCs:** *Acanthurus guttatus*, *Acanthurus lineatus*, *Acanthurus nigrofuscus*, *Acanthurus olivaceus*, *Acanthurus sp.*, *Acanthurus triostegus*, *Apolemichthys trimaculatus*, *Balistapus undulatus*, *Caranx melampygus*, *Centropyge flavissima*, *Cephalopholis argus*, *Cephalopholis urodeta*, *Chaetodon Auriga*, *Chaetodon citrinellus*, *Chaetodon quadrimaculatus*, *Chromis xanthurus*, *Chrysiptera brownriggii*, *Cirripectes variolosus*, *Ctenochaetus striatus*, *Dascyllus reticulatus*, *Decapterus macarellus*, *Halichoeres hortulanus*, *Labroides dimidiatus*, *Lutjanus kasmira*, *Melichthys vidua*, *Neocirrhites armatus*, *Paracanthurus hepatus*, *Paracirrhites arcatus*, *Parupeneus cyclostomus*, *Parupeneus multifasciatus*, *Plectroglyphidodon dickii*, *Plectroglyphidodon johnstonianus*, *Pomacanthus imperator*, *Pomachromis guamensis*, *Pygoplites diacanthus*, *Stegastes fasciatus*, *Sufflamen bursa*, *Sufflamen chrysopterum*, *Sufflamen fraenatum*, *Thalassoma quinquevittatum*, *Zebrasoma veliferum*

**Fish Swim:** *Acanthurus blochii*, *Acanthurus pyroferus*, *Aphareus furca*, *Caesio teres*, *Chaetodon ephippium*, *Cheilinus trilobatus*, *Chlorurus sordidus*, *Coris aygula*, *Coris gaimard*, *Lutjanus bohar*, *Melichthys niger*, *Monotaxis grandoculis*, *Myripristis kuntee*, *Naso lituratus*, *Paracirrhites hemistictus*, *Sargocentron caudimaculatum*, *Sargocentron tere*, *Scarus forsteni*, *Scarus oviceps*, *Scarus rubroviolaceus*, *Scarus schlegeli*, *Thalassoma purpureum*, *Variola louti*, *Zanclus cornutus*

OVERALL SCORE: MED-HIGH

## 32 - Old Man By the Sea, Saipan

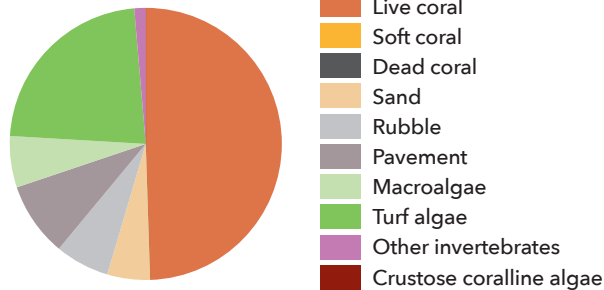
Old Man By the Sea is one of the secluded pocket beaches on Saipan's eastern coast. Old Man by the Sea is a popular site amongst both locals and visitors. A rock formation resembles the profile of a man when the coastline is viewed from sea at the proper angle. This site has medium-high scores for all resilience indicators excepting temperature variability, which is low. Roughly 50% of the benthic community at this site is made up by live coral. Greater than 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>32/78</b>	0.83	0.92	0.70	0.30	0.97	0.74	0.35	0.15	0.20
Intra-Island	<b>17/29</b>	0.84	0.92	0.81	0.30	0.97	0.77	0.36	0.09	0.20

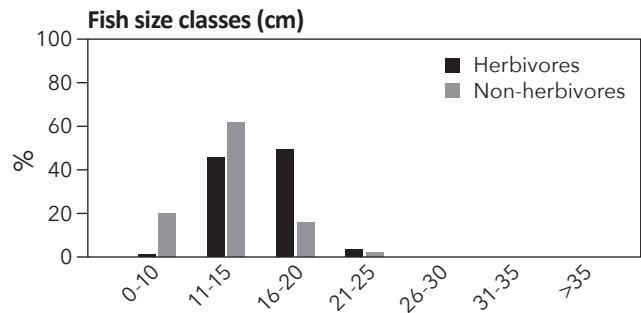
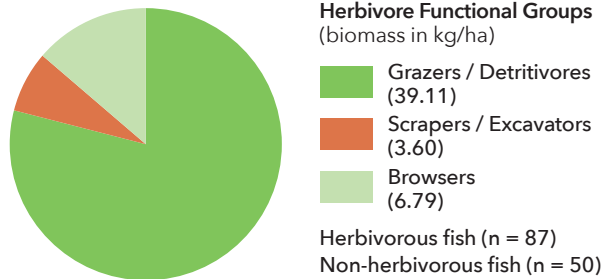
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



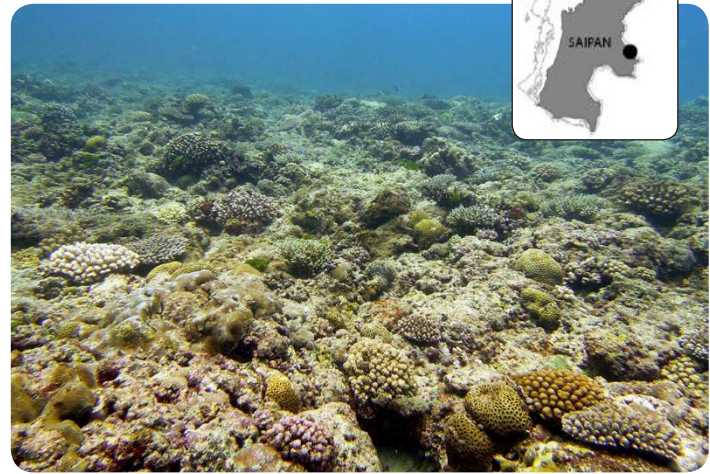
**Coral Quads:** *Acanthastrea hillae*, *Acropora digitifera*, *Acropora gemmifera*, *Acropora secale*, *Acropora surculosa*, *Astreopora listeri*, *Favia favus*, *Favia matthaii*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Galaxea fascicularis*, *Goniastrea retiformis*, *Hydnophora microconos*, *Leptastrea purpurea*, *Leptastrea transversa*, *Leptoria Phrygia*, *Montastrea curta*, *Montipora efflorescens*, *Montipora foveolata*, *Montipora grisea*, *Montipora boffmeisteri*, *Pavona diffluens*, *Pavona varians*, *Pocillopora elegans*, *Pocillopora meandrina*, *Porites rus*, *Stylocoeniella armata*

**Coral Swim:** *Acropora tenuis*, *Acropora vaughani*, *Acropora verweyi*, *Millepora platyphylla*, *Millepora tuberosa*, *Pavona duerdeni*, *Pocillopora eydouxi*, *Pocillopora verrucosa*, *Pocillopora woodjonesi*

**Fish SPCs:** *Acanthurus lineatus*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus triostegus*, *Cantherhines pardalis*, *Centropyge flavissima*, *Cephalopholis wrodeti*, *Chaetodon auriga*, *Chaetodon citrinellus*, *Chaetodon lunula*, *Chaetodon ornatissimus*, *Chaetodon quadrimaculatus*, *Chlorurus sordidus*, *Ctenochaetus striatus*, *Halichoeres hortulanus*, *Halichoeres* sp., *Kyphosus vaigiensis*, *Melichthys vidua*, *Naso lituratus*, *Scarus psittacus*, *Scarus rubroviolaceus*, *Thalassoma quinquevittatum*, *Zanclus cornutus*

### 33 - Tank Beach, Saipan

Tank Beach Tank Beach is located within the Forbidden Island Marine Sanctuary, on the exposed northeastern side of Saipan. Tank Beach is a well-documented turtle nesting site. This site has a high score for coral recruitment but medium-low scores for temperature variability and herbivore biomass. Nearly 50% of the benthic community is made up by live coral. Greater than 90% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site is a target for land-based sources of pollution reduction. Examples of actions that can be implemented to reduce LBSF near the identified site includes: stream bank stabilization, road and storm drain improvement, other erosion control practices and sewage treatment upgrades.

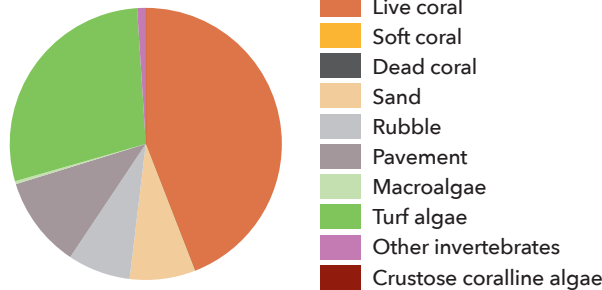


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSF
Inter-Island	33/78	0.83	1.00	0.69	0.42	0.99	0.78	0.10	N/A - MPA	0.30
Intra-Island	19/29	0.84	1.00	0.80	0.42	0.99	0.81	0.10	N/A - MPA	0.30

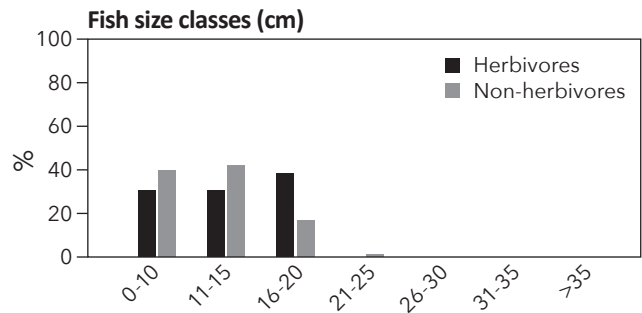
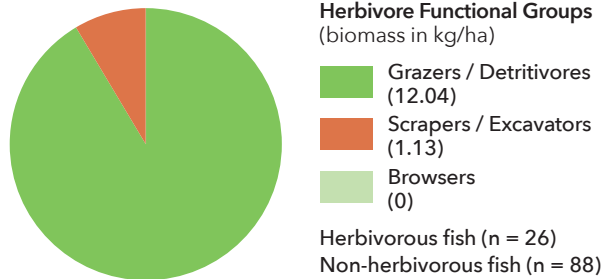
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

#### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

#### Fish community



**Coral Quads:** *Acanthastrea echinata, Acanthastrea hillae, Acropora digitifera, Acropora gemmifera, Acropora humilis, Acropora vaughani, Acropora verweyi, Astreopora listeri, Cyphastrea microphthalmia, Echinopora lamellosa, Favia favius, Favia matthaii, Favia stelligera, Favites abdita, Galaxea fascicularis, Goniastrea retiformis, Hydnothpora microconos, Leptastrea bottae, Leptoria Phrygia, Lobophyllia hemprichii, Montastrea curta, Montipora efflorescens, Montipora foveolata, Montipora grisea, Montipora boffmeisteri, Montipora turgescens, Pavona divaricata, Pavona duerdeni, Pavona varians, Pocillopora elegans, Pocillopora verrucosa, Porites cylindrical, Porites lichen, Porites rus, Porites vaughani, Psammocora haimeana, Stylocoeniella armata, Stylophora mordax*

**Coral Swim:** *Acropora azurea, Acropora monticulosa, Acropora robusta, Acropora secale, Acropora surculosa, Acropora tenuis, Cyphastrea chalcidicum, Favites russelli, Gardineroseris planulata, Goniastrea edwardsi, Goniopora fruticosa, Heliopora coerulea, Leptastrea purpurea, Montipora grisea, Pocillopora danae, Pocillopora woodjonesi, Porites lobata*

**Fish SPCs:** *Acanthurus lineatus, Acanthurus nigrofuscus, Aphareus furca, Balistapus undulatus, Caesionid sp., Centropyge flavissima, Cephalopholis urodeta, Chaetodon lunula, Chaetodon quadrimaculatus, Chaetodon ulietensis, Cheilinus trilobatus, Halichoeres hortulanus, Labroides dimidiatus, Melichthys vidua, Oxycheilinus unifasciatus, Rhinecanthus rectangulus, Scarus psittacus, Stethojulis bandanensis, Thalassoma quinquevittatum, Thalassoma trilobatum*

OVERALL SCORE: MED-HIGH

## 34 - Dynasty\_MMT, Tinian

Dynasty\_MMT is located off of Taga Beach on Tinian. This site was named in reference to the Tinian Dynasty Hotel & Casino, which can be seen from the water. This site is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. Bring your camera when snorkeling in front of the Dynasty hotel as anemonefish, green sea turtles and large schools of convict surgeonfish can be found here. This site has a high score for bleaching resistance but medium-high scores for coral recruitment and diversity, as well as temperature variability and herbivore biomass. Roughly 75% of the benthic community is made up in near equal parts by sand and live coral. Greater than 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. Dynasty\_MMT has high fishing access when compared to all sites surveyed and high LBSP when compared to the other sites on Tinian. This site is a target for LBSP reduction, fishery regulations & enforcement and reef restoration/coral translocation. Examples of actions that can be considered for implementation at this location include road and storm drain improvements and size regulations and bag/catch limits.

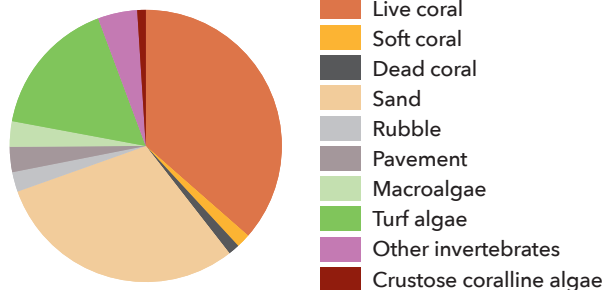


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	34/78	0.83	0.96	0.88	0.11	0.91	0.82	0.18	0.64	0.34
Intra-Island	16/25	0.85	0.94	0.95	0.20	0.91	0.82	0.31	0.52	0.99

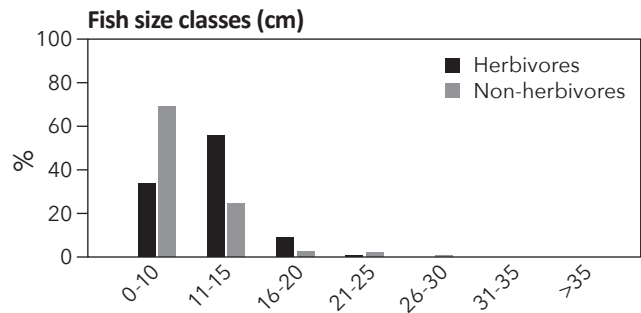
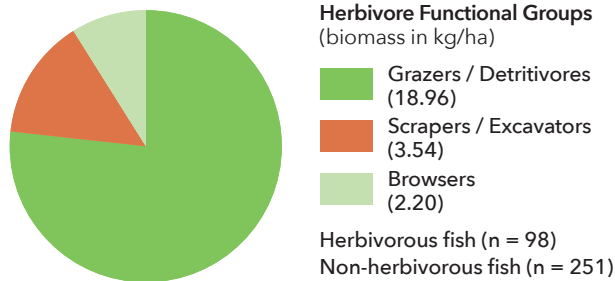
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Astreopora myriophthalma*, *Cyphastrea chalcidicum*, *Cyphastrea microphthalma*, *Favia fava*, *Favia matthaii*, *Faviid* sp., *Favites abdita*, *Goniastrea retiformis*, *Isozona palifera*, *Leptastrea purpurea*, *Montipora efflorescens*, *Pavona varians*, *Platygyra pini*, *Porites lichen*, *Porites lutea*, *Porites rus*

**Coral Swim:** *Favites flexuosa*, *Goniastrea edwardsi*, *Goniopora minor*, *Lobophyllia corymbosa*, *Montipora danae*, *Montipora* sp., *Montipora verrilli*, *Platygyra daedalea*, *Pocillopora verrucosa*, *Porites lobata*

**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus triostegus*, *Amphiprion melanopus*, *Amphiprion perideraion*, *Anampses caeruleopunctatus*, *Anampses twistii*, *Apogon angustatus*, *Balistapus undulatus*, *Cantherbines pardalis*, *Centropyge flavissima*, *Chaetodon auriga*, *Chaetodon lunula*, *Chaetodon reticulatus*, *Cheilinus chlorourus*, *Cheilodipterus macrodon*, *Chlorurus sordidus*, *Chromis agilis*, *Chromis viridis*, *Chrysiptera brownriggii*, *Corythoichthys flavofasciatus*, *Ctenochaetus cyanocheilus*, *Ctenochaetus striatus*, *Dascyllus aruanus*, *Dascyllus reticulatus*, *Dascyllus trimaculatus*, *Gomphosus varius*, *Halichoeres hortulanus*, *Halichoeres trimaculatus*, *Hemigymnus fasciatus*, *Heniochus chrysostomus*, *Labroides bicolor*, *Labroides dimidiatus*, *Macropharyngodon meleagris*, *Monotaxis grandoculis*, *Myripristis bernardi*, *Myripristis kuntee*, *Myripristis* sp., *Naso lituratus*, *Neoniphon argenteus*, *Oxycheilinus digrammus*, *Paracirrhites forsteri*, *Plectroglyphidodon lacrymatus*, *Pomacentrus vaiuli*, *Ptereleotris evides*, *Sargocentron tiere*, *Stegastes fasciolatus*, *Stethojulis bandanensis*, *Stethojulis strigiventer*, *Thalassoma Hardwicke*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Un-id fish* sp., *Zanclus cornutus*, *Zebbrasoma flavescens*

**Fish Swim:** *Bodianus axillaris*, *Caranx melampygus*, *Cheilinus trilobatus*, *Chelonia* sp., *Chromis margaritifer*, *Coris aygula*, *Epibulus insidiator*, *Gnathodentex aureolineatus*, *Lethrinus* sp., *Macolor niger*, *Ostracion meleagris*, *Parupeneus barberinus*, *Parupeneus insularis*, *Parupeneus multifasciatus*, *Sufflamen chrysopterum*

Observers: S. McKagan, J. Maynard, and L. Johnston

OVERALL SCORE: MED-HIGH

# 35 - Naftan Rock, Tinian

Naftan Rock (*naftan* — chamorro for place of burial), a small rock located off of Aguijan, is a place where sea birds come to congregate. There is a large pelagic influence at this site, which is likely why it is the only site where we saw tawny nurse sharks or rainbow runners. Scores for coral recruitment and temperature variability are high but the score for bleaching resistance is low. Greater than 50% of the benthic community here is made up by live coral. Uniquely, the herbivorous fish biomass at this site is comprised only of grazers/detritivores. This site is a target for bleaching monitoring & supporting recovery so should be monitored during upcoming warm seasons.

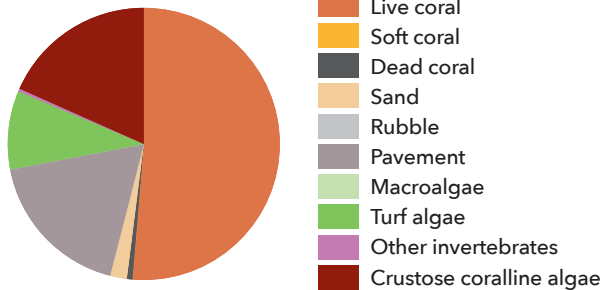


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	35/78	0.82	1.00	0.49	0.40	0.97	0.95	0.15	0.29	0.19
Intra-Island	13/25	0.86	1.00	0.53	0.70	0.97	0.95	0.18	0.06	0.56

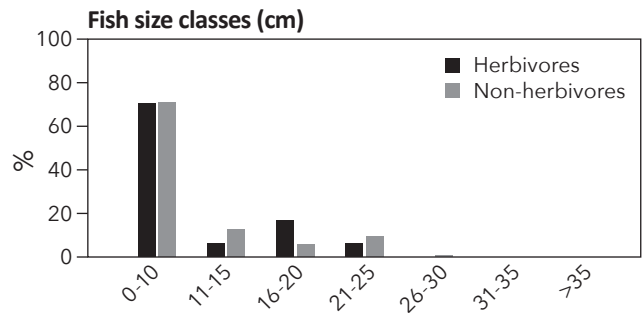
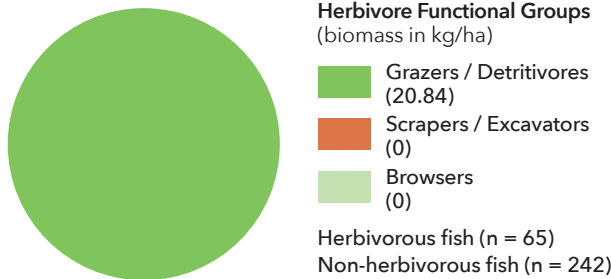
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acropora gemmifera*, *Acropora bumilis*, *Astreopora listeri*, *Astreopora myriophthalma*, *Astreopora randalli*, *Cyphastrea microphthalma*, *Cyphastrea serailia*, *Echinopora lamellosa*, *Favia danae*, *Favia heliantoides*, *Favia matthaii*, *Favia* sp., *Favia stelligera*, *Favites abdita*, *Favites* c.f. *russelli*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Heliopora coerulea*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Montipora* c.f. *floweri*, *Montipora calculata*, *Montipora grisea*, *Montipora hoffmeisteri*, *Montipora nodosa*, *Montipora* sp. 2, *Montipora venosa*, *Pavona varians*, *Platygyra pini*, *Pocillopora damicornis*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites australiensis*, *Porites lobata*, *Porites lutea*, *Psammocora haimaana*, *Stylophora mordax*

**Coral Swim:** *Acanthastrea echinata*, *Acropora robusta*, *Acropora secale*, *Acropora surculosa*, *Hydnophora microconos*, *Montastrea curta*, *Montipora foveolata*, *Pocillopora ankei*, *Pocillopora eydouxi*, *Porites vaughani*

**Fish SPCs:** *Acanthurus blochii*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus olivaceus*, *Apolemichthys trimaculatus*, *Centropyge flavissima*, *Cephalopholis argus*, *Cephalopholis urodeta*, *Chaetodon ornatissimus*, *Chaetodon quadrimaculatus*, *Chaetodon reticulatus*, *Chromis acares*, *Chromis margaritifer*, *Chromis vanderbilti*, *Cirripectes variolosus*, *Coris aygula*, *Ctenochaetus striatus*, *Dascyllus reticulatus*, *Gnathodentex aureolineatus*, *Halichoeres biocellatus*, *Halichoeres hortulanus*, *Hemigymnus fasciatus*, *Heniochus chrysostomus*, *Labroides dimidiatus*, *Labroides pectoralis*, *Melichthys vidua*, *Myripristis bernardi*, *Neocirrhites armatus*, *Neoniphon argenteus*, *Neoniphon opercularis*, *Oxycheilinus digrammus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Plectroglyphidodon dickii*, *Plectroglyphidodon johnstonianus*, *Pomacanthus imperator*, *Pomacanthus vaiuli*, *Pomachromis guamensis*, *Sargocentron caudimaculatum*, *Sargocentron tiera*, *Stegastes fasciolatus*, *Sufflamen bursa*, *Thalassoma quinquevittatum*, *Un-id fish* sp.

**Fish Swim:** *Balistoides viridescens*, *Elagatis bipinnulata*, *Forcipiger longirostris*, *Macolor niger*, *Melichthys niger*, *Naso hexacanthus*, *Naso lituratus*, *Nebrius ferrugineus*, *Parupeneus multifasciatus*, *Rhinecanthus rectangulus*, *Scarus forsteni*, *Scarus oviceps*, *Scarus rubroviolaceus*, *Zanclus cornutus*

OVERALL SCORE: MED-HIGH

# 36 - Unai Lamlam, Tinian

Unai Lamlam is located on the western coast of Tinian. Lamlam, the Chamorro word for “shiny” or “radiant”, is given to this beach because of the brilliant white sand. Bring your camera if you visit this site as you can find anemonefish and giant moray eels here. This site has a high score for temperature variability and medium-high scores for bleaching resistance, coral recruitment and coral diversity. The benthic community at this site was very diverse; roughly half the benthic cover was comprised in near equal parts by live coral and crustose coralline algae and the remaining half was roughly equally divided among 5 other categories. Greater than half of the total herbivorous fish biomass was comprised of grazers/detritivores. This site did not meet any of the criteria we set to identify targets for various types of management action. This site may warrant management attention for reasons distinct from the resilience assessment results. The Threatened coral species *Acropora globiceps* was seen in the shallow waters (<4 m) adjacent to this site during our surveys in May/June of 2014.

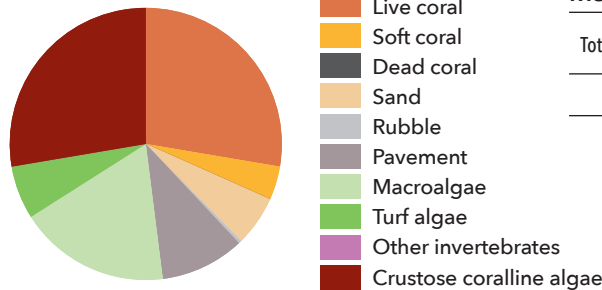


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>36/78</b>	0.82	0.75	0.73	0.29	0.98	0.99	0.12	0.31	0.20
Intra-Island	<b>17/25</b>	0.85	0.65	0.78	0.50	0.98	0.99	0.23	0.09	0.57

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community

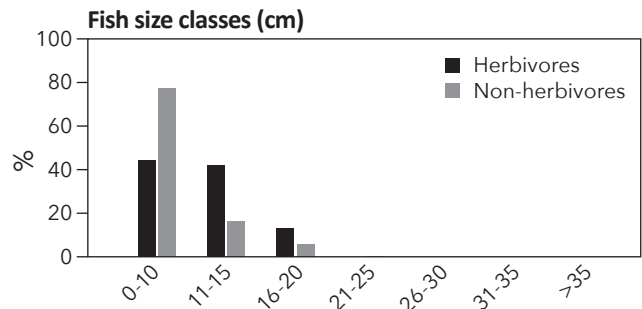
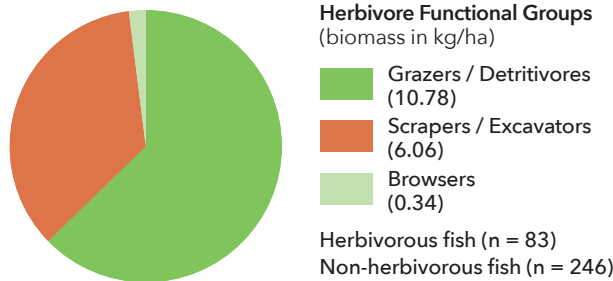


## Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
3.00	3.00	0	0	0

Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acanthastrea brevis*, *Acanthastrea echinata*, *Astreopora listeri*, *Cyphastrea microphthalma*, *Cyphastrea serailia*, *Favia danae*, *Favia favaus*, *Favia matthaii*, *Favia stelligera*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Hydnophora microconos*, *Isopora palifera*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Montastrea valenciennesi*, *Montipora efflorescens*, *Pavona duerdeni*, *Pavona minuta*, *Pavona varians*, *Platygyra c.f. daedalea 2547*, *Platygyra daedalea 2564*, *Platygyra pini*, *Porites lichen*, *Porites lobata*, *Psammodora haimeana*

**Coral Swim:** *Echinopora lamellosa*, *Favia pallida*, *Goniastrea pectinata*, *Heliopora coerulea*, *Lobophyllia corymbosa*, *Lobophyllia hemprichii*, *Plesiastrea versipora*, *Pocillopora elegans*, *Pocillopora verrucosa*, *Porites australiensis*, *Porites lutea*, *Porites rus*, *Stylophora mordax*, *Turbinaria stellulata*

**Fish SPCs:** *Acanthurus lineatus*, *Acanthurus nigrofuscus*, *Acanthurus sp.*, *Amphiprion chrysopterus*, *Anampses twistii*, *Aphareus furca*, *Balistapus undulatus*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon ornatissimus*, *Cheilinus oxycephalus*, *Chlorurus sordidus*, *Chromis acares*, *Chromis agilis*, *Chromis xanthura*, *Chrysiptera brownriggii*, *Coris gaimard*, *Ctenochaetus cyanocheilus*, *Ctenochaetus striatus*, *Gomphosus varius*, *Halichoeres hortulanus*, *Kyphosus vaigiensis*, *Labroides bicolor*, *Labroides dimidiatus*, *Macropharyngodon meleagris*, *Melichthys niger*, *Melichthys vidua*, *Myripristis kuntee*, *Neoniphon opercularis*, *Oxycheilinus digrammus*, *Oxycheilinus unifasciatus*, *Paracirrhites arcatus*, *Parupeneus multifasciatus*, *Pempheris ovalensis*, *Plectroglyphidodon johnstonianus*, *Plectroglyphidodon lacrymatus*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Sargocentron tiere*, *Scarus psittacus*, *Stegastes fasciolatus*, *Stethojulis bandanensis*, *Stethojulis strigiventer*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Zebrasoma flavescens*

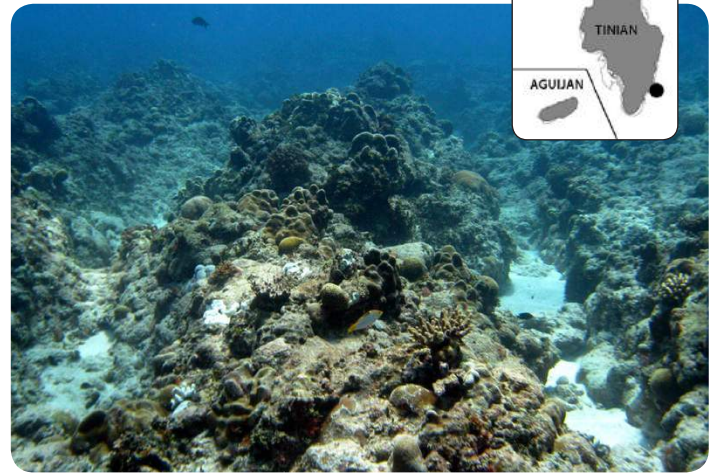
**Fish Swim:** *Abudefduf vaigiensis*, *Acanthurus nigricans*, *Bodianus axillaris*, *Chaetodon citrinellus*, *Chaetodon lunulatus*, *Chaetodon ulietensis*, *Forcipiger longirostris*, *Gymnothorax javanicus*, *Hemigymnus fasciatus*, *Kyphosus sp.*, *Lethrinus xanthochilus*, *Monotaxis grandoculis*, *Naso lituratus*, *Paracirrhites forsteri*, *Plectroglyphidodon imparipennis*, *Ptereleotris evides*, *Sargocentron microstoma*, *Scarus ghobban*, *Signanus argenteus*

OVERALL SCORE: MED-HIGH



## 37 - Puntan Kastiyu, Tinian

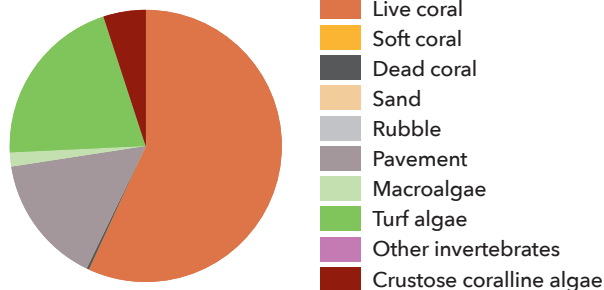
Puntan Kastiyu, or Castle Point, receives its name due to the large rock formation near the site that resembles the tower of a castle. This site had a wide range of marine fauna including a resident whitetip reef shark, green sea turtles and the only giant trevally seen during these surveys. This site has a high score for coral recruitment but a low score for bleaching resistance. Greater than 50% of the benthic community is comprised of live coral. Greater than 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site is a target for fishery regulations & enforcement. Examples of actions that can be considered for implementation at this location include increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	37/78	0.82	0.98	0.42	0.51	0.99	0.80	0.28	0.48	0.19
Intra-Island	11/25	0.89	0.97	0.46	0.89	0.99	0.80	0.39	0.31	0.56

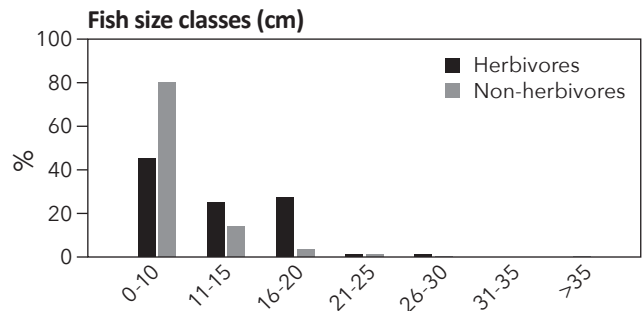
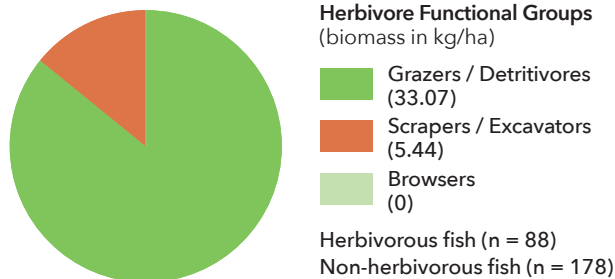
● Low (<avg - 1 SD) 
 ● Med-Low (<avg and >avg - 1 SD) 
 ● Med-High (>avg and <avg - 1 SD) 
 ● High (>avg + 1 SD) 
 ● Low 
 ● Med-High 
 ● Med-Low 
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

### Fish community



**Coral Quads:** *Acanthastrea echinata*, *Acropora digitifera*, *Acropora humilis*, *Acropora latistella*, *Acropora surculosa*, *Acropora tenuis*, *Astreopora listeri*, *Astreopora myriophthalma*, *Favia matthaii*, *Favia pallida*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Galaxea fascicularis*, *Goniastrea retiformis*, *Hydnophora microconos*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Montipora caliculata*, *Montipora efflorescens*, *Montipora foveolata*, *Montipora nodosa*, *Montipora tuberculosa*, *Pavona varians*, *Platygyra pini*, *Pocillopora elegans*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites australiensis*, *Porites lichen*, *Porites lobata*, *Porites lutea*, *Psammodora haimeana*, *Stylophora mordax*

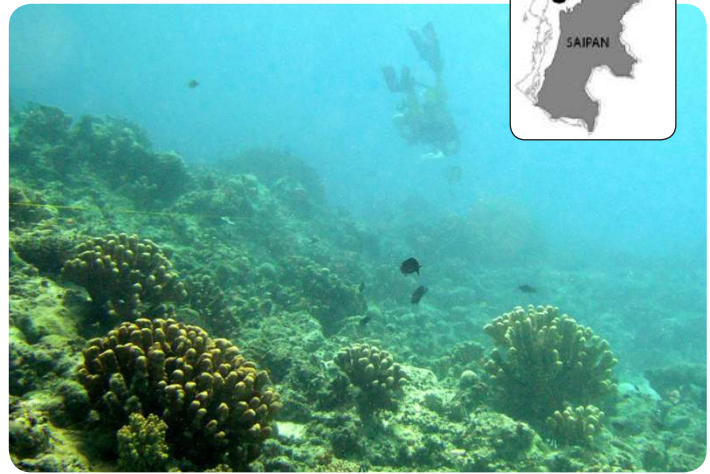
**Coral Swim:** *Acropora azurea*, *Acropora gemmifera*, *Acropora globiceps*, *Acropora secale*, *Acropora vaughani*, *Echinopora lamellosa*, *Favia favus*, *Favia helianthoides*, *Millepora platyphylla*, *Millepora tuberosa*, *Montastrea curta*, *Montipora verrilli*, *Pavona duerdeni*, *Pocillopora danae*, *Pocillopora eydouxi*, *Pocillopora woodjonesi*, *Porites vaughani*, *Psammodora nierstraszi*

**Fish SPCs:** *Acanthurus blochii*, *Acanthurus lineatus*, *Acanthurus nigrofuscus*, *Apolemichthys trimaculatus*, *Centropyge flavissima*, *Cephalopholis argus*, *Chaetodon ephippium*, *Chaetodon ornatissimus*, *Chlorurus sordidus*, *Chromis margaritifer*, *Chrysiptera brownriggii*, *Chrysiptera traceyi*, *Cirripectes variolosus*, *Ctenochaetus striatus*, *Dascyllus reticulatus*, *Forcipiger longirostris*, *Gomphosus varius*, *Halichoeres biocellatus*, *Halichoeres ornatissimus*, *Labroides dimidiatus*, *Melichthys vidua*, *Neocirrhites armatus*, *Oxycheilinus digrammus*, *Paracanthurus hepatus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Paracirrhites hemistictus*, *Parupeneus multifasciatus*, *Plectroglyphidodon dickii*, *Plectroglyphidodon imparipennis*, *Plectroglyphidodon johnstonianus*, *Pomacanthus imperator*, *Rhinecanthus rectangulus*, *Scarus rubroviolaceus*, *Stegastes fasciolatus*, *Thalassoma amblycephalum*, *Thalassoma quinquevittatum*, *Triacodon obesus*, *Zanclus cornutus*

**Fish Swim:** *Amanes scopas*, *Aphareus furca*, *Caranx ignobilis*, *Caranx melampygus*, *Chelonia sp.*, *Coris aygula*, *Coris gaimard*, *Epinephelus hexagonatus*, *Gnathodentex aureolineatus*, *Lutjanus bohar*, *Naso lituratus*, *Scarus oviceps*

## 38 - Managaha Patch\_MMT, Saipan

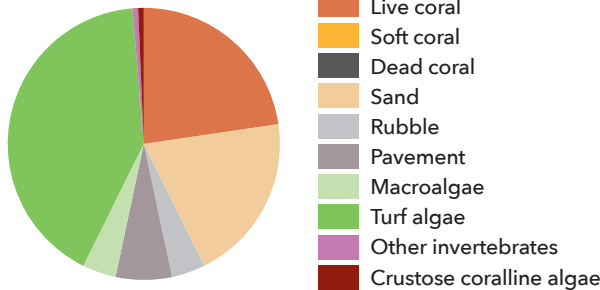
Managaha Patch\_MMT is located within the Managaha Marine Conservation Area (MMCA). This is one of three sites established by the CNMI Marine Monitoring Team within the MMCA to represent the various habitats. This site has medium-high scores for all resilience indicators excepting bleaching resistance, which has a medium-low score. Greater than 40% of the benthic community is made up by turfing algae. Roughly 75% of the total herbivorous fish biomass is comprised of scrapers/excavators. This site is a target for land-based sources of pollution reduction and fishery regulations and enforcement. Examples of actions that can be considered for implementation at this location include road and storm drain improvements and size regulations and bag/catch limits.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>38/78</b>	0.82	0.94	0.65	0.28	0.95	0.85	0.24	N/A - MPA	0.64
Intra-Island	<b>20/29</b>	0.83	0.94	0.75	0.28	0.95	0.88	0.24	N/A - MPA	0.64

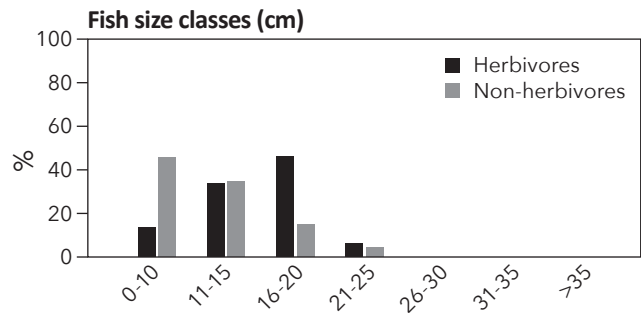
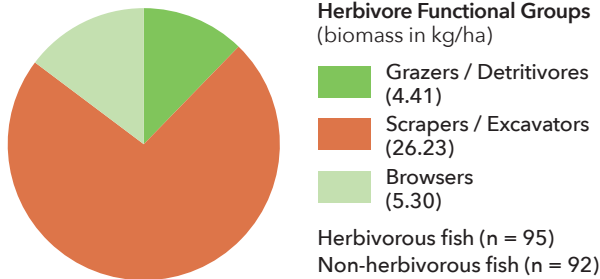
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg + 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



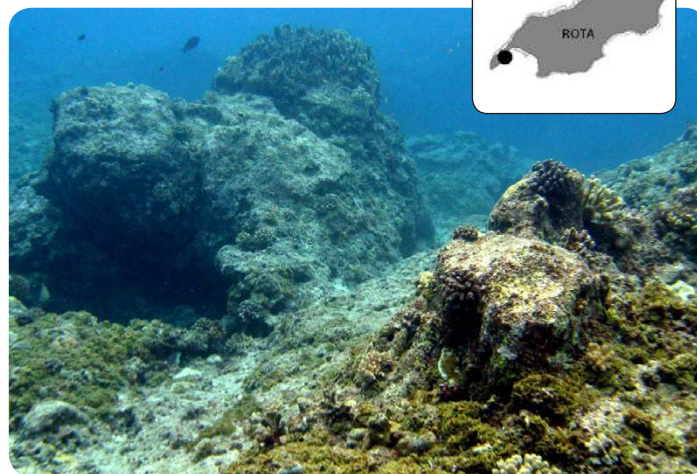
**Coral Quads:** *Acropora digitifera*, *Acropora tenuis*, *Acropora verweyi*, *Astreopora listeri*, *Astreopora myriophthalma*, *Astreopora randalli*, *Favia fava*, *Favia matthaii*, *Galaxea fascicularis*, *Goniastrea pectinata*, *Goniastrea retiformis*, *Heliopora coerulea*, *Isopora palifera*, *Leptastrea bottae*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Millepora tuberosa*, *Montipora hoffmeisteri*, *Montipora verrilli*, *Pavona varians*, *Pocillopora elegans*, *Porites lichen*, *Porites lobata*, *Porites vaughani*, *Scolymia australis*, *Stylocoenellia armata*, *Stylophora mordax*

**Coral Swim:** *Acanthastrea echinata*, *Cyphastrea chalcidicum*, *Cyphastrea serailia*, *Echinophyllia aspera*, *Fungia scutaria*, *Goniastrea edwardsi*, *Montipora grisea*, *Montipora lobulata*, *Montipora nodosa*, *Montipora tuberculosa*, *Pavona duerdeni*, *Platygyra pini*, *Pocillopora verrucosa*, *Psammocora nierstzi*, *Psammocora haimeana*

**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus triostegus*, *Canthigaster janthinoptera*, *Chaetodon auriga*, *Chaetodon ephippium*, *Chaetodon lunula*, *Chaetodon lunulatus*, *Chaetodon mertensii*, *Chlorurus sordidus*, *Chromis viridis*, *Ctenochaetus striatus*, *Gomphosus varius*, *Halichoeres hortulanus*, *Halichoeres trimaculatus*, *Hemigymnus fasciatus*, *Labroides dimidiatus*, *Naso lituratus*, *Oxycheilinus unifasciatus*, *Parupeneus barberinus*, *Parupeneus insularis*, *Scarus psittacus*, *Scolopsis lineata*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Zanclus cornutus*, *Zebrasoma flavescens*

## 39 - East Wedding Cake, Rota

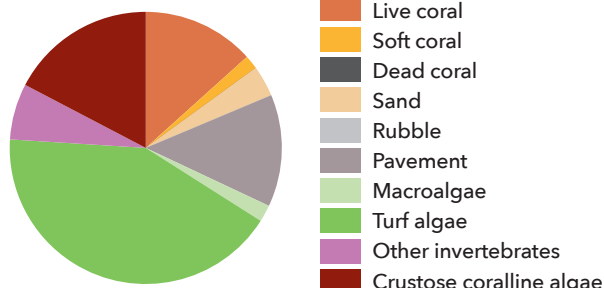
On the southwestern tip of Rota is Wedding Cake Mountain. Connected to the rest of the island by a thin isthmus, the mountain resembles a tiered wedding cake. East Wedding Cake boasted some of the largest mini-fin parrotfish seen on any survey. This site has a high score for bleaching resistance but a low score for coral recruitment. The benthic community at this site is very diverse; roughly 40% of the community is made up by turfing algae with the remaining roughly split among 8 other benthic categories. Roughly 75% of the total herbivorous fish biomass is comprised in near equal parts by grazers/detritivores and scrapers/excavators. This site is a target for reef restoration/coral translocation activities due to the low coral cover and diversity at the site and because it is accessible.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	39/78	0.82	0.97	0.82	0.06	0.88	0.83	0.28	0.33	0.20
Intra-Island	7/24	0.90	0.96	0.82	0.11	0.89	0.89	0.59	0.33	0.70

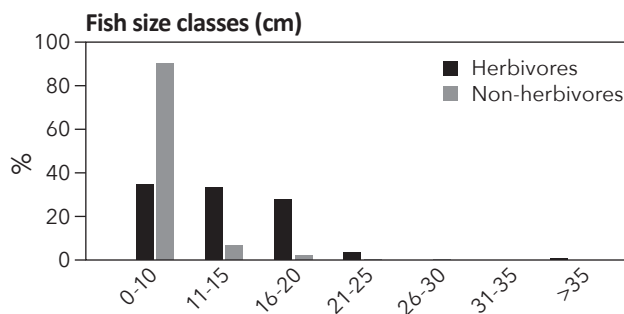
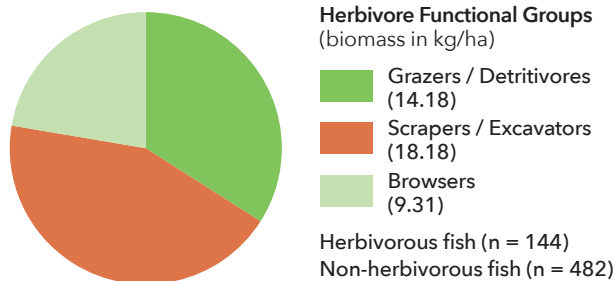
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Acanthastrea echinata*, *Astreopora listeri*, *Astreopora myriophthalma*, *Cyphastrea chalcidicum*, *Cyphastrea microphthalma*, *Cyphastrea senailia*, *Favia favaus*, *Favia matthaii*, *Goniastrea edwardsi*, *Heliopora coerulea*, *Leptastrea purpurea*, *Montastrea valenciennesi*, *Pavona varians*, *Platygyra pini*, *Porites australiensis*, *Porites lichen*, *Porites massive (australiensis, lobata, lutea complex)*, *Porites rus*

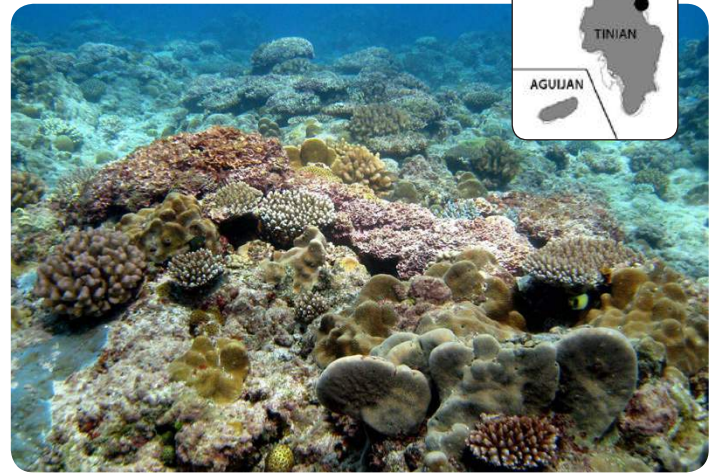
**Coral Swim:** *Favia stelligera*, *Fungia scutaria*, *Galaxea fascicularis*, *Pocillopora elegans*, *Pocillopora eydouxi*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites lutea*

**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus nigroris*, *Acanthurus olivaceus*, *Acanthurus pyroferus*, *Acanthurus sp.*, *Aphareus furca*, *Canthigaster solandri*, *Centropyge flavissima*, *Centropyge shepardi*, *Cephalopholis urodeta*, *Chaetodon auriga*, *Chaetodon citrinellus*, *Chaetodon ephippium*, *Chaetodon ornatissimus*, *Chaetodon punctatofasciatus*, *Chlorurus sordidus*, *Chromis acares*, *Chromis agilis*, *Chromis margaritifer*, *Chrysiptera brownriggii*, *Coris gaimard*, *Ctenochaetus cyanocheilus*, *Ctenochaetus striatus*, *Dascyllus trimaculatus*, *Forcipiger longirostris*, *Gomphosus varius*, *Labroides bicolor*, *Labroides dimidiatus*, *Lutjanus kasmira*, *Macropharyngodon meleagris*, *Monotaxis grandoculis*, *Naso lituratus*, *Naso unicornis*, *Nemateleotris magnifica*, *Neonippon argenteus*, *Parupeneus insularis*, *Plectroglyphidodon lacrymatus*, *Pomacanthus imperator*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Ptereleotris evides*, *Pygoplites diacanthus*, *Sargocentron microstoma*, *Sargocentron tiere*, *Scarus altipinnis*, *Scarus forsteni*, *Scarus psittacus*, *Stegastes fasciolatus*, *Stethojulis bandanensis*, *Stethojulis strigiventer*, *Sufflamen bursa*, *Sufflamen chrysopterum*, *Thalassoma amblycephalum*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Zebrasoma flavescens*

**Fish Swim:** *Acanthurus xanthopterus*, *Chaetodon reticulatus*, *Chlorurus frontalis*, *Chromis xanthura*, *Coris aygula*, *Decapterus macarellus*, *Gnathodentex aureolineatus*, *Gobiid sp.*, *Hemigymnus melapterus*, *Heniochus chrysostomus*, *Lutjanus bobar*, *Meiacanthus atrodorsalis*, *Mulloidichthys vanicolensis*, *Myripristis kuntzei*, *Naso hexacanthus*, *Oxycheilinus digrammus*, *Parupeneus multifasciatus*, *Pempheris ovalensis*, *Scarus frenatus*, *Scarus rubroviolaceus*, *Scarus schlegeli*, *Siganus argenteus*, *Synodus sp.*, *Zanclus cornutus*, *Zebrasoma veliferum*

## 40 - Unai Asiga, Tinian

Unai Asiga ("Salty Beach") is a "sub-beach" of Unai Dangkolo; the two are separated by a small rock outcropping. This site has medium-high scores for all resilience indicators except herbivore biomass, which is medium-low. Nearly 50% of the benthic community was comprised of live coral. Roughly 90% of the total herbivorous fish biomass was roughly split between grazers/detritivores and scrapers/excavators. This site is a target for land-based sources of pollution reduction. Examples of actions that can be implemented to reduce LBSP near the identified sites include: stream bank stabilization, road and storm drain improvement, other erosion control practices and sewage treatment upgrades. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

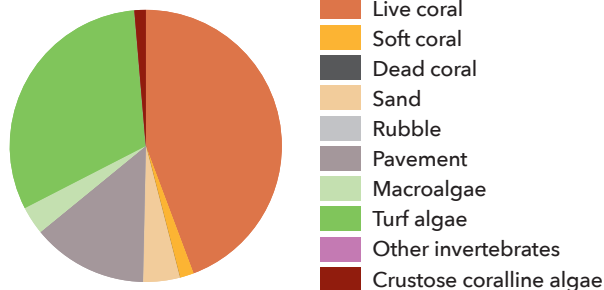


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	40/78	0.82	0.95	0.69	0.32	0.99	0.86	0.07	0.28	0.34
Intra-Island	14/25	0.86	0.93	0.74	0.56	0.99	0.86	0.16	0.05	0.97

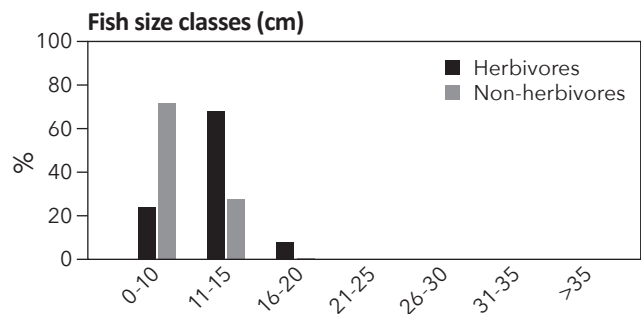
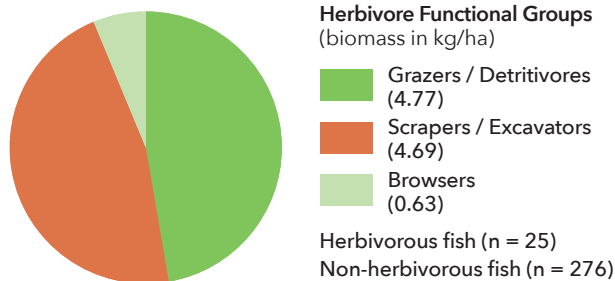
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

### Fish community



**Coral Quads:** *Acropora gemmifera*, *Acropora surculosa*, *Acropora tenuis*, *Astreopora listeri*, *Astreopora myriophthalma*, *Astreopora randalli*, *Astreopora listeri*, *Cyphastrea microphthalma*, *Cyphastrea senailia*, *Echinopora cf. pacificus*, *Echinopora lamellosa*, *Favia danae*, *Favia fava*, *Favia matthaii*, *Favia pallida*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea pectinata*, *Goniastrea retiformis*, *Hydnophora microconos*, *Leptastrea purpurea*, *Leptoria Porygia*, *Montipora aequituberculata*, *Montipora efflorescens*, *Montipora floweri*, *Montipora nodosa*, *Montipora sp. 2*, *Montipora verrilli*, *Pavona duerdeni*, *Pavona varians*, *Pavona duerdeni*, *Platygyra daedalea*, *Platygyra pini*, *Pocillopora elegans*, *Pocillopora verrucosa*, *Porites australiensis*, *Porites lobata*, *Porites lutea*, *Porites rus*, *Psammocora haimeana*, *Stylophora mordax*

**Coral Swim:** *Acanthastrea echinata*, *Acropora digitifera*, *Acropora globiceps*, *Acropora humilis*, *Acropora latistella*, *Acropora robusta*, *Acropora secale*, *Acropora vaughani*, *Acropora verweyi*, *Coccinarea columna*, *Heliopora coerulea*, *Pocillopora ankei*, *Pocillopora danae*, *Pocillopora eydouxi*, *Pocillopora woodjonesi*

**Fish SPCs:** *Acanthurus lineatus*, *Acanthurus nigrofuscus*, *Anampses twistii*, *Balistapus undulatus*, *Canthigaster solandri*, *Centropyge flavissima*, *Cephalopholis argus*, *Cephalopholis urodeta*, *Chaetodon auriga*, *Chaetodon ephippium*, *Chaetodon lunula*, *Chaetodon reticulatus*, *Chaetodon unimaculatus*, *Cheilinus chlorourus*, *Cheilinus inermis*, *Chlorurus sordidus*, *Chromis margaritifer*, *Chromis vanderbilti*, *Dascyllus reticulatus*, *Forcipiger longirostris*, *Gobiid sp.*, *Gomphosus varius*, *Halichoeres biocellatus*, *Halichoeres hortulanus*, *Halichoeres ornatissimus*, *Labroides dimidiatus*, *Macolor niger*, *Macropharyngodon meleagris*, *Melichthys vidua*, *Naso lituratus*, *Neocirrhites armatus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Parupeneus multifasciatus*, *Plectroglyphidodon dickii*, *Plectroglyphidodon johnstonianus*, *Plectroglyphidodon lacrymatus*, *Pomacentrus vaiuli*, *Pomacentrus guamensis*, *Scarus psittacus*, *Stegastes fasciatus*, *Stethojulis bandanensis*, *Sufflamen bursa*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Zanclus cornutus*

**Fish Swim:** *Acanthurus nigricans*, *Acanthurus olivaceus*, *Acanthurus sp.*, *Amanses scopas*, *Balistoides viridescens*, *Chaetodon ornatissimus*, *Chaetodon quadrimaculatus*, *Cheilinus trilobatus*, *Chrysiptera brownriggii*, *Chrysiptera traceyi*, *Cirripectes variolosus*, *Coris aygula*, *Coris gaimard*, *Epibulus insidiator*, *Oxycheilinus digrammus*, *Paracanthurus hepatus*, *Parupeneus cyclostomus*, *Pygoplites diacanthus*, *Scarus rubroviolaceus*, *Thalassoma amblycephalum*, *Zanclus cornutus*

Observers: S. McKagan, J. Maynard, and S. Johnson

OVERALL SCORE: MED-HIGH

# 41 - Long Beach\_MMT, Tinian

Long Beach\_MMT, or Unai Dánkolo, is the largest stretch of beach on Tinian's east side and is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. An ancient Chamorro village is located here and during World War II, US military forces made one of their amphibious landings at this beach. Rare Turkey moray eels were observed at this site. This site has a high score for coral recruitment but medium-low scores for bleaching resistance, temperature variability and herbivore biomass. The benthic community at this site is highly diverse; this is one of only a few sites where all ten of the benthic categories were used to classify the benthic community. Nearly 75% of the total herbivorous fish biomass was comprised of browsers. This site is a target for bleaching monitoring and supporting recovery so should be monitored during upcoming warm seasons.

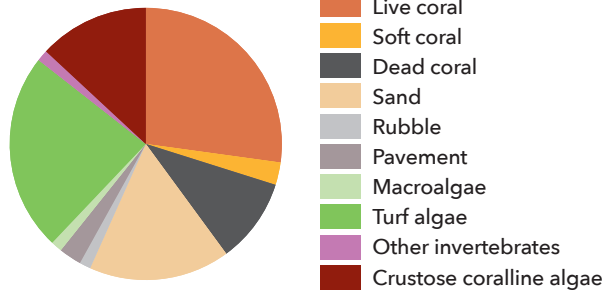


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	41/78	0.82	0.98	0.62	0.42	1.00	0.78	0.11	0.31	0.19
Intra-Island	7/25	0.93	0.97	0.67	0.74	1.00	0.78	0.51	0.08	0.56

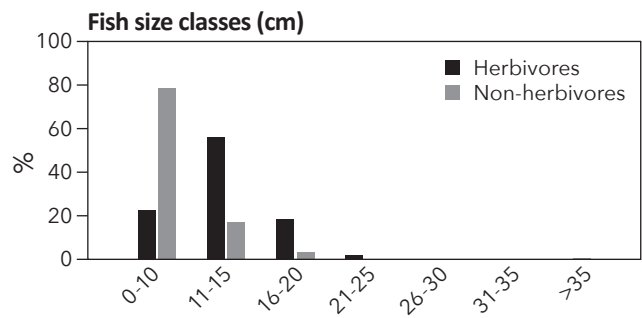
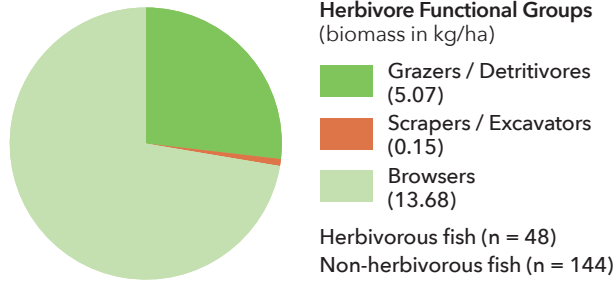
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg + 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acanthastrea echinata, Acropora latistella, Acropora samoensis, Acropora surculosa, Astreopora listeri, Astreopora myriophthalma, Astreopora randalli, Cyphastrea chalcidicum, Cyphastrea serailia, Favia danae, Favia matthaii, Favia pallida, Favia stelligera, Favites abdita, Favites russelli, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea retiformis, Hydnothpora microconos, Leptastrea purpurea, Leptastrea transversa, Leptoria Phrygia, Millepora platyphylla, Montipora efflorescens, Montipora floweri, Montipora foveolata, Montipora grisea, Montipora hoffmeisteri, Montipora nodosa, Montipora venosa, Montipora verrilli, Pavona duerdeni, Pavona varians, Pavona venosa, Platygyra pini, Pocillopora danae, Pocillopora elegans, Pocillopora meandrina, Porites lichen, Porites lutea, Porites rus, Psammocora haimeana, Psammocora nierstraszi, Stylophora mordax*

**Coral Swim:** *Acropora azurea, Acropora c.f. striata, Acropora digitifera, Acropora gemmifera, Acropora humilis, Acropora robusta, Acropora secale, Acropora tenuis, Acropora verweyi, Cyphastrea microphthalma, Echinopora lamellosa, Favia javus, Favia helianthoides, Pocillopora eydouxi, Pocillopora verrucosa, Porites australiensis, Porites lobata, Stylocoeniella armata*

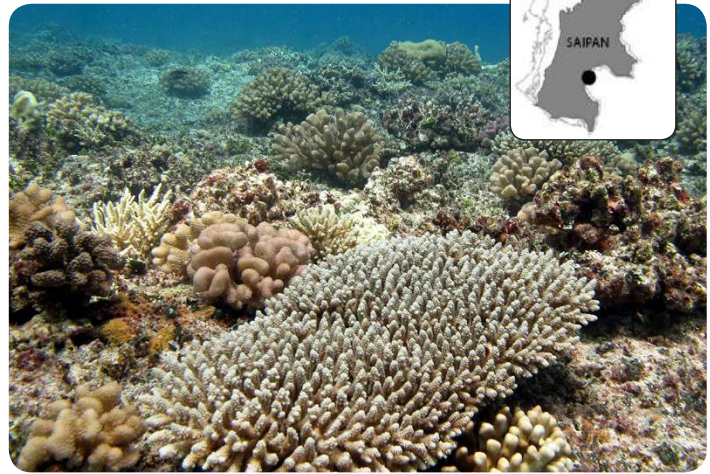
**Fish SPCs:** *Acanthurus lineatus, Acanthurus nigricans, Acanthurus nigrofuscus, Balistapus undulatus, Cephalopholis urodeta, Chaetodon melanotus, Chaetodon ornatissimus, Chaetodon reticulatus, Chromis agilis, Chromis margaritifera, Cirrhitilabrus katherinae, Coris aygula, Ctenochaetus striatus, Dascyllus reticulatus, Gomphosus varius, Gymnothorax meleagris, Halichoeres biocellatus, Halichoeres hortulanus, Hemigymnus fasciatus, Labrid sp., Labroides dimidiatus, Melichthys vidua, Naso lituratus, Oxycheilinus digrammus, Paracirrhites arcatus, Paracirrhites forsteri, Parupeneus multifasciatus, Plectroglyphidodon dickii, Plectroglyphidodon johnstonianus, Plectroglyphidodon lacrymatus, Pomacentrus vaiuli, Scarus psittacus, Stegastes fasciolatus, Stethojulis bandanensis, Stethojulis strigiventer, Sufflamen bursa, Sufflamen chrysopterum, Thalassoma quinquevittatum, Zanclus cornutus*

**Fish Swim:** *Acanthurus olivaceus, Calotomus carolinus, Chaetodon citrinellus, Chlorurus sordidus, Chrysiptera brownriggii, Chrysiptera traceyi, Coris gaimard, Epibulus insidiator, Oxycheilinus unifasciatus, Pomachromis guamensis, Sufflamen fraenatum*

OVERALL SCORE: MED-HIGH

## 42 - North Dakota, Saipan

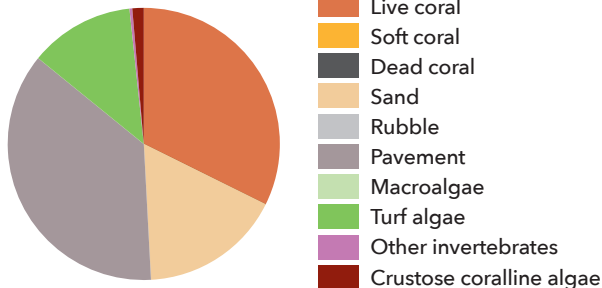
North Dakota reef is located in the southern half of Laolao Bay near the abandoned estate of Larry Hilbloom, the estranged millionaire who went missing in the 1980s. Large yellow striped emperors swam through our fish surveys at this site. This site has a high score for coral recruitment but medium-low scores for bleaching resistance, temperature variability and herbivore biomass. Roughly 80% of the benthic community is made up in near equal parts by live coral and bare pavement. Nearly 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site is a target for bleaching monitoring and supporting recovery so should be monitored during upcoming warm seasons. This site is also a target for LBSP reduction. Examples of actions that can be implemented to reduce LBSP near the identified site includes: stream bank stabilization, road and storm drain improvement, other erosion control practices and sewage treatment upgrades.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>42/78</b>	0.81	1.00	0.65	0.41	0.98	0.76	0.11	0.29	0.33
Intra-Island	<b>22/29</b>	0.82	1.00	0.75	0.41	0.98	0.79	0.11	0.25	0.33

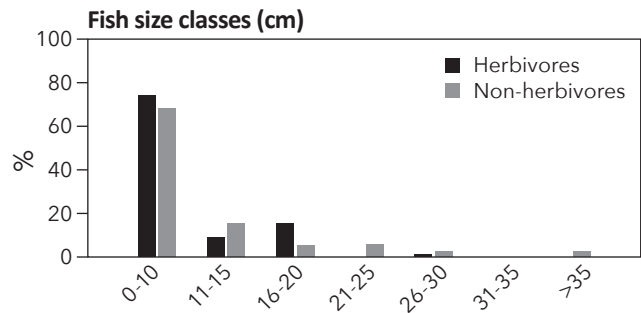
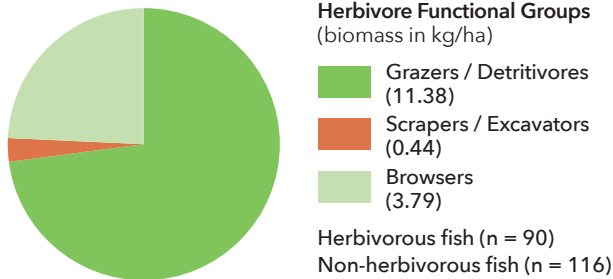
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



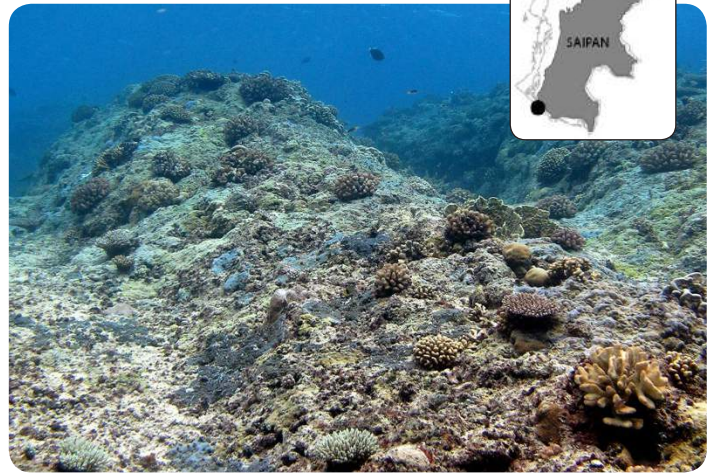
**Coral Quads:** *Acropora digitifera*, *Acropora gemmifera*, *Acropora monticulosa*, *Acropora nasuta*, *Acropora secale*, *Acropora surculosa*, *Acropora vaughani*, *Astreopora listeri*, *Astreopora myriophthalma*, *Cyphastrea ocellina*, *Cyphastrea serailia*, *Favia favus*, *Favia matthaii*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Leptastrea purpurea*, *Leptastrea transversa*, *Leptoria Phrygia*, *Millepora tuberosa*, *Montastrea curta*, *Montipora calculata*, *Montipora grisea*, *Montipora hoffmeisteri*, *Montipora nodosa*, *Montipora tuberculosa*, *Pavona duerdeni*, *Pavona varians*, *Pocillopora ankei*, *Pocillopora elegans*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites lutea*, *Stylocoeniella armata*, *Stylophora mordax*

**Coral Swim:** *Acropora verweyi*, *Favia stelligera*, *Millepora platyphyllia*

**Fish SPCs:** *Acanthurus blochii*, *Acanthurus nigricauda*, *Acanthurus nigrofuscus*, *Aphareus furca*, *Balistapus undulatus*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon quadrimaculatus*, *Cheilinus chlorourus*, *Chlorurus sordidus*, *Ctenochaetus striatus*, *Forcipiger longirostris*, *Halichoeres margaritaceus*, *Labroides dimidiatus*, *Letrinus obsoletus*, *Macolor niger*, *Melichthys vidua*, *Naso lituratus*, *Parupeneus multifasciatus*, *Pomacanthus imperator*, *Rhinocanthus rectangulus*, *Sargocentron tere*, *Sufflamen bursa*, *Sufflamen chrysopterum*, *Sufflamen fraenatum*, *Thalassoma quinquevittatum*, *Zebrasoma flavescens*

# 43 - Agingan Point, Saipan

Agingan Point is the southwestern most point on Saipan. An outfall point from a sewage treatment plant is located at this site, roughly 90 feet deep and 100 feet from the coast. A rare yellow-edge moray eel was observed at this site. This site has a high score for temperature variability but medium-low scores for bleaching resistance, coral recruitment and herbivore biomass. Roughly 80% of the benthic community was made up in near equal parts by turf algae and live coral. Greater than 75% of the total herbivorous fish biomass was comprised of grazers/detritivores. This site is a target for LBSP reduction, fishery regulations and enforcement and bleaching monitoring and supporting recovery. This is one of only four sites that met at least three of the criteria set to identify targets for management actions. This site should be monitored during upcoming warm seasons. Examples of actions that can be considered for implementation at this location include road and storm drain improvements and size regulations and bag/catch limits.

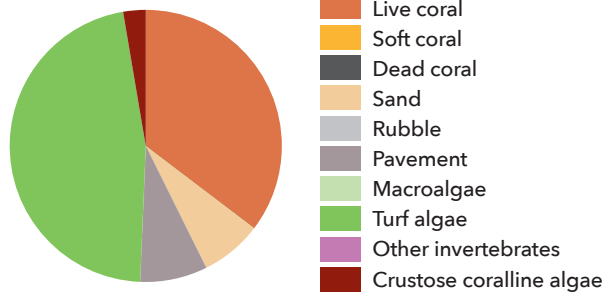


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	43/78	0.81	1.00	0.67	0.15	0.94	0.94	0.16	0.64	0.27
Intra-Island	21/29	0.83	1.00	0.78	0.15	0.94	0.97	0.17	0.62	0.27

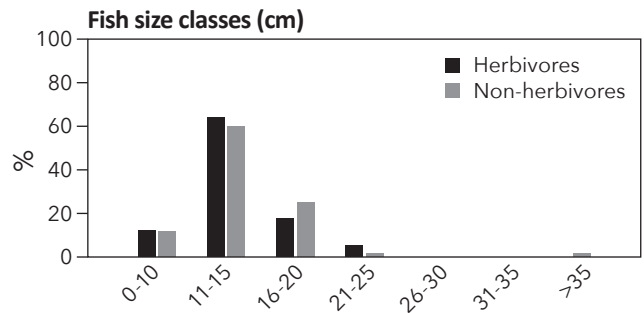
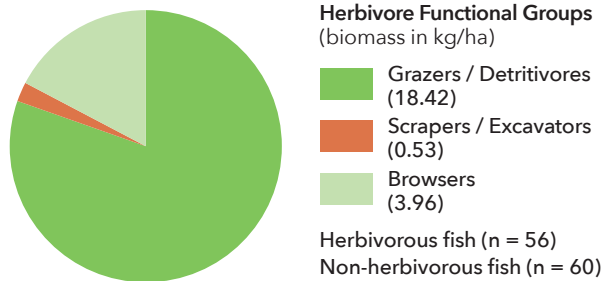
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acropora digitifera, Acropora gemmifera, Acropora surculosa, Acropora verweyi, Astreopora myriophthalma, Astreopora randalli, Cyphastrea chalcidicum, Cyphastrea serailia, Favia matthaii, Favites abdita, Favites russelli, Fungia scutaria, Galaxea fascicularis, Hydnothpora microconos, Leptastrea purpurea, Leptoria Phrygia, Montipora floweri, Montipora grisea, Montipora hoffmeisteri, Montipora monasteriata, Montipora tuberculosa, Montipora verrilli, Pavona varians, Pocillopora danae, Pocillopora elegans, Pocillopora meandrina, Pocillopora verrucosa, Porites lichen, Porites lobata, Porites vaughani, Stylocoeniella armata, Stylophora mordax*

**Coral Swim:** *Favia stelligera, Goniopora minor, Montastrea curta, Pocillopora anكلي*

**Fish SPCs:** *Acanthurus blochii, Acanthurus nigricans, Acanthurus nigrofuscus, Acanthurus olivaceus, Aphareus furca, Balistapus undulatus, Cantherbines pardalis, Canthigaster solandri, Centropyge flavissima, Cephalopholis urodeta, Chaetodon auriga, Chaetodon citrinellus, Ctenochaetus striatus, Gymnothorax flavimarginatus, Halichoeres hortulanus, Halichoeres ornatissimus, Melichthys vidua, Naso lituratus, Paracanthurus hepatus, Rbinecanthus rectangulus, Sargocentron caudimaculatum, Scarus psittacus, Sufflamen bursa, Sufflamen chrysopterum, Sufflamen fraenatum, Thalassoma lutescens, Thalassoma quinquevittatum*

OVERALL SCORE: MED-HIGH

# 44 - Happy Days, Tinian

Happy Days is on the southern side of Aguijan Island. After a long morning working from our survey boat, our boat captain, Fonz, was able to show us some dolphins before heading in for this dive. The team decided to name the site Happy Days, in honor of "The Fonz". This site was among those with the greatest warm season temperature variability but had low bleaching resistance and medium-low herbivore biomass. Roughly 60% of the benthic community was made up in near equal parts by crustose coralline algae and live coral. Greater than 80% of the total herbivorous fish biomass was comprised of grazers/detritivores. This site is a target for bleaching monitoring and supporting recovery so should be monitored during upcoming warm seasons. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

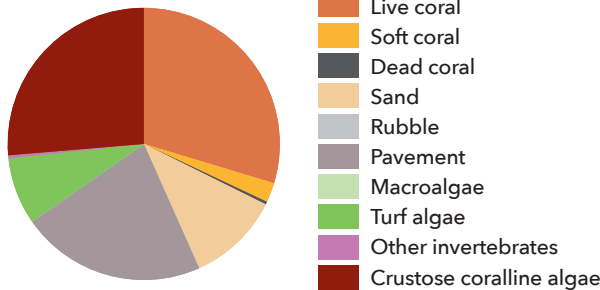


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	44/78	0.81	1.00	0.49	0.29	0.97	1.00	0.14	0.34	0.19
Intra-Island	18/25	0.84	1.00	0.53	0.51	0.97	1.00	0.20	0.12	0.56

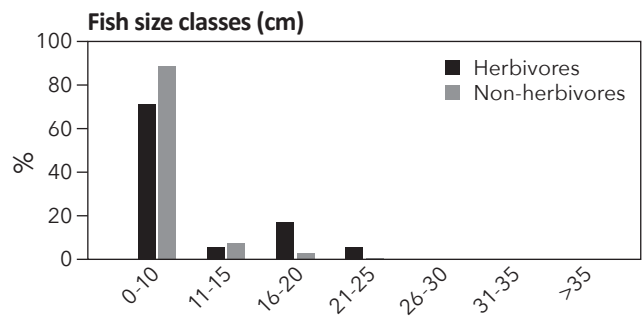
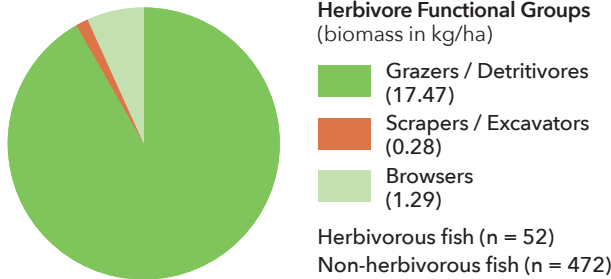
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



**Coral Quads:** *Acropora gemmifera*, *Acropora humilis*, *Astropora listeri*, *Astropora myriophthalma*, *Astropora randalli*, *Cyphastrea microphthalma*, *Cyphastrea serailia*, *Favia danae*, *Favia belianthoides*, *Favia matthaii*, *Favia pallida*, *Favia stelligera*, *Favites abdita*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Heliopora coerulea*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Montipora c.f. floweri*, *Montipora caliculata*, *Montipora grisea*, *Montipora hoffmeisteri*, *Montipora nodosa*, *Montipora sp. 2*, *Montipora venosa*, *Pavona varians*, *Platygyra pini*, *Plesiastrea versipora*, *Pocillopora danae*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites australiensis*, *Porites lobata*, *Porites lutea*, *Psammocora haimiana*, *Stylophora mordax*, *Turbinaria stellulata*

**Coral Swim:** *Acropora digitifera*, *Acropora globiceps*, *Acropora latistella*, *Acropora monticulosa*, *Acropora secale*, *Acropora surculosa*, *Acropora tenuis*, *Fungia scutaria*, *Hydnophora microconos*, *Lobophyllia corymbosa*, *Montipora foveolata*, *Montipora verrilli*, *Pavona duerdeni*, *Pocillopora eydouxi*, *Porites vaughani*

**Fish SPCs:** *Acanthurus nigrofuscus*, *Acanthurus olivaceus*, *Acanthurus pyroferus*, *Anampses caeruleopunctatus*, *Balistapus undulatus*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon auriga*, *Chaetodon reticulatus*, *Cheilinus chlorourus*, *Cheilinus oxycephalus*, *Chromis agilis*, *Chromis margaritifer*, *Ctenochaetus striatus*, *Dascyllus reticulatus*, *Dascyllus trimaculatus*, *Forcipiger longirostris*, *Gomphosus varius*, *Halichoeres biocellatus*, *Halichoeres hortulanus*, *Halichoeres ornatissimus*, *Labroides dimidiatus*, *Macropharyngodon meleagris*, *Melichthys vidua*, *Monotaxis grandoculis*, *Naso lituratus*, *Neocirrhites armatus*, *Oxycheilinus digrammus*, *Paracirrhites arcatus*, *Parupeneus multifasciatus*, *Plectroglyphidodon dickii*, *Plectroglyphidodon johnstonianus*, *Pomacentrus vaiuli*, *Pomacromis guamensis*, *Pseudocheilinus tetrataenia*, *Ptereleotris evides*, *Scarus psittacus*, *Stegastes fasciolatus*, *Sufflamen bursa*, *Thalassoma amblycephalum*, *Thalassoma quinquevittatum*

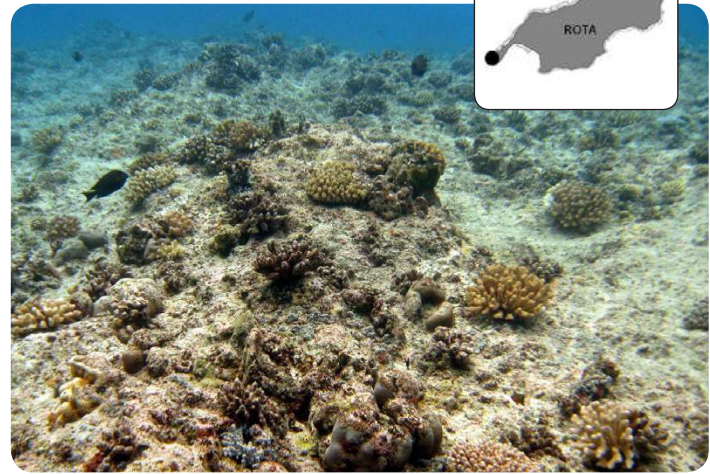
**Fish Swim:** *Acanthurus blochii*, *Acanthurus guttatus*, *Acanthurus nigricans*, *Amanes scopas*, *Aphareus furca*, *Caesio teres*, *Chaetodon quadrimaculatus*, *Chaetodon unimaculatus*, *Coris aygula*, *Coris gaimard*, *Gnathodentex aureolineatus*, *Gobiid sp.*, *Kyphosus sp.*, *Lethrinus xanthochilus*, *Lutjanus bohar*, *Lutjanus kasmira*, *Macolor macularis*, *Mulloidichthys flavolineatus*, *Mulloidichthys vanicolensis*, *Myripristis berndti*, *Naso tonganus*, *Naso unicornis*, *Neoniphon opercularis*, *Oxycheilinus unifasciatus*, *Rhinecanthus rectangulus*, *Sargocentron caudimaculatum*, *Sargocentron tiera*, *Scarus forsteni*, *Scarus oviceps*, *Scarus rubroviolaceus*, *Stethojulis bandanensis*, *Sufflamen fraenatum*, *Thalassoma lutescens*, *Valenciennesa strigata*, *Zebbrasoma flavescens*

OVERALL SCORE: MED-HIGH



# 45 - Senhanom Wall, Rota

Senhanom Wall is wall dive off of Rota's southwest point; senhanom is Chamorro for great water. This is arguably the most popular dive site in Rota. The dive is highlighted by an opening at the top of a cavern cave where light can shine down. Adult Napoleon wrasses were observed below us during surveys at this site. This site has a high score for herbivore biomass but low score for coral recruitment. Roughly 40% of the benthic community is made up of turfing algae. Roughly 50% of the total herbivorous fish biomass is comprised of grazers/detritivores with the remaining half roughly split between scrapers/excavators and browsers. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results.

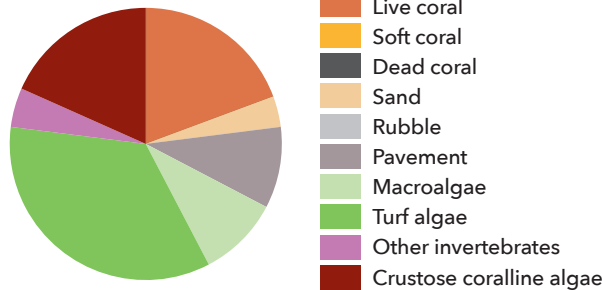


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	45/78	0.81	0.87	0.71	0.09	0.88	0.79	0.48	0.32	0.19
Intra-Island	5/24	0.93	0.80	0.71	0.17	0.89	0.86	1.00	0.32	0.67

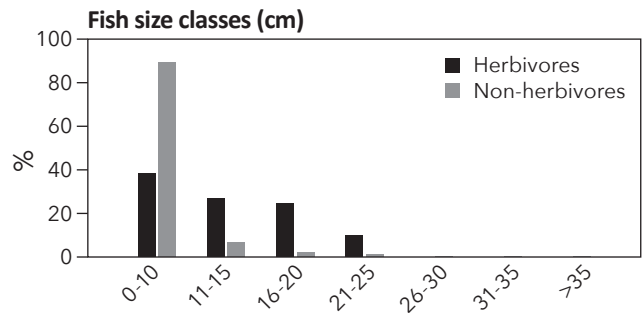
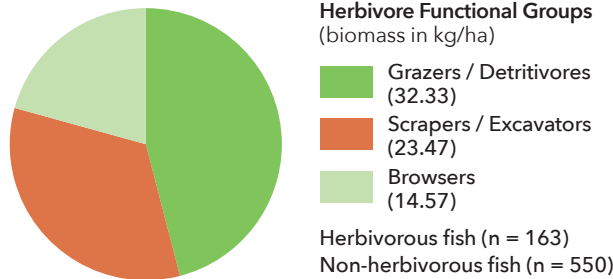
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-Low ● Med-High ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acropora surculosa*, *Astreopora listeri*, *Astreopora myriophthalma*, *Cyphastrea chalcidicum*, *Favia favus*, *Favia matthaii*, *Favia stelligera*, *Goniastrea edwardsi*, *Leptastrea purpurea*, *Montastrea valenciennesi*, *Pavona c.f. frondifera*, *Pavona varians*, *Pocillopora elegans*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites elegans*, *Porites lichen*, *Psammocora haimeana*, *Psammocora nierstraszi*

**Coral Swim:** *Acanthastrea echinata*, *Acropora cerealis*, *Acropora gemmifera*, *Acropora humilis*, *Acropora quelchi*, *Acropora tenuis*, *Cyphastrea agassizi*, *Heliopora coerulea*, *Hydnophora microconos*, *Leptoria Pbrygia*, *Millepora platyphylla*, *Montipora verrucosa*, *Pavona duerdeni*, *Platygyra daedalea*, *Platygyra pini*, *Pocillopora ankei*, *Pocillopora eydouxi*, *Porites lutea*, *Stylophora mordax*

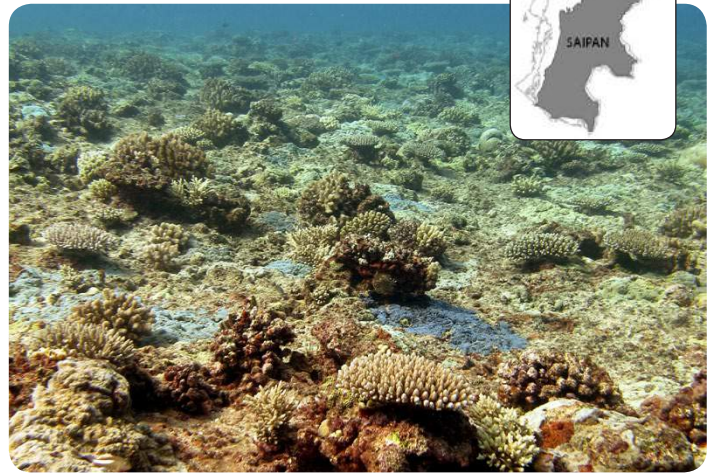
**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus nigricauda*, *Acanthurus nigrofuscus*, *Acanthurus olivaceus*, *Acanthurus sp.*, *Aphareus furca*, *Apolemichthys trimaculatus*, *Balistapus undulatus*, *Caranx melampygus*, *Cephalopholis argus*, *Cephalopholis urodeta*, *Chaetodon auriga*, *Chaetodon citrinellus*, *Chaetodon ornatissimus*, *Chaetodon quadrimaculatus*, *Chaetodon reticulatus*, *Chlorurus sordidus*, *Chromis margaritifer*, *Chrysiptera brownriggii*, *Chrysiptera traceyi*, *Cirripectes variolosus*, *Coris gaimard*, *Ctenochaetus cyanocheilus*, *Ctenochaetus striatus*, *Gobiid sp.*, *Halichoeres margaritaceus*, *Labroides dimidiatus*, *Melichthys vidua*, *Naso brevirostris*, *Naso lituratus*, *Nemateleotris magnifica*, *Neocirrhites armatus*, *Oxycheilinus digrammus*, *Oxycheilinus unifasciatus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Parupeneus multifasciatus*, *Plectroglyphidodon dickii*, *Plectroglyphidodon johnstonianus*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Ptereleotris zebra*, *Scarus forsteni*, *Scarus oviceps*, *Stegastes fasciolatus*, *Stethojulis strigiventer*, *Sufflamen bursa*, *Sufflamen chrysopterum*, *Thalassoma amblycephalum*, *Thalassoma quinquevittatum*, *Valenciennesa strigata*, *Variola louti*, *Zanclus cornutus*, *Zebrasoma flavescens*, *Zebrasoma veliferum*

**Fish Swim:** *Cantherbines pardalis*, *Cheilinus undulatus*, *Coris aygula*, *Forcipiger longirostris*, *Hemigymnus fasciatus*, *Naso unicornis*, *Parupeneus cyclostomus*, *Scarus rubroviolaceus*, *Variola albimarginata*

OVERALL SCORE: MED-LOW

## 46 - Wing Beach, Saipan

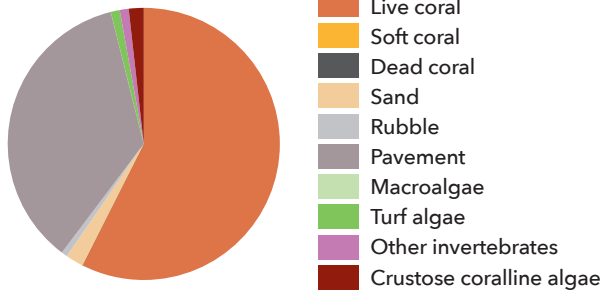
Wing Beach is located on the northwest side of Saipan and is a Marine Monitoring Team survey site. On calm days, divers often see turtles, sharks and other charismatic megafauna. This site is a great spot to find photogenic anemonefishes. This site has a high score for coral recruitment but a low score for bleaching resistance. Greater than 50% of the benthic community is made up by live coral. Greater than 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site is a target for bleaching monitoring and supporting recovery so should be monitored during upcoming warm seasons. This site is also a target for fishery regulations and enforcement. Examples of actions that can be considered for implementation at this location include increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>46/78</b>	0.80	1.00	0.51	0.40	0.98	0.81	0.18	0.52	0.19
Intra-Island	<b>24/29</b>	0.81	1.00	0.59	0.40	0.98	0.84	0.19	0.49	0.19

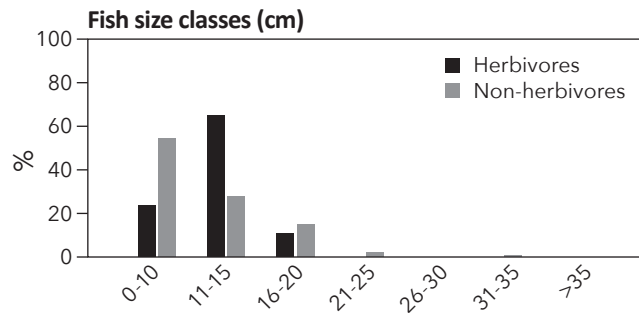
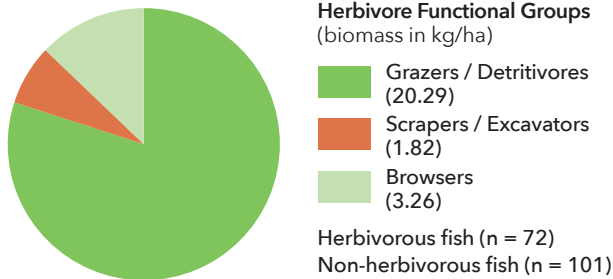
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



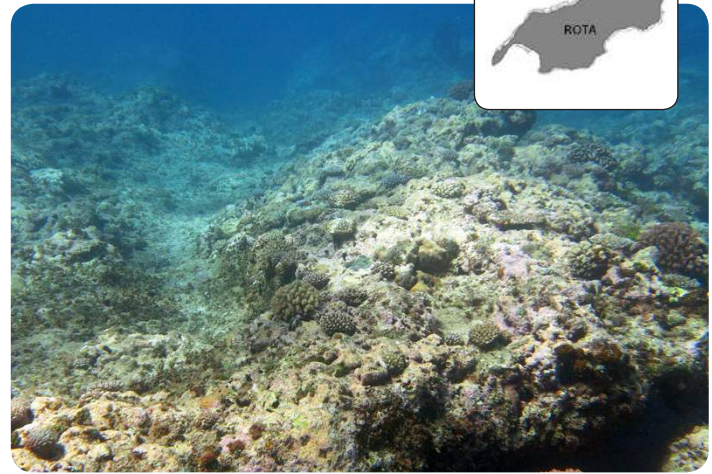
**Coral Quads:** *Acropora azurea, Acropora digitifera, Acropora humilis, Acropora monticulosa, Acropora nasuta, Acropora surculosa, Acropora tenuis, Acropora vaughani, Acropora verweyi, Astreopora listeri, Astreopora myriophthalma, Astreopora randalli, Cyphastrea serailia, Favia matthaii, Favites russelli, Galaxea fascicularis, Goniastrea edwardsi, Leptastrea purpurea, Leptastrea transversa, Millepora tuberosa, Montipora efflorescens, Montipora floweri, Montipora grisea, Montipora hoffmeisteri, Montipora nodosa, Montipora tuberculosa, Pavona varians, Pocillopora elegans, Pocillopora meandrina, Pocillopora verrucosa, Porites lichen, Porites lobata, Porites rus, Psammocora haimeana, Stylocoeniella armata, Stylophora mordax*

**Coral Swim:** *Acropora gemmifera, Acropora secale, Favia stelligera, Goniastrea retiformis, Montastrea curta, Platygyra pini, Pocillopora ankei, Pocillopora eydouxi*

**Fish SPCs:** *Acanthurus nigricans, Acanthurus nigrofuscus, Acanthurus olivaceus, Amphiprion chrysopterus, Balistapus undulatus, Cantherbines pardalis, Centropyge flavissima, Cephalopholis urodeta, Chaetodon citrinellus, Chaetodon quadrimaculatus, Cheilinus chlorourus, Ctenochaetus striatus, Halichoeres ornatus, Labroides dimidiatus, Letbrinus xanthochilus, Melichthys vidua, Naso lituratus, Odonus niger, Paracanthurus hepatus, Scarus forsteri, Sufflamen bursa, Sufflamen chrysopterus, Thalassoma quinquevittatum, Zanclus cornutus*

# 47 - Mochong, Rota

Mochong is one of several sites on the island of Rota where you can find a latte stone quarry. Latte stones are architectural constructs that are unique to the Marianas. This site had a wide range of marine fauna including a resident blacktip reef shark, green sea turtles and large blunthead parrotfish. This site has a high score for coral recruitment but has very low herbivore biomass and high macroalgae cover. Turf algae and macroalgae make up nearly 50% of the benthic community. The total herbivorous fish biomass is comprised in roughly equal parts by grazers/detritivores and scrapers/excavators. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

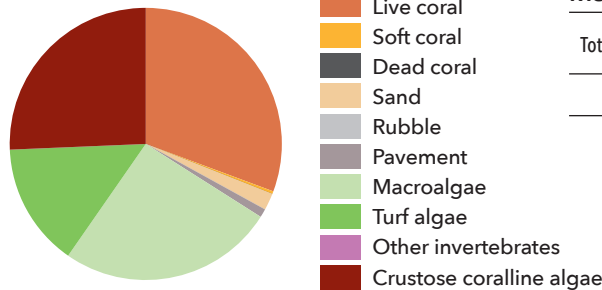


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	47/78	0.80	0.65	0.80	0.49	0.97	0.82	0.04	0.12	0.19
Intra-Island	9/24	0.87	0.46	0.80	0.93	0.98	0.89	0.07	0.12	0.67

● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

## Benthic community

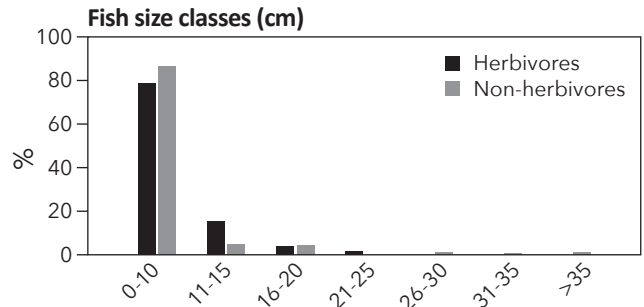
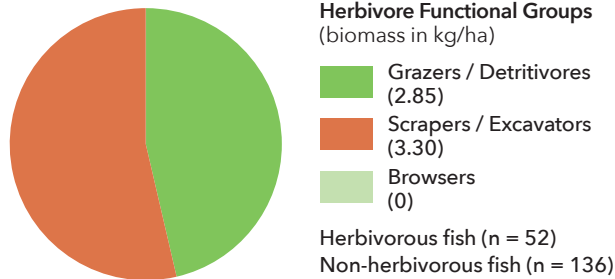


## Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
1.33	1.33	0	0	0

Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



**Coral Quad:** *Acanthastrea c.f. brevis*, *Acanthastrea echinata*, *Acropora abrotenoides*, *Acropora digitifera*, *Acropora monticulosa*, *Acropora surculosa*, *Astreopora myriophthalma*, *Astreopora randalli*, *Cyphastrea micropthalma*, *Favia danae*, *Favia pallida*, *Favia sp.*, *Favia speciosa*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Goniastrea retiformis*, *Leptastrea purpurea*, *Millepora platyphylla*, *Montipora boffmeisteri*, *Pavona varians*, *Pocillopora damicornis*, *Pocillopora danae*, *Porites australiensis*, *Porites lichen*, *Porites lobata*, *Porites lutea*, *Stylophora mordax*

**Coral Swim:** *Acropora azurea*, *Acropora cophyodactyla*, *Acropora gemmifera*, *Acropora globiceps*, *Acropora humilis*, *Acropora samoensis*, *Acropora tenuis*, *Acropora verweyi*, *Cyphastrea serailia*, *Favia matthaii*, *Favites flexuosa*, *Heliopora coerulea*, *Hydnophora microconos*, *Montipora floweri*, *Montipora foveolata*, *Montipora grisea*, *Montipora turgescens*, *Onulophyllia crispa*, *Pavona duerdeni*, *Platygyra daedalea*, *Pocillopora elegans*, *Pocillopora meandrina*, *Porites vaughani*

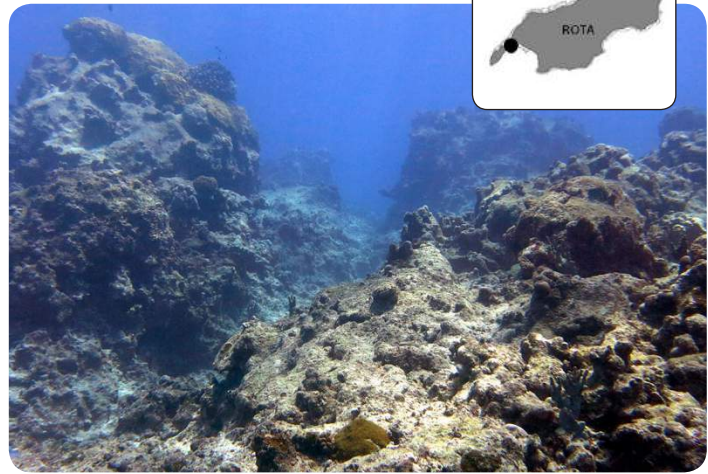
**Fish SPC:** *Acanthurus guttatus*, *Acanthurus lineatus*, *Acanthurus nigrofuscus*, *Acanthurus sp.*, *Anampses caeruleopunctatus*, *Balistapus undulatus*, *Carangoides ferdau*, *Caranx melampygus*, *Cephalopholis argus*, *Cephalopholis urodeta*, *Chaetodon citrinellus*, *Chromis acares*, *Chrysiptera brownriggii*, *Chrysiptera traceyi*, *Cirripectes variolosus*, *Coris aygula*, *Ctenochaetus striatus*, *Halichoeres biocellatus*, *Halichoeres hortulanus*, *Halichoeres ornatissimus*, *Labroides dimidiatus*, *Melichthys vidua*, *Neocirrhites armatus*, *Neoniphon argenteus*, *Paracirrhites arcatus*, *Plectroglyphidodon dickii*, *Pomacanthus imperator*, *Rhinecanthus rectangulus*, *Scarus frenatus*, *Stegastes fasciolatus*, *Sufflamen chrysopterum*, *Thalassoma quinquevittatum*, *Valenciennesia strigata*, *Zebbrasoma flavescens*

**Fish Swim:** *Acanthurus olivaceus*, *Acanthurus triostegus*, *Aphareus furca*, *Bothus mancus*, *Carcharhinus melanopterus*, *Chaetodon auriga*, *Chaetodon ulietensis*, *Cheilinus trilobatus*, *Chelonia sp.*, *Chlorurus microrhinos*, *Chlorurus sordidus*, *Kyphosus sp.*, *Lutjanus bohar*, *Melichthys niger*, *Naso lituratus*, *Parupeneus cyclostomus*, *Scarus psittacus*, *Scarus rubroviolaceus*, *Spratelloides delicatulus*, *Thalassoma purpuraceum*

OVERALL SCORE: MED-LOW

# 48 - Sasanhaya\_MMT, Rota

Sasanhaya\_MMT is located on the northwestern end of Sasanhaya Bay and is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. This site has medium-low scores for coral recruitment, temperature variability and herbivore biomass. Nearly 50% of the benthic community is made up by turf algae and macroalgae. Nearly 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site did not meet any of the criteria we set to identify targets for various types of management action. This site may warrant management attention for reasons distinct from the resilience assessment results.

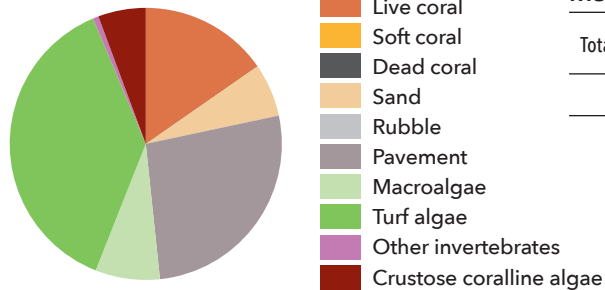


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	48/78	0.80	0.89	0.78	0.16	0.93	0.83	0.19	0.35	0.24
Intra-Island	12/24	0.86	0.84	0.78	0.30	0.94	0.89	0.31	0.35	0.83

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-Low ● Med-High ● High

## Benthic community

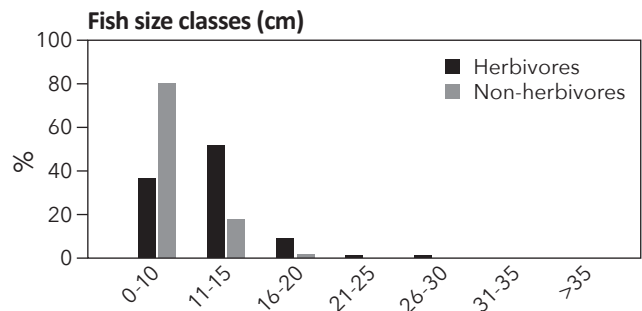
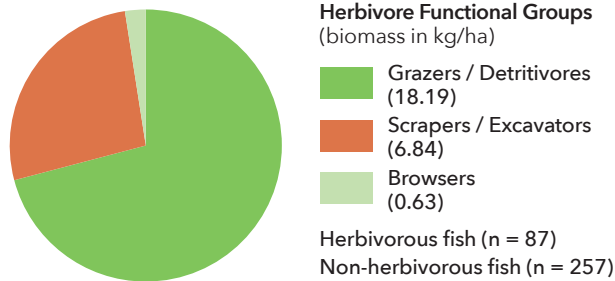


## Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
0.90	0.90	0	0	0

Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acanthastrea echinata, Astreopora myriophthalma, Astreopora randalli, Cyphastrea microphthalma, Favia danae, Favia fava, Favia pallida, Favia sp., Favia stelligera, Favites abdita, Favites russelli, Fungia scutaria, Goniastrea edwardsi, Goniastrea retiformis, Leptastrea purpurea, Leptastrea transversa, Montipora hoffmeisteri, Pavona diffluens, Pavona varians, Platygyra pini, Pocillopora damicornis, Porites australiensis, Porites lobata, Porites lutea, Porites rus, Porites vaughani, Psammocora haimana, Psammocora nierstraszi*

**Coral Swim:** *Acropora digitifera, Acropora surculosa, Acropora tenuis, Cycloseris c.f. vaughani, Echinopora lamellosa, Favia matthaii, Favites flexuosa, Fungia repanda, Fungia scutaria, Galaxea fascicularis, Heliopora coerulea, Millepora tuberosa, Montipora foveolata, Montipora grisea, Montipora nodosa, Pavona duerdeni, Pavona venosa, Platygyra daedalea, Plesiastrea versipora, Pocillopora danae, Porites annae*

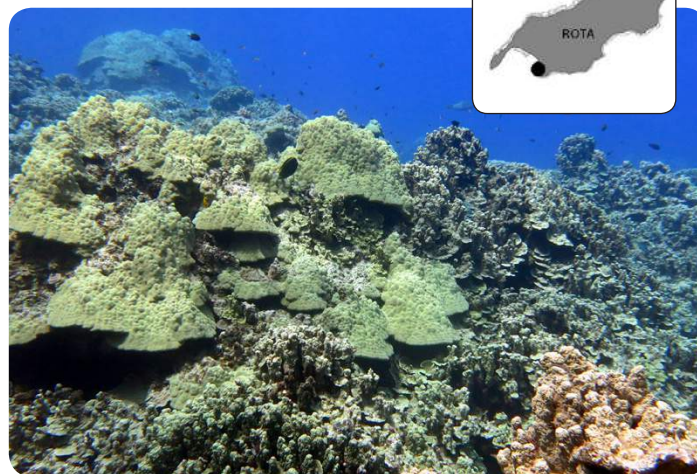
**Fish SPCs:** *Acanthurus nigricans, Acanthurus nigrofuscus, Acanthurus pyroferus, Anampses caeruleopunctatus, Anampses twistii, Centropyge shepardi, Cephalopholis urodeta, Chaetodon lunulatus, Chaetodon ornatus, Chaetodon reticulatus, Chaetodon ulietensis, Cheilinus trilobatus, Chlorurus sordidus, Chromis acares, Chromis agilis, Chromis margaritifera, Chromis xanthurus, Chrysiptera traceyi, Coris aygula, Ctenochaetus cyanocheilus, Ctenochaetus striatus, Dascyllus trimaculatus, Forcipiger flavissimus, Forcipiger longirostris, Gnathodentex aureolineatus, Gomphosus varius, Halichoeres hortulanus, Halichoeres trimaculatus, Heniochus chrysostomus, Labroides dimidiatus, Meiacanthus atrodorsalis, Monotaxis grandoculis, Myripristis kuntee, Naso lituratus, Neoniphon argenteus, Paracirrhites forsteri, Parupeneus insularis, Parupeneus multifasciatus, Plectroglyphidodon lacrymatus, Pomacentrus vaiuli, Pomacentrus guamensis, Pseudanthias pascalus, Ptereleotris evides, Sargocentron caudimaculatum, Scarus niger, Scarus psittacus, Stegastes fasciolatus, Stegastes nigricans, Stetbojulis bandanensis, Thalassoma lutescens, Thalassoma quinquevittatum, Zebrasoma flavescens*

**Fish Swim:** *Acanthurus xanthopterus, Aphaeus furca, Cantherhines dumerilii, Chaetodon quadrimaculatus, Cheilinus oxycephalus, Epibulus insidiator, Hemigymnus fasciatus, Kyphosus cinerascens, Lutjanus monostigma, Malacanthus latovittatus, Naso brevirostris, Oxycheilinus digrammus, Oxycheilinus unifasciatus, Parupeneus barberinus, Parupeneus cyclostomus, Scarus altipinnis, Scarus forsteri, Zandrus cornutus, Zebrasoma veliferum*

OVERALL SCORE: MED-LOW

# 49 - Coral Gardens\_MMT, Rota

Coral Gardens\_MMT is located in the Sasanhaya Bay Fish Preserve and there are many large fish at this site. This site is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. Coral Gardens is a popular dive site because large colonies of *Porites* and *Diploastrea* corals dominate the reefscape. This site has high scores for bleaching resistance and herbivore biomass but low scores for coral recruitment, coral diversity and temperature variability. Roughly 75% of the benthic community was made up by live coral. Roughly 75% of the total herbivorous fish biomass is comprised of scrapers/excavators. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

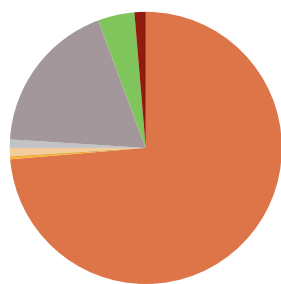


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	49/78	0.80	1.00	0.96	0.01	0.63	0.67	0.47	N/A - MPA	0.20
Intra-Island	6/24	0.91	1.00	0.96	0.03	0.63	0.73	0.98	N/A - MPA	0.68

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community



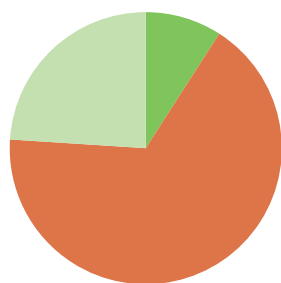
- Live coral
- Soft coral
- Dead coral
- Sand
- Rubble
- Pavement
- Macroalgae
- Turf algae
- Other invertebrates
- Crustose coralline algae

## Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
9.83	9.63	0	0.20	0

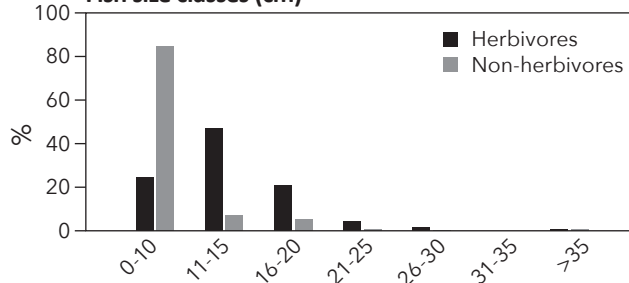
Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



- Herbivore Functional Groups (biomass in kg/ha)**
- Grazers / Detritivores (6.51)
  - Scrapers / Excavators (47.97)
  - Browsers (17.19)
- Herbivorous fish (n = 129)  
Non-herbivorous fish (n = 411)

## Fish size classes (cm)



**Coral Quads:** *Favia stelligera*, *Favites abdita*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Goniopora fruticosa*, *Leptastrea purpurea*, *Montipora foveolata*, *Pavona diffluens*, *Pavona varians*, *Pocillopora verrucosa*, *Porites australiensis*, *Porites c.f. deformis*, *Porites lichen*, *Porites lobata*, *Porites lutea*, *Porites rus*, *Porites vaughani*

**Coral Swim:** *Acropora globiceps*, *Acropora surculosa*, *Astreopora listeria*, *Astreopora myriophthalma*, *Cyphastrea microphthalma*, *Diploastrea heliopora*, *Favia matthaii*, *Fungia fungites*, *Fungia paumotensis*, *Fungia repanda*, *Heliopora coerulea*, *Pocillopora ankei*, *Pocillopora danae*, *Porites annae*, *Turbinaria stellulata*

**Fish SPCs:** *Abudefduf vaigiensis*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus sp.*, *Anampses twistii*, *Aphareus furca*, *Balistapus undulatus*, *Bodianus axillaris*, *Centropyge flavissima*, *Centropyge heraldi*, *Cephalopholis sonnerati*, *Cephalopholis urodeta*, *Chaetodon auriga*, *Chaetodon ephippium*, *Chaetodon ornatissimus*, *Chaetodon reticulatus*, *Chaetodon ulietensis*, *Chlorurus sordidus*, *Chromis acaras*, *Chromis agilis*, *Chromis margaritifer*, *Chrysiptera traceyi*, *Ctenochaetus cyanocheilus*, *Ctenochaetus striatus*, *Forcipiger flavissimus*, *Forcipiger longirostris*, *Gnathodentex aureolineatus*, *Gomphosus varius*, *Halichoeres hortulanus*, *Hemigymnus melapterus*, *Kyphosus sp.*, *Labroides bicolor*, *Labroides dimidiatus*, *Lutjanus monostigma*, *Lutjanus bohar*, *Lutjanus gibbus*, *Meiacanthus atrodorsalis*, *Myripristis berndii*, *Naso hexacanthus*, *Naso lituratus*, *Nemateleotris magnifica*, *Neoniphon argenteus*, *Oxycheilinus dignammus*, *Paracirrhites arcatus*, *Pempheris ovalensis*, *Plectroglyphidodon lacrymatus*, *Pomacentrus vaiuli*, *Ptereleotris evides*, *Pygoplites diacanthus*, *Sargocentron caudimaculatum*, *Scarus altipinnis*, *Stegastes fasciatus*, *Thalassoma hardwicke*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Un-id fish sp.*, *Zebrasoma flavescens*

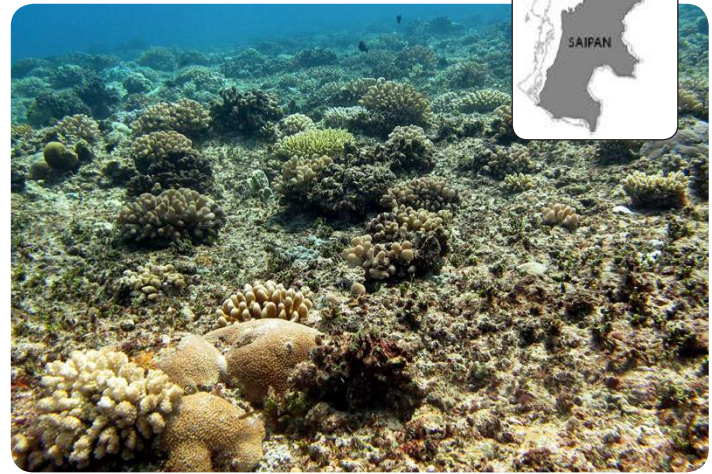
**Fish swim:** *Aprion virescens*, *Arothron meleagris*, *Arothron nigropunctatus*, *Cantherhines pardalis*, *Centropyge shepardii*, *Chaetodon bennetti*, *Chaetodon lumulatus*, *Chaetodon punctatofasciatus*, *Epinephelus sp.*, *Hemigymnus fasciatus*, *Kyphosus bigibbus*, *Lutjanus bohar*, *Lutjanus gibbus*, *Meiacanthus atrodorsalis*, *Parupeneus multifasciatus*, *Scarus forsteni*, *Scarus rubroviolaceus*, *Zanclus cornutus*, *Zebrasoma veliferum*

Observers: S. McKagan, J. Maynard, S. Johnson, and L. Raymundo

OVERALL SCORE: MED-LOW

# 50 - Achu Dangkulu, Saipan

Achu Dangkulu translates to “Big Rock”. There is a group of large rocks at this site that the fishers of Tanapag village use as a navigation landmark. This site has medium-low scores for bleaching resistance, temperature variability, and herbivore biomass. This is one of only a few sites where coral cover is >70%. Nearly 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site is a target for fishery regulations and enforcement and bleaching monitoring and supporting recovery. Examples of actions that can be considered for implementation at this location include: size regulations and bag and catch limits and increased monitoring during warm seasons.

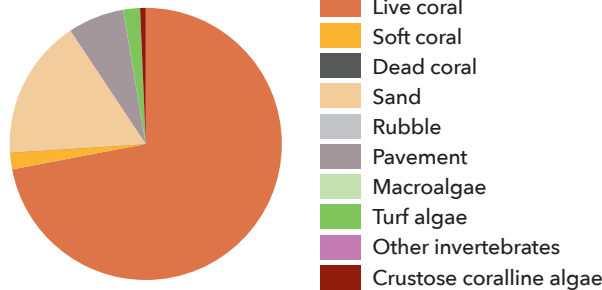


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	50/78	0.80	1.00	0.68	0.27	0.98	0.79	0.10	0.64	0.19
Intra-Island	23/29	0.81	1.00	0.79	0.27	0.98	0.82	0.10	0.62	0.19

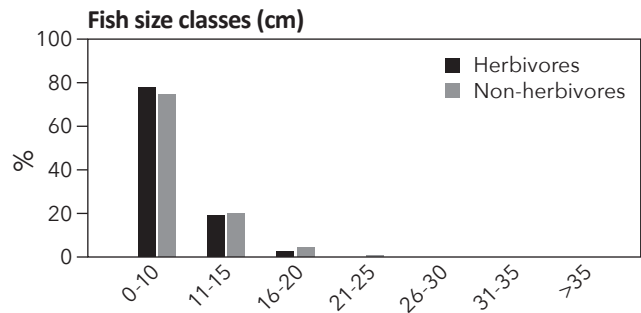
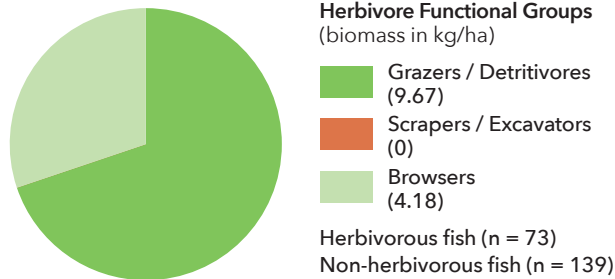
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acropora digitifera, Acropora gemmifera, Acropora humilus, Acropora secale, Acropora vaughani, Acropora verweyi, Astreopora myriophthalma, Astreopora randalli, Cyphastrea chalcidicum, Cyphastrea serailia, Favia favus, Favia matthaii, Favia speciosa, Favia stelligera, Favites abdita, Favites russelli, Fungia scutaria, Galaxea fascicularis, Goniastrea edwardsi, Goniopora fruticosa, Leptastrea purpurea, Leptastrea transversa, Leptoria Phrygia, Montipora caliculata, Montipora floweri, Montipora grisea, Montipora boffmeisteri, Montipora monasteriata, Montipora nodosa, Montipora sp. # 1, Pavona varians, Platygyra pini, Pocillopora ankei, Pocillopora damicornis, Pocillopora danae, Pocillopora elegans, Pocillopora meandrina, Pocillopora verrucosa, Porites lichen, Porites lobata, Porites vaughani, Stylophora mordax*

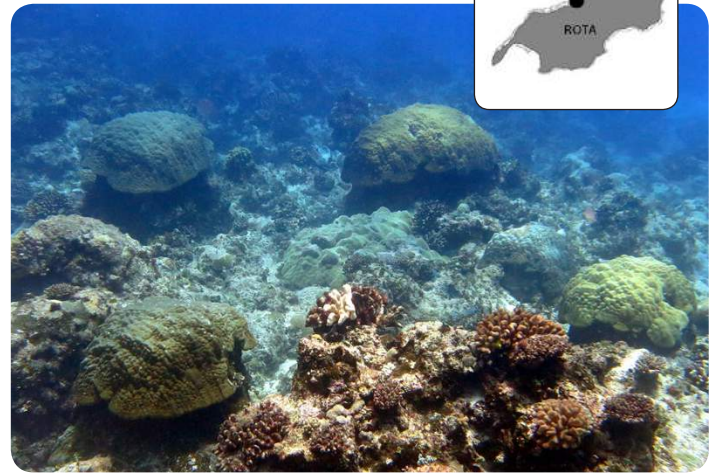
**Coral Swim:** *Acropora monticulosa, Acropora nasuta, Heliopora coerulea, Hydnothpora microconos, Lobophyllia hemprichii, Millepora tuberosa, Montastrea curta*

**Fish SPCs:** *Acanthurus nigrofuscus, Balistapus undulatus, Cantherbines pardalis, Centropyge flavissima, Centropyge shepardii, Cephalopholis urodeta, Chaetodon ornatissimus, Chaetodon quadrimaculatus, Cheilinus chlorourus, Ctenochaetus striatus, Halichoeres margaritaceus, Labroides dimidiatus, Letbrinus rubrioperculatus, Melichthys vidua, Naso lituratus, Oxycheilinus unifasciatus, Sufflamen chrysopterum, Sufflamen fraenatum, Thalassoma lutescens, Thalassoma quinquevittatum, Zebrasoma flavescens*

OVERALL SCORE: MED-LOW

# 51 - Coconut Village, Rota

Coconut Village is a collection of tropical bungalows along the shore adjacent to this site. Coconut Village was once an exotic holiday getaway for locals and tourists. This site has medium-high scores for most indicators but has medium-low herbivore biomass and has above average macroalgae cover. Uniquely, nearly 50% of the benthic community is made up by crustose coralline algae. Greater than 50% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site is a target for reef restoration and coral translocation. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

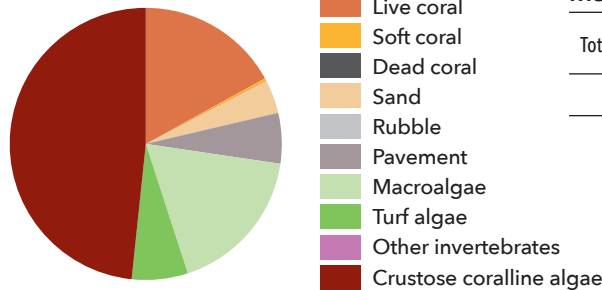


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	51/78	0.80	0.76	0.76	0.27	0.97	0.85	0.14	0.22	0.20
Intra-Island	10/24	0.86	0.63	0.76	0.50	0.98	0.92	0.29	0.22	0.70

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community

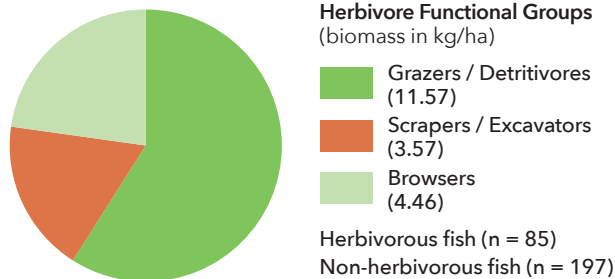


## Mean disease prevalence (%)

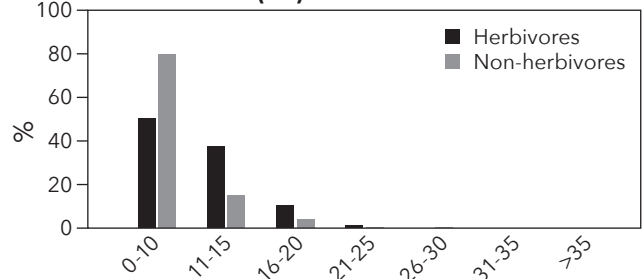
Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
2.99	2.57	0.21	0.21	0

Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



## Fish size classes (cm)



**Coral Quads:** *Acanthastrea echinata, Acropora digitifera, Acropora surculosa, Astropora myriophthalma, Echinopora lamellosa, Favia danae, Favia matthaii, Favia pallida, Favites abdita, Favites russelli, Goniastrea edwardsi, Goniastrea reitiformis, Goniopora minor, Hydnothpora microconos, Leptastrea purpurea, Leptastrea transversa, Leptoria Phrygia, Millepora tuberosa, Montipora efflorescens, Montipora hoffmeisteri, Montipora sp. 2, Oulophyllia crispa, Pavona duerdeni, Pavona frondifera, Pavona varians, Porites australiensis, Porites lobata, Porites lutea, Stylophora mordax*

**Coral Swim:** *Acropora gemmifera, Acropora globiceps, Acropora robusta, Acropora verweyi, Cyphastrea micropthalma, Cyphastrea serialia, Favia stelligera, Fungia fungites, Fungia repanda, Galaxea fascicularis, Goniopora djiboutiensis, Heliopora coerulea, Isopora palifera, Montipora acquituberculata, Montipora floweri, Montipora nodosa, Pavona maldiviensis, Pavona venosa, Pocillopora damicornis, Pocillopora danae, Pocillopora elegans, Pocillopora eydouxi, Porites annae, Porites rus, Psammocora nierstraszi, Turbinaria stellulata*

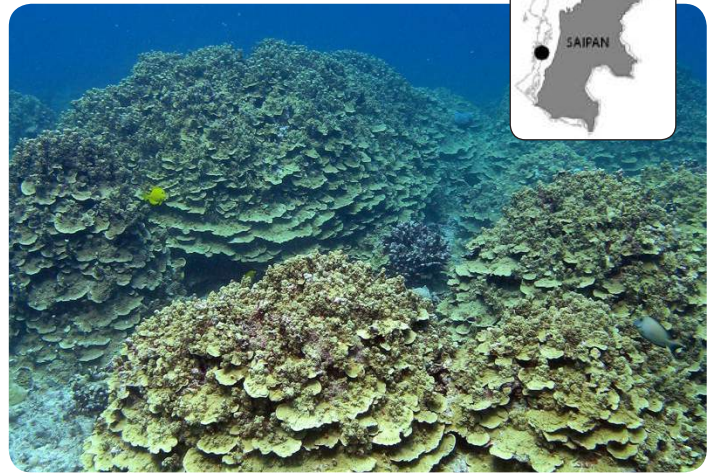
**Fish SPCs:** *Acanthurus lineatus, Acanthurus nigricans, Acanthurus nigrofuscus, Acanthurus sp., Anampses twistii, Cephalopholis urodeta, Chaetodon auriga, Chaetodon lunula, Chaetodon reticulatus, Chlorurus sordidus, Chromis acares, Chromis agilis, Chromis margaritifera, Chrysiptera brownriggii, Chrysiptera traceyi, Cirripectes variolosus, Ctenochaetus cyanocheilus, Ctenochaetus striatus, Forcipiger flavissimus, Gomphosus varius, Halichoeres hortulanus, Halichoeres ornatus, Labrid sp., Labroides dimidiatus, Macropharyngodon meleagris, Myripristis kuntee, Naso lituratus, Neoniphon opercularis, Oxycheilinus digrammus, Paracirrhites arcatus, Paracirrhites forsteri, Parupeneus barberinus, Parupeneus cyclostomus, Pempheris ovalensis, Plectroglyphidodon dickii, Plectroglyphidodon lacrymatus, Pomacentrus vaiuli, Sargocentron caudimaculatum, Sargocentron diadema, Scarus psittacus, Stegastes fasciolatus, Stebojulis bandanensis, Sufflamen bursa, Thalassoma quinquevittatum*

**Fish Swim:** *Aphareus furca, Bodianus axillaris, Caesio teres, Cheilinus trilobatus, Cirrhitilabrus katherinae, Coris aygula, Coris gaimard, Epibulus insidiator, Hemigymnus fasciatus, Hemigymnus melapterus, Lethrinus xanthurus, Lutjanus monostigma, Monotaxis grandoculis, Parupeneus multifasciatus, Plectroglyphidodon johnstonianus, Pomacentrus imperator, Ptereleotris evides, Sargocentron tere, Scarus altipinnis, Scarus forsteri, Scarus rubroviolaceus, Zebriasoma flavescens*

OVERALL SCORE: MED-LOW

## 52 - Oleai Rocks, Saipan

Oleai Rocks is located on the western side of Saipan. Dive operators take divers to this area using as a back-up to more popular sites further south. This site has medium-low scores for bleaching resistance, coral recruitment and temperature variability. Roughly 70% of the benthic community is made up in near equal parts by live coral and bare pavement. Greater than 50% of the total herbivorous fish biomass is comprised of scrapers/excavators. This site did not meet any of the criteria we set to identify targets for various types of management action. This site may warrant management attention for reasons distinct from the resilience assessment results.

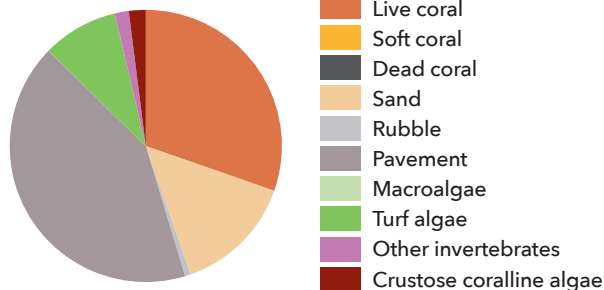


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	52/78	0.79	1.00	0.59	0.16	0.96	0.82	0.28	0.67	0.19
Intra-Island	25/29	0.80	1.00	0.68	0.16	0.96	0.85	0.28	0.65	0.19

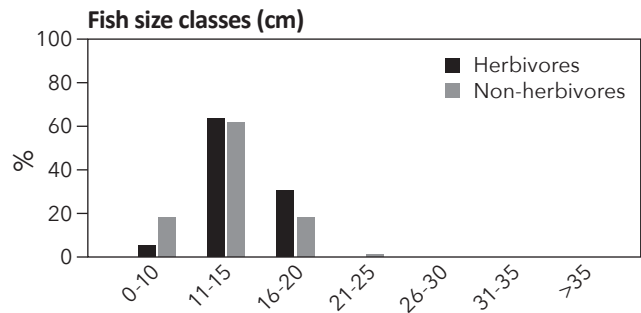
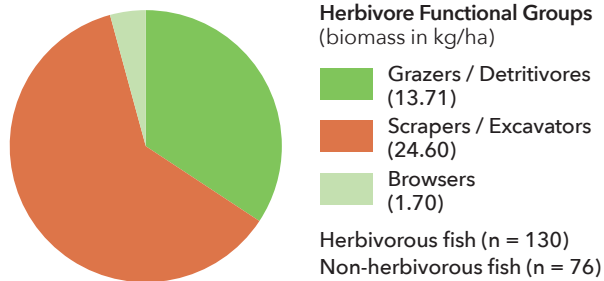
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Acanthastrea echinata*, *Acropora azurea*, *Acropora digitifera*, *Acropora secale*, *Astreopora listeri*, *Astreopora myriophthalma*, *Astreopora randalli*, *Cyphastrea chalcidicum*, *Cyphastrea serailia*, *Favia matthaii*, *Favia speciosa*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Hydnophora microconos*, *Leptastrea purpurea*, *Montipora caliculata*, *Montipora efflorescens*, *Montipora floweri*, *Montipora grisea*, *Montipora hoffmeisteri*, *Montipora nodosa*, *Pavona varians*, *Platygyra pini*, *Pocillopora elegans*, *Pocillopora verrucosa*, *Porites lichen*, *Porites lobata*, *Porites rus*, *Psammacora haimeana*, *Stylophora mordax*

**Coral Swim:** *Acropora gemmifera*, *Acropora humilis*, *Acropora monticulosa*, *Acropora robusta*, *Acropora vaughani*, *Acropora verweyi*, *Favia favus*, *Isopora palifera*, *Lobophyllia corymbosa*, *Montastrea curta*, *Pavona duerdeni*, *Pocillopora danae*, *Porites australiensis*

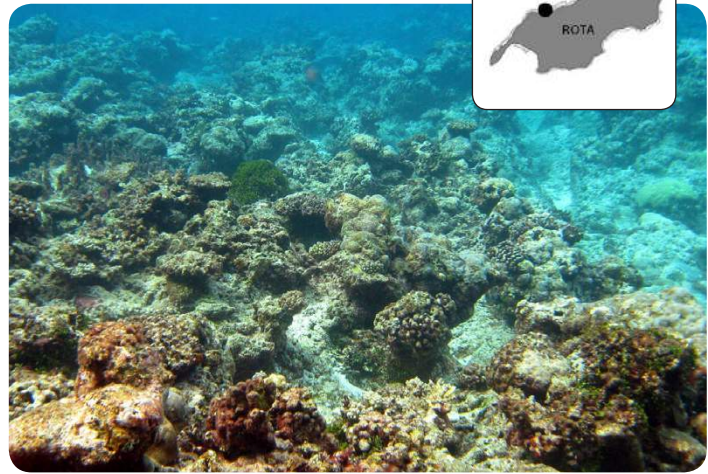
**Fish SPCs:** *Abudefduf sexfasciatus*, *Acanthurus nigrofuscus*, *Aphareus furca*, *Bodianus axillaris*, *Canthigaster solandri*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon lunula*, *Chaetodon ornatissimus*, *Chaetodon unimaculatus*, *Cheilinus trilobatus*, *Chlorurus sordidus*, *Coris aygula*, *Ctenochaetus striatus*, *Gomphosus varius*, *Halichoeres hortulanus*, *Hemigymnus fasciatus*, *Heniochus chrysostomus*, *Labroides dimidiatus*, *Lutjanus fulvus*, *Myripristis kumtee*, *Naso lituratus*, *Pemppheris oualensis*, *Ptereleotris euides*, *Sargocentron caudimaculatum*, *Scarus psittacus*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Zanclus cornutus*, *Zebbrasoma flavescens*

OVERALL SCORE: MED-LOW



## 53 - Sunset Villa\_MMT, Rota

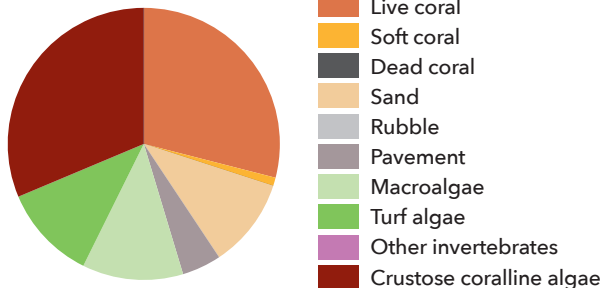
Sunset Villa\_MMT is near the now-closed Sunset Villa Resort, which is located onshore from this reef. This site is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. Like many of the other small resorts on Rota, the Resort had to close due to recent steep declines in visitor numbers. This site has a high score for coral recruitment but has medium-low scores for bleaching resistance, coral diversity and herbivore biomass and has above average macroalgae cover. Greater than 50% of the benthic community is made up by live coral and crustose coralline algae. Greater than 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site is a target for bleaching monitoring and supporting recovery so should be monitored during upcoming warm seasons.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	53/78	0.79	0.83	0.64	0.42	0.90	0.85	0.11	0.27	0.21
Intra-Island	8/24	0.89	0.75	0.64	0.78	0.91	0.92	0.18	0.27	0.73

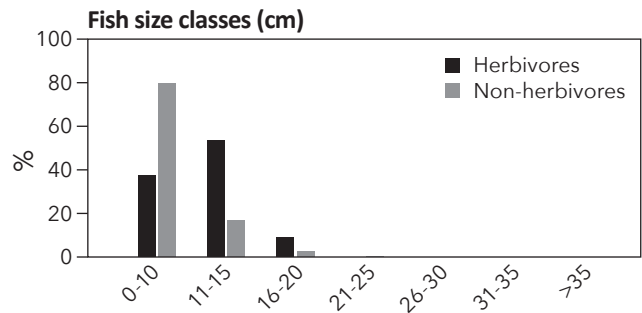
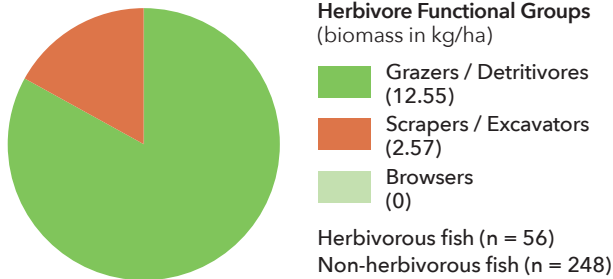
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Acanthastrea echinata*, *Acropora verweyi*, *Cyphastrea chalcidicum*, *Cyphastrea serailia*, *Favia fava*, *Favia matthaii*, *Favia stelligera*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Heliopora coerulea*, *Leptoria Phrygia*, *Montastrea valenciennesi*, *Montipora boffmeisteri*, *Montipora* sp. 0447, *Pavona varians*, *Platygyra pini*, *Pocillopora meandrina*, *Pocillopora verrucosa*

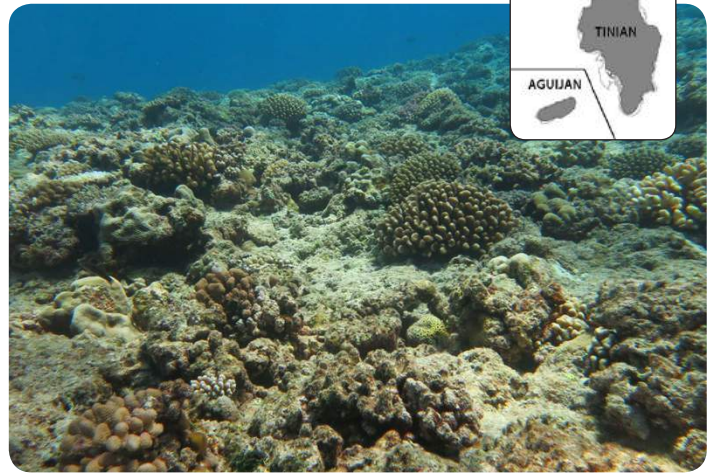
**Coral Swim:** *Acropora digitifera*, *Acropora gemmifera*, *Acropora surculosa*, *Astreopora myriophthalma*, *Favites flexuosa*, *Goniopora minor*, *Hydnophora microconos*, *Leptastrea transversa*, *Montipora* sp. 0460, *Montipora* sp. 0463, *Pavona duerdeni*, *Pocillopora elegans*, *Pocillopora eydouxi*, *Porites lobata*, *Porites lutea*, *Stylophora mordax*, *Turbinaria stellulata*

**Fish SPCs:** *Abudefduf vaigiensis*, *Acanthurus guttatus*, *Acanthurus lineatus*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus* sp., *Aphareus furca*, *Balistapus undulatus*, *Chaetodon auriga*, *Chaetodon lunula*, *Chaetodon ornatissimus*, *Chaetodon ulietensis*, *Cheilinus trilobatus*, *Chlorurus sordidus*, *Chrysiptera brownriggii*, *Cirripectes variolosus*, *Coris aygula*, *Ctenochaetus cyanocheilus*, *Ctenochaetus striatus*, *Epinephelus* sp., *Epinephelus tauvina*, *Gomphosus varius*, *Halichoeres hortulanus*, *Labroides bicolor*, *Labroides dimidiatus*, *Monotaxis grandoculis*, *Myripristis murdjan*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Parupeneus insularis*, *Plectroglyphidodon dickii*, *Sargocentron tiele*, *Scarus psittacus*, *Stegastes fasciolatus*, *Stethojulis bandanensis*, *Stethojulis strigiventer*, *Thalassoma quinquevittatum*

**Fish Swim:** *Acanthurus blochii*, *Acanthurus olivaceus*, *Anampses caeruleopunctatus*, *Anampses twistii*, *Cantherhines pardalis*, *Cephalopobolis argus*, *Chaetodon quadrimaculatus*, *Chaetodon reticulatus*, *Forcipiger longirostris*, *Hemigymnus melapterus*, *Lethrinus xanthurus*, *Lutjanus bobar*, *Melichthys vidua*, *Naso lituratus*, *Naso tonganus*, *Rhinecanthus rectangulus*, *Scarus rubroviolaceus*, *Siganus argenteus*

# 54 - Puntan Lamanibot Sanhilo, Tinian

Puntan Lamanibot Sanhilo designates the northern portion of the *Lamanibot* area. *Sanhilo* is Chamorro for “to be above”. This area is just around the corner from an area known as Dump Coke – a place where divers can find Coca-Cola bottles that World War II soldiers threw into the ocean. This site has a low score for herbivore biomass and medium-low scores for coral recruitment and diversity. Roughly 50% of the benthic community is made up by live coral and crustose coralline algae. Roughly 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site did not meet any of the criteria we set to identify targets for various types of management action. This site may warrant management attention for reasons distinct from the resilience assessment results. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

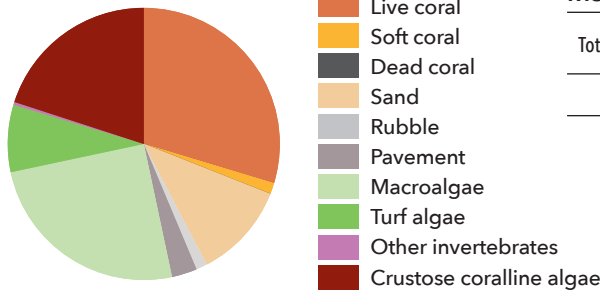


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	54/78	0.78	0.93	0.72	0.16	0.87	0.95	0.02	0.45	0.20
Intra-Island	19/25	0.83	0.51	0.85	0.56	0.95	0.78	0.40	0.20	0.56

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community

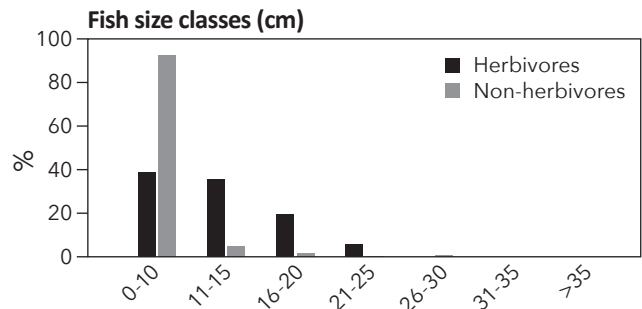
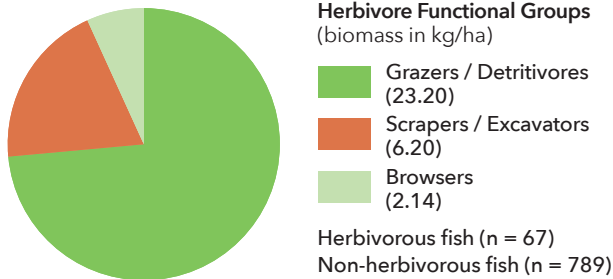


## Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
2.40	2.34	0	0.07	0

Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



**Coral Quads:** *Acanthastrea echinata*, *Astreopora listeri*, *Astreopora myriophthalma*, *Astreopora randalli*, *Cyphastrea agassizi*, *Cyphastrea microphthalma*, *Cyphastrea serailia*, *Favia danae*, *Favia favaus*, *Favia matthaii*, *Favia stelligera*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Montastrea curta*, *Montastrea valenciennesi*, *Montipora floweri*, *Montipora* sp., *Montipora* sp. 3051, *Pavona varians*, *Platygyra pini*, *Porites lobata*, *Porites lutea*, *Porites rus*, *Psammocora haimeana*, *Stylophora mordax*

**Coral Swim:** *Acropora humilis*, *Fungia scutaria*, *Goniastrea pectinata*, *Heliopora coerulea*, *Hydnophora microconos*, *Lobophyllia corymbosa*, *Lobophyllia hemprichii*, *Montipora aequituberculata*, *Pavona duerdeni*, *Platygyra daedalea*, *Pocillopora elegans*, *Pocillopora verrucosa*, *Turbinaria stellulata*

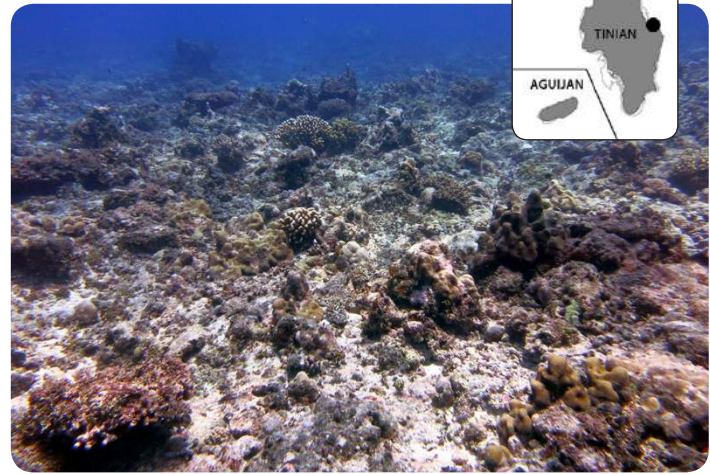
**Fish SPCs:** *Acanthurus lineatus*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus* sp., *Anampses twistii*, *Aphareus furca*, *Balistapus undulatus*, *Caranx melampygus*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon lunulatus*, *Chaetodon reticulatus*, *Cheilinus oxycephalus*, *Cheilinus trilobatus*, *Chlorurus sordidus*, *Chromis acares*, *Chromis agilis*, *Chrysiptera brownriggii*, *Coris gaimard*, *Ctenochaetus striatus*, *Dascyllus reticulatus*, *Epibulus insidiator*, *Forcipiger longirostris*, *Halichoeres hortulanus*, *Halichoeres ornatissimus*, *Labroides dimidiatus*, *Macropharyngodon meleagris*, *Melichthys vidua*, *Naso lituratus*, *Nemateleotris magnifica*, *Oxycheilinus digrammus*, *Paracirrhites arcatus*, *Parupeneus insularis*, *Parupeneus multifasciatus*, *Plectroglyphidodon johnstonianus*, *Plectroglyphidodon lacrymatus*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Ptereleotris evides*, *Sargocentron tieze*, *Scarus ghibban*, *Scarus psittacus*, *Scarus rubroviolaceus*, *Scarus schlegeli*, *Stegastes fasciolatus*, *Sufflamen bursa*, *Thalassoma amblycephalum*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Valenciennea strigata*

**Fish Swim:** *Anampses caeruleopunctatus*, *Apogon* sp., *Chaetodon lunula*, *Chaetodon ornatissimus*, *Chaetodon ulietensis*, *Chromis margaritifer*, *Ctenochaetus cyanocheilus*, *Gomphosus varius*, *Gymnothorax meleagris*, *Hemigymnus fasciatus*, *Labroides pectoralis*, *Lutjanus bobar*, *Meiacanthus atrodorsalis*, *Myripristis berndti*, *Myripristis kumtee*, *Naso unicornis*, *Paracirrhites forsteri*, *Parupeneus barberinus*, *Parupeneus cyclostomus*, *Pempheris oualensis*, *Rhinecanthus rectangulus*, *Sargocentron caudimaculatum*, *Sargocentron microstoma*, *Scarus oviceps*, *Zebrasoma veliferum*

OVERALL SCORE: MED-LOW

## 55 - Masilok Beach Wall, Tinian

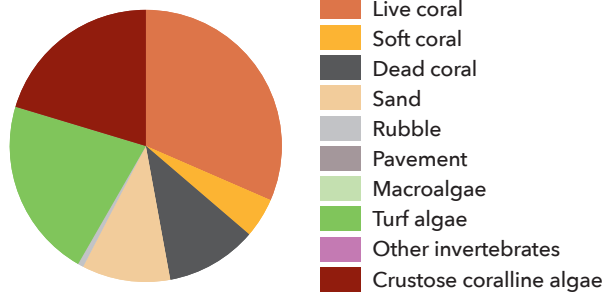
Masilok Beach Wall is near Masilok Beach on the eastern side of Tinian. A very steep wall characterizes the reef at this site. This site has a high score for coral recruitment but has medium-low bleaching resistance, temperature variability and herbivore biomass. Roughly 50% of the benthic community is made up by live coral and crustose coralline algae. The herbivorous fish biomass is comprised in nearly equal parts by the three herbivore functional groups. This site is a target for bleaching monitoring and supporting recovery so should be monitored during upcoming warm seasons.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	55/78	0.79	1.00	0.56	0.38	1.00	0.78	0.08	0.33	0.19
Intra-Island	15/25	0.85	1.00	0.61	0.66	1.00	0.78	0.25	0.12	0.56

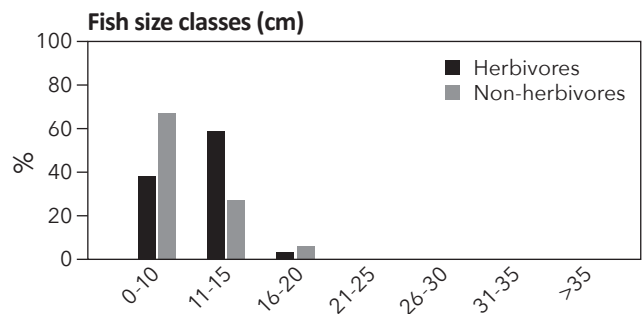
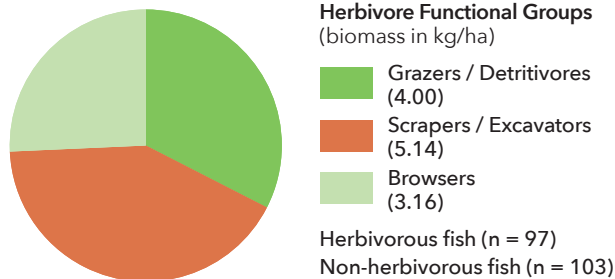
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Acanthastrea echinata*, *Acropora gemmifera*, *Astreopora gracilis*, *Astreopora listeri*, *Astreopora myriophthalma*, *Cyphastrea chalcidicum*, *Cyphastrea microphthalma*, *Cyphastrea senailia*, *Echinopora lamellosa*, *Favia danae*, *Favia favus*, *Favia matthaii*, *Favia stelligera*, *Faviid* sp. 0193, *Faviid* sp. 0209, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniopora fruticosa*, *Hydnophora microconos*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Montastrea valenciennesi*, *Montipora hoffmeisteri*, *Montipora tuberculosa*, *Pavona varians*, *Platygyra daedalea*, *Platygyra pini*, *Pocillopora woodjonesi*, *Porites australiensis*, *Porites* sp. ? 0206, *Psammocora haimeana*, *Stylocoeniella armata*, *Stylocoeniella guentheri*, *Stylophora mordax*

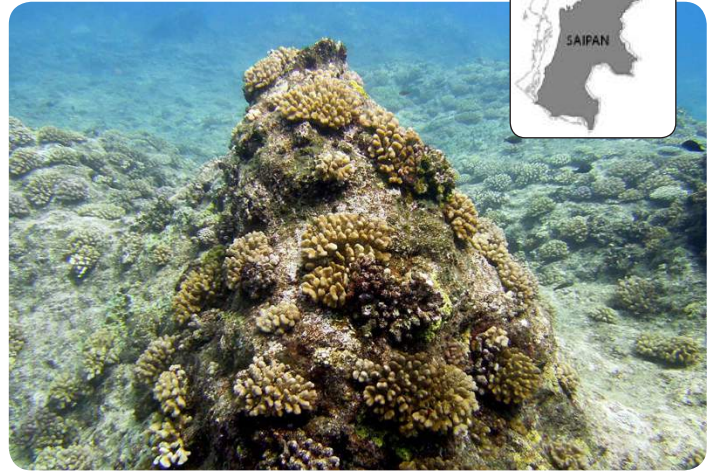
**Coral Swim:** *Acropora humilis*, *Millepora platyphylla*, *Montastrea curta*, *Pavona duerdeni*, *Pocillopora ankei*, *Pocillopora elegans*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites lobata*, *Porites lutea*

**Fish SPCs:** *Acanthurus lineatus*, *Acanthurus nigrofuscus*, *Aphareus furca*, *Arothron nigropunctatus*, *Balistapus undulatus*, *Calotomus carolinus*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon citrinellus*, *Chaetodon lunula*, *Chaetodon melanotus*, *Chlorurus sordidus*, *Chrysiptera traceyi*, *Coris gaimard*, *Ctenochaetus cyanocheilus*, *Ctenochaetus striatus*, *Dascyllus reticulatus*, *Forcipiger flavissimus*, *Gomphosus varius*, *Halichoeres biocellatus*, *Halichoeres hortulanus*, *Halichoeres marginatus*, *Labroides dimidiatus*, *Naso lituratus*, *Oxycheilinus digrammus*, *Oxycheilinus unifasciatus*, *Paracirrhites arcatus*, *Parupeneus multifasciatus*, *Pomacanthus imperator*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Pseudodax moluccanus*, *Ptereleotris euides*, *Pygoplites diacanthus*, *Scarus psittacus*, *Stegastes fasciolatus*, *Stethojulis bandanensis*, *Stethojulis strigiventer*, *Sufflamen chrysopteryum*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*

**Fish Swim:** *Chaetodon auriga*, *Chaetodon ephippium*, *Chaetodon reticulatus*, *Cheilinus trilobatus*, *Chromis acares*, *Chromis agilis*, *Cirrhitichthys falco*, *Gnathodentex aureolineatus*, *Lethrinus xanthurus*, *Macropharyngodon meleagris*, *Malacanthus latovittatus*, *Melichthys vidua*, *Monotaxis grandoculis*, *Neocirrhites armatus*, *Siganus argenteus*, *Variola louti*

# 56 - Achugao, Saipan

Achugao is located on the northeast side of Saipan. Achugao is the name of the village just onshore of this reef. *Achugao* means “rock with a node in it” in Chamorro. This site is a great spot to find photogenic anemonefishes. This site has high coral recruitment but low bleaching resistance and medium-low temperature variability and herbivore biomass. Greater than 50% of the benthic community is made up by live coral. Roughly 90% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site is a target for fishery regulations and enforcement and bleaching monitoring and supporting recovery. Examples of actions that can be considered for implementation at this location include: size regulations and bag and catch limits and increased monitoring during warm seasons.

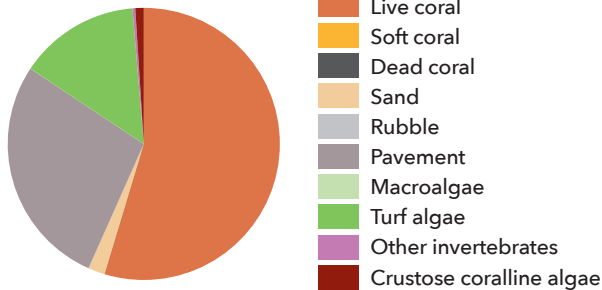


ISLAND SCORE: LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	56/78	0.79	1.00	0.40	0.55	0.97	0.81	0.09	0.64	0.19
Intra-Island	28/29	0.79	1.00	0.47	0.55	0.97	0.84	0.10	0.62	0.19

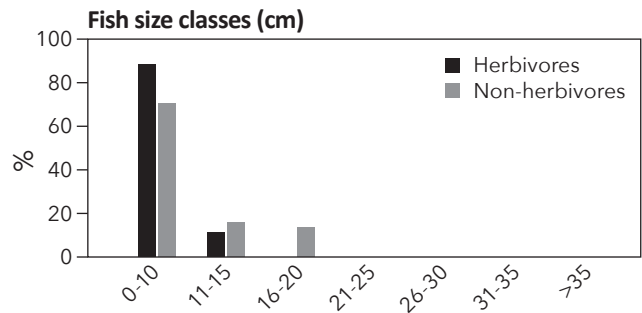
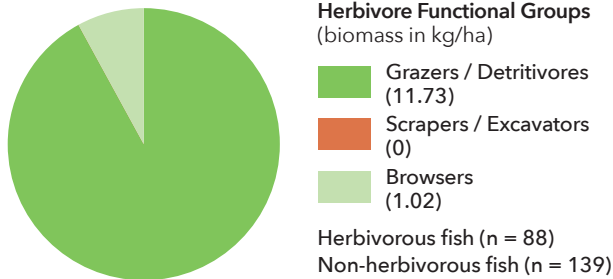
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg + 1 SD) ● High (>avg + 1 SD) ● Low ● Med-Low ● Med-High ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acropora digitifera, Acropora gemmifera, Acropora secale, Acropora surculosa, Acropora vaughani, Acropora verweyi, Astreopora listeri, Astreopora myriophthalma, Favia matthaii, Favia stelligera, Favites abdita, Favites russelli, Galaxea fascicularis, Goniastrea edwardsi, Heliopora coerulea, Leptastrea purpurea, Leptastrea transversa, Lobophyllia corymbosa, Montipora efflorescens, Montipora floweri, Montipora grisea, Montipora hoffmeisteri, Montipora nodosa, Montipora tuberculosa, Pavona varians, Pocillopora elegans, Pocillopora meandrina, Pocillopora verrucosa, Porites lichen, Porites lobata, Porites lutea, Porites vaughani, Stylophora mordax*

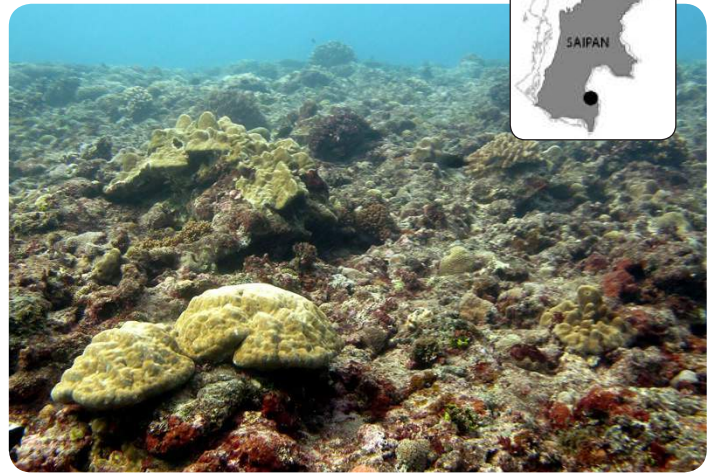
**Coral Swim:** *Acropora humilus, Acropora palifera, Acropora robusta, Acropora tenuis, Cyphastrea chalcidicum, Cyphastrea serailia, Favia speciosa, Gardineroseris planulata, Lobophyllia hemprichii, Millepora platyphyllia, Millepora tuberosa, Pavona duerdeni, Platygyra pini, Pocillopora ankeli, Pocillopora eydouxi, Pocillopora woodjonesi*

**Fish SPCs:** *Acanthurus nigrofuscus, Amphiprion chrysopterus, Apolemichthys trimaculatus, Balistapus undulatus, Cantherbines pardalis, Centropyge flavissima, Cephalopholis urodeta, Chaetodon punctatofasciatus, Chaetodon quadrimaculatus, Cheilinus chlorourus, Gomphosus varius, Halichoeres hortulanus, Halichoeres margaritaceus, Hemigymnus fasciatus, Labroides dimidiatus, Melichthys vidua, Naso lituratus, Sufflamen bursa, Sufflamen chrysopteron, Sufflamen fraenatum, Thalassoma quinquevittatum*

OVERALL SCORE: MED-LOW

## 57 - South Laolao, Saipan

South Laolao is the most southerly site surveyed in Laolao Bay. There is unusually high wave exposure at this site in comparison to other locations within Laolao Bay. This site is a great spot to find photogenic anemonefish. This site has a high score for coral recruitment but medium-low scores for temperature variability and herbivore biomass and has above average macroalgae cover. Nearly half of the benthic community was made up by macroalgae and turfing algae. Roughly 90% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results.

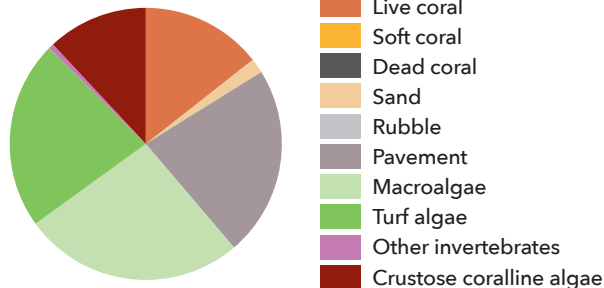


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	57/78	0.78	0.66	0.74	0.37	0.99	0.76	0.17	0.35	0.25
Intra-Island	26/29	0.79	0.54	0.94	0.36	0.98	0.79	0.17	0.27	0.24

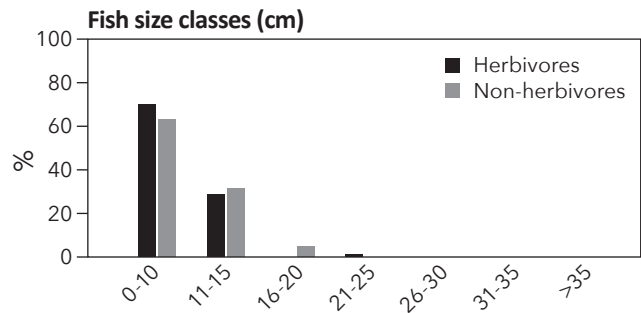
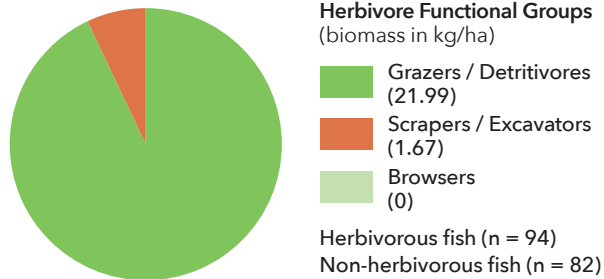
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Acropora humilis*, *Astreopora listeri*, *Astreopora myriophthalma*, *Cyphastrea chalcidicum*, *Cyphastrea ocellina*, *Cyphastrea serailia*, *Echinopora lamellosa*, *Favia fava*, *Favia matthaii*, *Favia speciosa*, *Favia stelligera*, *Favites abdita*, *Favites flexuosa*, *Favites russelli*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Hydnophora microconos*, *Leptastrea purpurea*, *Leptoria Phrygia*, *Pavona duerdeni*, *Pavona varians*, *Platygyra pini*, *Pocillopora ankei*, *Pocillopora elegans*, *Porites lichen*, *Porites rus*, *Stylocoeniella armata*, *Stylophora mordax*

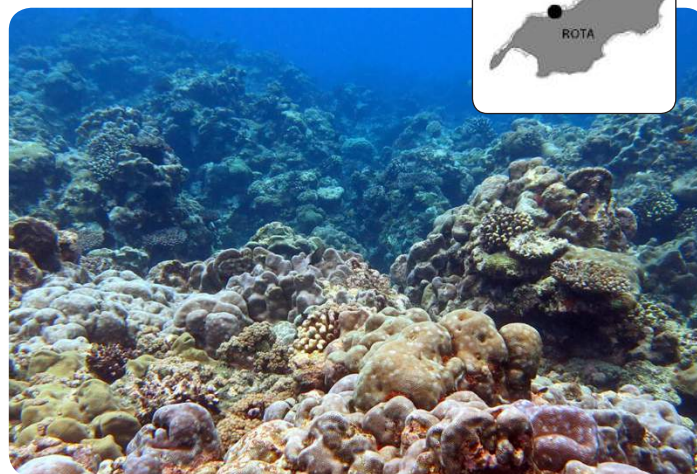
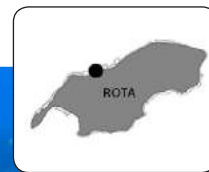
**Coral Swim:** *Acropora gemmifera*, *Acropora tenuis*, *Acropora verweyi*, *Astreopora randalli*, *Fungia scutaria*, *Goniopora fruticosa*, *Goniopora minor*, *Millepora platyphyllia*, *Pavona divaricata*, *Platygyra daedalea*, *Pocillopora meandrina*, *Pocillopora verrucosa*

**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus triostegus*, *Amphiprion chrysopterus*, *Cantherbines pardalis*, *Centropyge flavissima*, *Cephalopholis wrodeti*, *Chaetodon quadrimaculatus*, *Cheilinus chlorourus*, *Chlorurus sordidus*, *Coris aygula*, *Halichoeres hortulanus*, *Halichoeres margaritaceus*, *Halichoeres sp.*, *Labroides dimidiatus*, *Melichthys vidua*, *Oxycheilinus unifasciatus*, *Parupeneus multifasciatus*, *Pomacanthus imperator*, *Stethojulis bandanensis*, *Sufflamen bursa*, *Sufflamen chrysopterus*, *Tbalassoma lutescens*, *Tbalassoma quinquevittatum*

OVERALL SCORE: MED-LOW

# 58 - Iota Salvage\_MMT, Rota

Iota Salvage\_MMT is where dredging and excavation activities by the IOTA company occurred. A Spanish galleon ran into the reef in the 1600s and the site contains many artifacts. This site has a low score for coral recruitment and medium-low scores for coral diversity and herbivore biomass. Roughly half of the benthic community is made up by live coral. Greater than 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

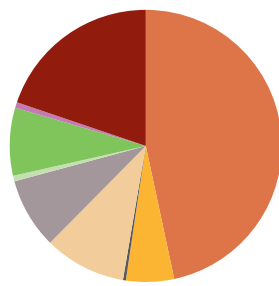


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>58/78</b>	0.78	0.99	0.77	0.06	0.86	0.85	0.14	0.25	0.20
Intra-Island	<b>16/24</b>	0.82	0.99	0.77	0.11	0.87	0.92	0.24	0.25	0.68

● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

## Benthic community



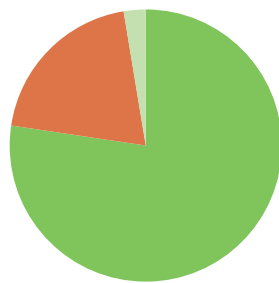
- Live coral
- Soft coral
- Dead coral
- Sand
- Rubble
- Pavement
- Macroalgae
- Turf algae
- Other invertebrates
- Crustose coralline algae

## Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
0.95	0.95	0	0	0

Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



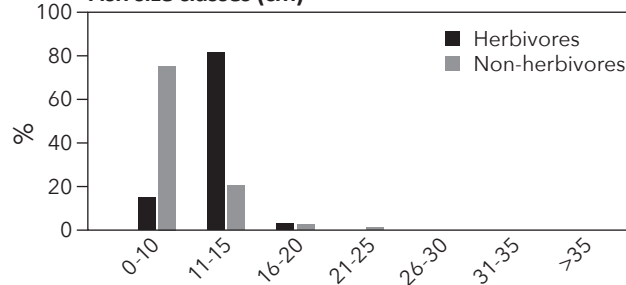
### Herbivore Functional Groups (biomass in kg/ha)

- Grazers / Detritivores (15.16)
- Scrapers / Excavators (3.93)
- Browsers (0.51)

Herbivorous fish (n = 66)

Non-herbivorous fish (n = 151)

## Fish size classes (cm)



**Coral Quads:** *Acanthastrea echinata, Acropora gemmifera, Acropora surculosa, Astrospora myriophthalma, Cyphastrea micropthalma, Cyphastrea serailia, Favia danae, Favia fava, Favia matthaii, Favia pallida, Favia stelligera, Favites abdita, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea retiformis, Leptastrea purpurea, Leptoria Phrygia, Millepora tuberosa, Pavona duerdeni, Pavona varians, Platygyra daedalea, Platygyra pini, Pocillopora danae, Pocillopora meandrina, Psammocora nierstraszi*

**Coral Swim:** *Acropora digitifera, Acropora globiceps, Acropora humilis, Acropora robusta, Acropora tenuis, Acropora verweyi, Favites flexuosa, Fungia fungites, Goniopora djiboutiensis, Goniopora fruticosa, Heliopora coerulea, Hydnohpora microconos, Isopora palifera, Lobophyllia hemprichii, Millepora platyphylla, Montipora aequituberculata, Pavona venosa, Pocillopora damicornis, Pocillopora elegans, Pocillopora verrucosa, Porites australiensis, Porites lobata, Porites lutea, Stylophora mordax, Turbinaria stellulata*

**Fish SPCs:** *Acanthurus lineatus, Acanthurus nigricans, Acanthurus nigrofuscus, Acanthurus sp., Centropyge flavissima, Cephalopholis urodeta, Chaetodon reticulatus, Cheilinus chlorourus, Cheilinus trilobatus, Chlorurus sordidus, Chrysiptera brownriggii, Cirripectes variolosus, Ctenochaetus cyanocheilus, Ctenochaetus striatus, Epibulus insidiator, Halichoeres biocellatus, Halichoeres hortulanus, Hemigymnus fasciatus, Labroides dimidiatus, Naso lituratus, Paracirrhites arcatus, Paracirrhites hemistictus, Parupeneus cyclostomus, Parupeneus multifasciatus, Plectroglyphidodon dickii, Plectroglyphidodon johnstonianus, Pomacentrus vaiuli, Pomachromis guamensis, Scarus psittacus, Stegastes fasciolatus, Stethojulis bandanensis, Thalassoma quinquevittatum*

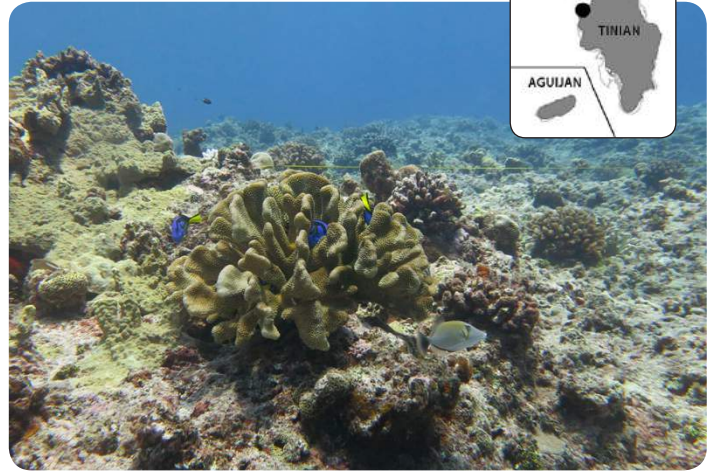
**Fish Swim:** *Acanthurus guttatus, Acanthurus olivaceus, Anampses twistii, Balistapus undulatus, Chaetodon auriga, Chaetodon citrinellus, Chaetodon lunula, Chromis agilis, Dascyllus trimaculatus, Forcipiger longirostris, Gnathodentex aureolineatus, Gomphosus varius, Kyphosus cinerascens, Labroides bicolor, Lutjanus bohar, Lutjanus monostigma, Macolor macularis, Melichthys vidua, Monotaxis grandoculis, Naso hexacanthus, Naso tonganus, Naso unicornis, Oxycheilinus digrammus, Oxycheilinus unifasciatus, Plectroglyphidodon lacrymatus, Sargocentron tiere, Scarus oviceps, Scarus rubroviolaceus, Zebrasoma flavescens, Zebrasoma veliferum*

Observers: S. McKagan, J. Maynard, S. Johnson, and L. Raymundo

OVERALL SCORE: MED-LOW

## 59 - Puntan Lamanibot Sampapa, Tinian

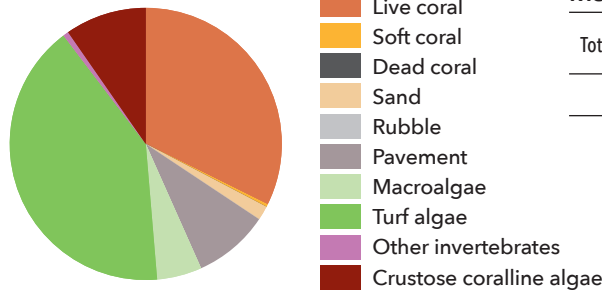
Puntan Lamanibot Sampapa refers to the southern point of the Lamanibot area; *Sampapa* is Chamorro for “to be below”. The famous Tinian Grotto is near this site, which is a fully submerged cavern. This site has a high score for temperature variability but a low score for herbivore biomass. Roughly 75% of the benthic community is made up in near equal parts by live coral and turfing algae. Roughly half of the total herbivorous fish biomass is comprised of grazers/detritivores and the other half is scrapers/excavators. This site is a target for fishery regulations and enforcement activities. Examples of actions that can be considered for implementation at these locations include increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>59/78</b>	0.78	0.93	0.72	0.16	0.87	0.95	0.02	0.45	0.20
Intra-Island	<b>22/25</b>	0.79	0.90	0.77	0.28	0.87	0.95	0.05	0.27	0.57

● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community

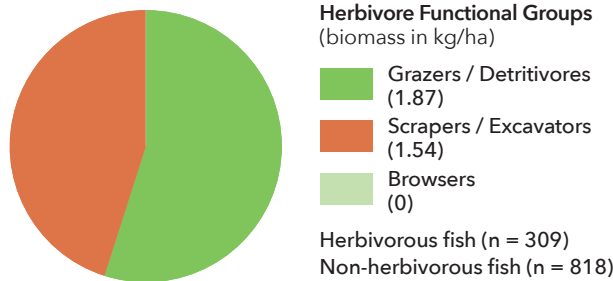


### Mean disease prevalence (%)

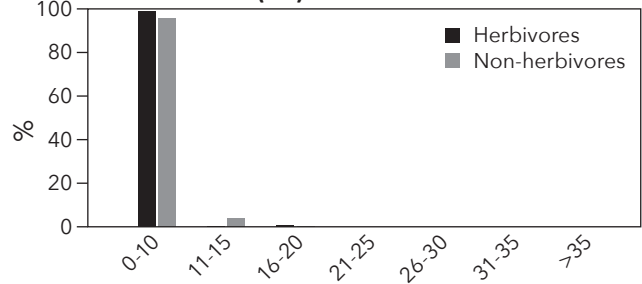
Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
2.45	1.77	0.68	0	0

Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



### Fish size classes (cm)



**Coral Quads:** *Acropora digitifera*, *Acropora gemmifera*, *Astreopora myriophthalma*, *Astreopora randalli*, *Cyphastrea microphthalma*, *Cyphastrea serailia*, *Favia fava*, *Favia matthaii*, *Favia stelligera*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Hydnophora microconos*, *Leptastrea purpurea*, *Montastrea valenciennesi*, *Montipora c.f. stuederi*, *Montipora calculata*, *Montipora danae*, *Montipora efflorescens*, *Montipora foveolata*, *Montipora nodosa*, *Pavona varians*, *Platygyra pini*, *Pocillopora elegans*, *Pocillopora eydouxi*, *Pocillopora meandrina*, *Pocillopora sp.*, *Pocillopora verrucosa*, *Porites australiensis*, *Porites lobata*, *Porites massive (australiensis, lobata, lutea complex)*, *Psammocora haimeana*, *Stylophora mordax*, *Turbinaria reniformis*

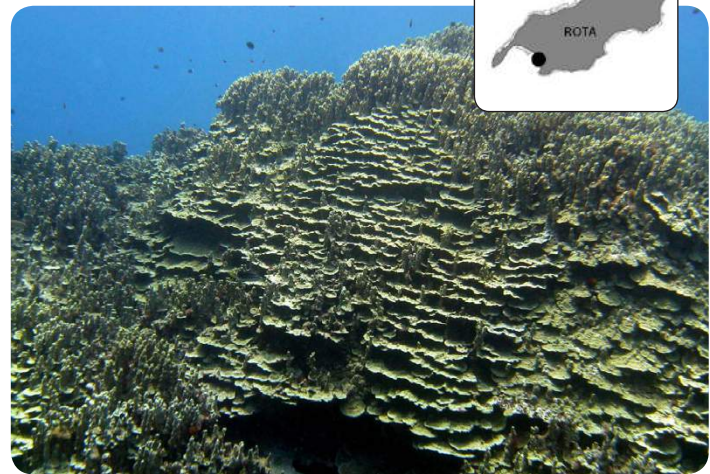
**Coral Swim:** *Acropora humilis*, *Acropora paniculata*, *Acropora surculosa*, *Acropora tenuis*, *Leptoria Phrygia*, *Millepora platyphylla*, *Montastrea curta*, *Montipora venosa*, *Pavona duerdeni*, *Pavona venosa*, *Pocillopora danae*, *Turbinaria stellulata*

**Fish SPCs:** *Acanthurus nigrofuscus*, *Acanthurus olivaceus*, *Acanthurus sp.*, *Acanthurus triostegus*, *Apolemichthys trimaculatus*, *Cephalopholis urodeta*, *Chaetodon citrinellus*, *Chaetodon lunula*, *Chaetodon ornatissimus*, *Chaetodon quadrimaculatus*, *Chrysiptera brownriggii*, *Cirripectes variolosus*, *Dascyllus reticulatus*, *Epinephelus hexagonatus*, *Halichoeres margaritaceus*, *Labroides dimidiatus*, *Melichthys vidua*, *Neocirrhites armatus*, *Paracanthurus hepatus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Parupeneus insularis*, *Parupeneus multifasciatus*, *Plectroglyphidodon imparipennis*, *Plectroglyphidodon johnstonianus*, *Pomachromis guamensis*, *Ptereleotris zebra*, *Rhinocanthus rectangulus*, *Scarus psittacus*, *Scarus rubroviolaceus*, *Stegastes fasciolatus*, *Sufflamen bursa*, *Sufflamen chrysopterum*, *Thalassoma amblycephalum*, *Thalassoma quinquevittatum*

**Fish Swim:** *Acanthurus blochii*, *Acanthurus nigricans*, *Aphareus furca*, *Aprion virescens*, *Chaetodon ulietensis*, *Chaetodon unimaculatus*, *Chlorurus sordidus*, *Cirrhitichthys falco*, *Coris gaimard*, *Ctenochaetus striatus*, *Ecsenius opsifrontalis*, *Epibulus insidiator*, *Forcipiger flavissimus*, *Gnathodentex aureolineatus*, *Halichoeres hortulanus*, *Lethrinus xanthochilus*, *Lutjanus bobar*, *Macolor niger*, *Macropharyngodon meleagris*, *Melichthys niger*, *Monotaxis grandoculis*, *Mulloidichthys vanicolensis*, *Myripristis sp.*, *Naso lituratus*, *Naso unicornis*, *Oxycheilinus digrammus*, *Parupeneus cyclostomus*, *Plectroglyphidodon dickii*, *Sargocentron caudimaculatum*, *Scarus forsteri*, *Scarus niger*, *Variola louti*, *Zanclus cornutus*

# 60 - Honey Gardens, Rota

Honey Gardens is located in the Sasanhaya Bay Fish Reserve and is one of the most popular dives sites on Rota. This site received its name due to the honeycomb-like nature of the reef here. This site has a high score for bleaching resistance but low scores for coral recruitment and diversity. Greater than half of the benthic community was comprised of live coral; primarily *Porites rus*. Greater than half of the total herbivorous fish biomass is comprised of scrapers/excavators. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results.

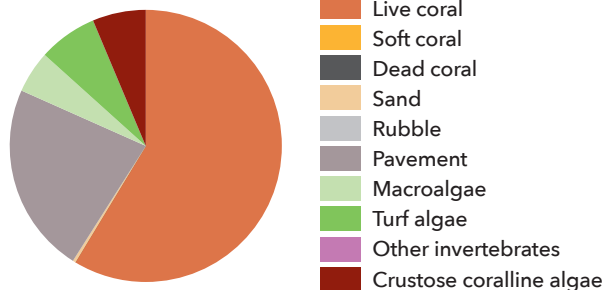


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>60/78</b>	0.77	0.93	1.00	0.05	0.53	0.83	0.25	N/A - MPA	0.19
Intra-Island	<b>15/24</b>	0.83	0.90	1.00	0.09	0.53	0.89	0.53	N/A - MPA	0.67

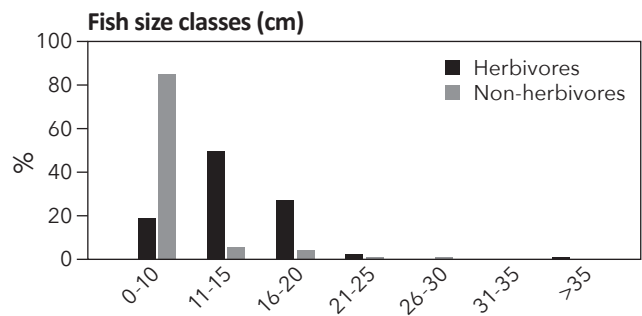
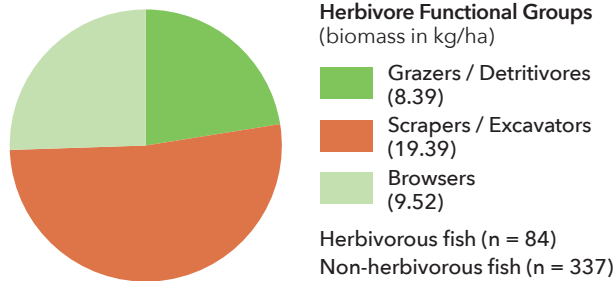
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acanthastrea echinata, Acropora humilis, Galaxea fascicularis, Goniopora fruticosa, Heliopora coerulea, Leptastrea purpurea, Montastrea valenciennesi, Pavona varians, Porites lichen, Porites massive (australiensis, lobata, lutea complex), Porites rus, Psammocora nierstraszi*

**Coral Swim:** *Acropora digitifera, Acropora sp. 0743, Acropora tenuis, Astreopora myriophthalma, Cyphastrea microphthalma, Diploastrea heliopora, Echinopora lamellosa, Favia pallida, Fungia paumotensis, Fungia scutaria, Goniastrea edwardsi, Goniastrea retiformis, Montipora sp. 0732, Pavona c.f. frondifera (grl), Pocillopora elegans, Porites australiensis (?), Porites lobata, Porites lutea, Turbinaria stellulata*

**Fish SPCs:** *Acanthurus nigricans, Acanthurus nigrofuscus, Anampses twistii, Aphareus furca, Balistapus undulatus, Carcharhinus melanopterus, Centropyge flavissima, Centropyge beraldi, Centropyge shepardi, Cephalopholis sonnerati, Cephalopholis urodeta, Chaetodon auriga, Chaetodon bennetti, Chaetodon ephippium, Chaetodon ornatissimus, Chaetodon punctatofasciatus, Chaetodon reticulatus, Cheilinus oxycephalus, Chlorurus sordidus, Chromis acares, Chromis agilis, Chromis margaritifer, Chromis xanthurus, Chrysiptera traceyi, Ctenochaetus cyanocheilus, Ctenochaetus striatus, Forcipiger longirostris, Gomphosus varius, Halichoeres biocellatus, Halichoeres hortulanus, Hemigymnus fasciatus, Labroides bicolor, Labroides dimidiatus, Lutjanus monostigma, Melichthys vidua, Monotaxis grandoculis, Myripristis kuntee, Naso hexacanthus, Naso lituratus, Oxycheilinus digrammus, Parupeneus multifasciatus, Plectroglyphidodon lacrymatus, Pomacentrus vaiuli, Ptereleotris evides, Scarus altipinnis, Scarus forsteni, Scarus oviceps, Stegastes fasciolatus, Stetbojulis bandanensis, Sufflamen bursa, Thalassoma lutescens, Thalassoma quinquevittatum, Triaenodon obesus, Zebrasoma flavescens*

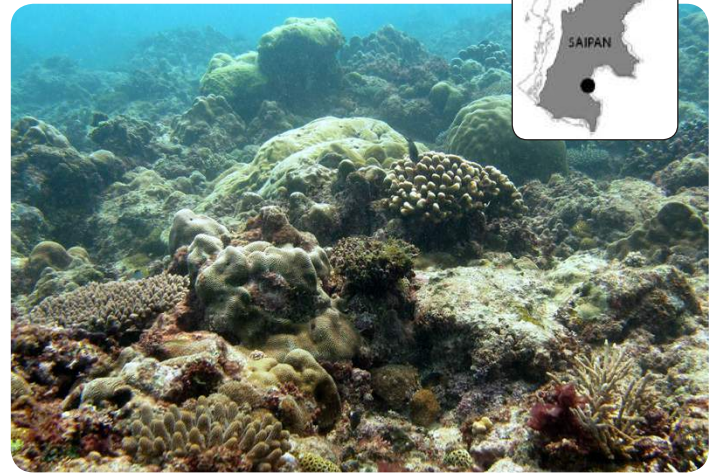
**Fish Swim:** *Acanthurus blochii, Acanthurus thompsoni, Acanthurus triostegus, Anampses caeruleopunctatus, Arothron meleagris, Carangoides orthogrammus, Caranx melampygus, Chaetodon lunula, Chaetodon melanotus, Chaetodon ulietensis, Dascyllus trimaculatus, Epibulus insidiator, Hemitaenichthys polylepis, Heniochus monoceros, Kyphosus cinerascens, Lutjanus bohar, Lutjanus kasmira, Naso vlamingii, Sargocentron tiere, Zanclus cornutus, Zebrasoma veliferum*

OVERALL SCORE: MED-LOW



# 61 - South Dakota, Saipan

South Dakota reef is located within Laolao Bay, in the Dan Dan watershed. The survey site was named South Dakota due to its resemblance to the rolling hills of that U.S. state. This site has a high score for bleaching resistance but medium-low scores for temperature variability and herbivore biomass and has above average macroalgae cover. Roughly 75% of the benthic community is made up in near equal parts by live coral and macroalgae. Greater than 75% of the total herbivorous fish biomass is comprised of grazers/detritivores and scrapers/excavators. This site did not meet any of the criteria we set to identify targets for various types of management action. This site may warrant management attention for reasons distinct from the resilience assessment results.

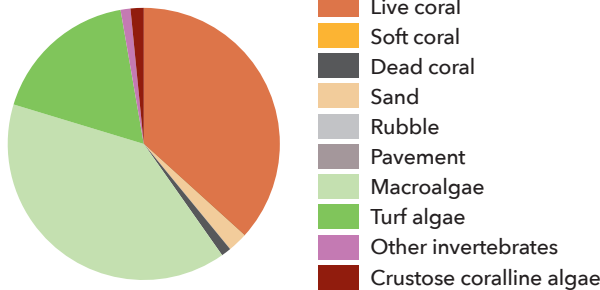


ISLAND SCORE: LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	61/78	0.77	0.54	0.81	0.36	0.98	0.76	0.17	0.32	0.24
Intra-Island	27/29	0.79	0.54	0.94	0.36	0.98	0.79	0.17	0.27	0.24

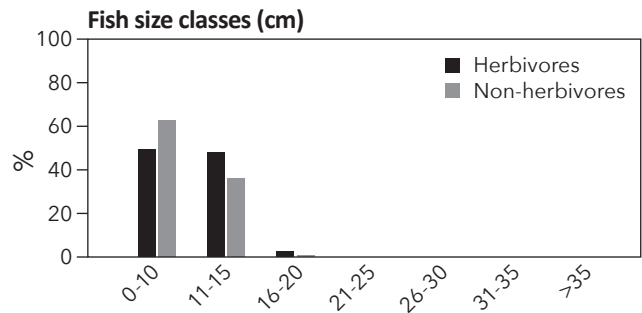
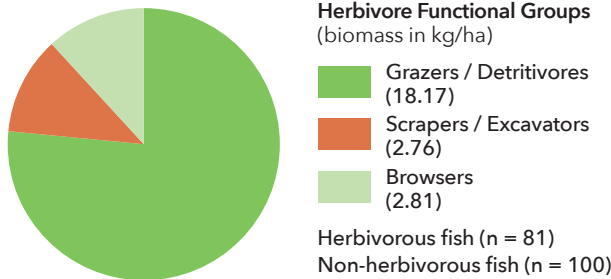
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acanthastrea echinata, Acropora secale, Acropora tenuis, Acropora verweyi, Astreopora listeri, Astreopora randalli, Cyphastrea chalcidicum, Cyphastrea ocellina, Cyphastrea serailia, Echinopora lamellosa, Favia favus, Favia matthaii, Favia stelligera, Favites abdita, Favites russelli, Fungia scutaria, Galaxea fascicularis, Goniastrea retiformis, Goniopora fruticosa, Hydnothya microconus, Leptastrea purpurea, Leptastrea transversa, Leptoria Phrygia, Montipora efflorescens, Montipora floweri, Montipora hoffmeisteri, Pavona varians, Pocillopora danae, Pocillopora elegans, Pocillopora verrucosa, Porites lichen, Porites lobata, Porites lutea, Porites rus, Psammacora haimeana, Stylophora mordax*

**Coral Swim:** *Acropora azurea, Acropora digitifera, Acropora gemmifera, Acropora humilis, Acropora monticulosa, Acropora nasuta, Acropora robusta, Acropora vaughani, Astreopora myriophthalma, Favites flexuosa, Millepora dichedom, Millepora platyphyllia, Montipora caliculata, Pavona duerdeni, Pocillopora ankei, Pocillopora damicornis*

**Fish SPCs:** *Acanthurus lineatus, Acanthurus nigrofuscus, Centropyge flavissima, Chaetodon ephippium, Chaetodon lunula, Chaetodon quadrimaculatus, Cheilinus trilobatus, Chlorurus sordidus, Coris gaimard, Ctenochaetus striatus, Gomphosus varius, Halichoeres hortulanus, Halichoeres margaritaceus, Halichoeres marginatus, Naso lituratus, Oxycheilinus unifasciatus, Parupeneus multifasciatus, Rhinecanthus rectangulus, Scarus psittacus, Stethojulis bandanensis, Stethojulis strigiventer, Sufflamen chrysopterum, Thalassoma lutescens, Thalassoma quinquevittatum*

OVERALL SCORE: MED-LOW

## 62 - Atgidon, Tinian

Atgidon (Chamorro for "cotton", derived from the Spanish *algodón*), is the name for the cotton tree found in the Mariana Islands. The Atgidon region of Tinian is known for having many of these trees. This site has a high score for temperature variability but medium-low scores for herbivore biomass and bleaching resistance and has above average macroalgae cover. The benthic community is made up in near equal parts by crustose coralline algae, live coral, sand, bare pavement and macroalgae. Greater than 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site is a target for fishery regulations and enforcement and bleaching monitoring & supporting recovery activities. Examples of actions that can be considered for implementation at this location include: size regulations and bag and catch limits and increased monitoring during warm seasons. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

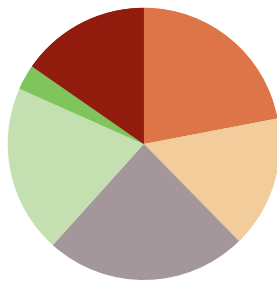


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	62/78	0.77	0.72	0.55	0.32	0.97	0.95	0.16	0.50	0.19
Intra-Island	21/25	0.80	0.61	0.60	0.55	0.97	0.95	0.27	0.34	0.56

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

### Benthic community



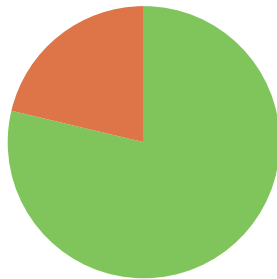
- Live coral
- Soft coral
- Dead coral
- Sand
- Rubble
- Pavement
- Macroalgae
- Turf algae
- Other invertebrates
- Crustose coralline algae

### Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
0.80	0.80	0	0	0

Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

### Fish community

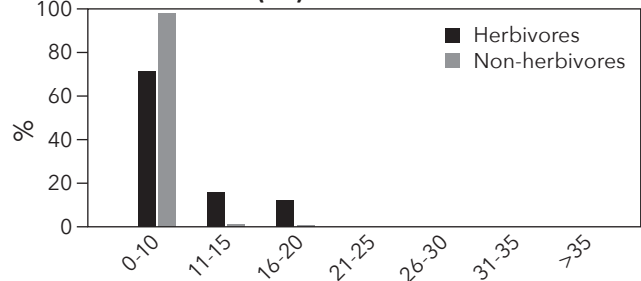


**Herbivore Functional Groups**  
(biomass in kg/ha)

- Grazers / Detritivores (14.84)
- Scrapers / Excavators (6.98)
- Browsers (0)

Herbivorous fish (n = 145)  
Non-herbivorous fish (n = 1596)

### Fish size classes (cm)



**Coral Quads:** *Acropora tenuis*, *Acropora vaughani*, *Astreopora myriophthalma*, *Astreopora randalli*, *Cyphastrea microphthalma*, *Cyphastrea serailia*, *Favia danae*, *Favia fava*, *Favia matthai*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Isopora palifera*, *Leptastrea purpurea*, *Leptoria irregularis*, *Montastrea valenciennesi*, *Montipora aequituberculata*, *Montipora efflorescens*, *Montipora floweri*, *Montipora hoffmeisteri*, *Montipora monasteriata*, *Montipora sp. 2794*, *Montipora tuberculosa*, *Montipora verrilli*, *Montipora verrucosa*, *Pavona varians*, *Pocillopora meandrina*, *Porites lichen*, *Porites lobata*, *Porites lutea*, *Porites sp. 2775*, *Psammocora haimeana*, *Stylophora mordax*, *Turbinaria stellulata*

**Coral Swim:** *Acropora digitifera*, *Acropora gemmifera*, *Acropora humilis*, *Acropora selago*, *Acropora verweyi*, *Goniastrea retiformis*, *Lobophyllia corymbosa*, *Pavona duerdeni*, *Platygyra pini*, *Pocillopora elegans*

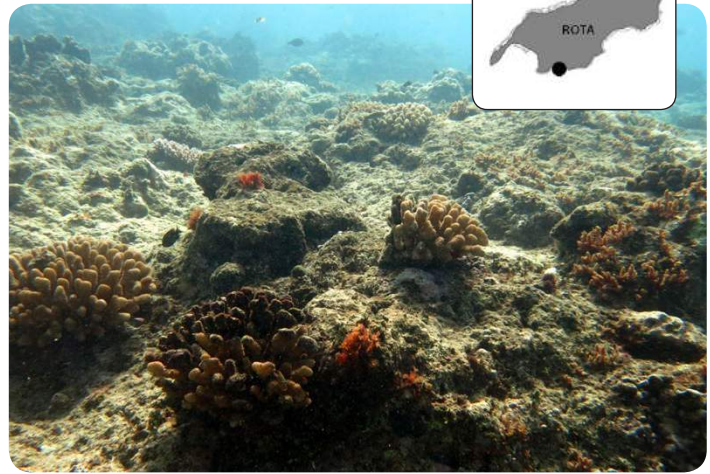
**Fish SPCs:** *Acanthurus nigrofuscus*, *Acanthurus olivaceus*, *Acanthurus pyroferus*, *Acanthurus sp.*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon auriga*, *Chaetodon citrinellus*, *Chaetodon punctatofasciatus*, *Chaetodon quadrimaculatus*, *Chlorurus sordidus*, *Chromis acares*, *Chromis margaritifer*, *Cirrhitichthys falco*, *Coris gaimard*, *Ctenochaetus striatus*, *Ecsenius bicolor*, *Forcipiger longirostris*, *Halichoeres hortulanus*, *Halichoeres margaritaceus*, *Halichoeres ornatissimus*, *Labroides dimidiatus*, *Melichthys vidua*, *Oxycheilinus digrammus*, *Paracirrhites arcatus*, *Parupeneus insularis*, *Parupeneus multifasciatus*, *Plagiotremus tapeinosoma*, *Plectroglyphidodon johnstonianus*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Ptereleotris evides*, *Scarus forsteni*, *Scarus psittacus*, *Stegastes fasciolatus*, *Sufflamen chrysopterum*, *Thalassoma ambycephalum*, *Thalassoma quinquevittatum*, *Valenciennesia strigata*

**Fish Swim:** *Acanthurus triostegus*, *Aphareus furca*, *Apogon angustatus*, *Cantherhines pardalis*, *Centropyge heraldi*, *Centropyge shepardii*, *Chromis xanthura*, *Halichoeres ornatissimus*, *Macropharyngodon meleagris*, *Malacanthus latovittatus*, *Melichthys niger*, *Naso lituratus*, *Neocirrhites armatus*, *Novaculichthys taeniourus*, *Parupeneus cyclostomus*, *Plectroglyphidodon lacrymatus*, *Sargocentron caudimaculatum*, *Sargocentron tiera*, *Scarus ghobban*, *Siganus argenteus*, *Sufflamen fraenatum*, *Variola louti*, *Zanclus cornutus*

OVERALL SCORE: MED-LOW

# 63 - Okgok\_MMT, Rota

Okgok\_MMT is near the Okgok subwatershed, which is located in the Talakhaya watershed, and is downstream from a river. This site is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. This site has high bleaching resistance and coral recruitment but has low scores for temperature variability and has above average macroalgae cover. The benthic community at this site is very diverse; 8 of the 10 benthic categories were used in classifying the community at this site. Greater than 50% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site did not meet any of the criteria we set to identify targets for various types of management action. This site may warrant management attention for reasons distinct from the resilience assessment results. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

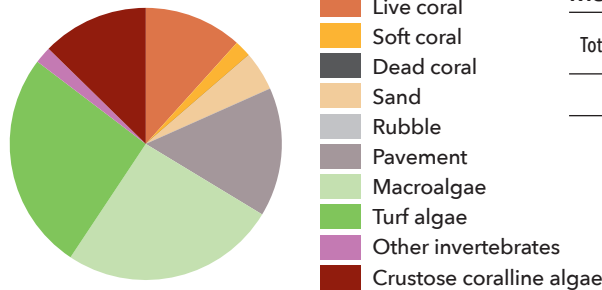


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>63/78</b>	0.77	0.65	0.85	0.43	0.87	0.67	0.16	0.23	0.20
Intra-Island	<b>14/24</b>	0.84	0.46	0.85	0.81	0.87	0.73	0.26	0.23	0.69

● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community

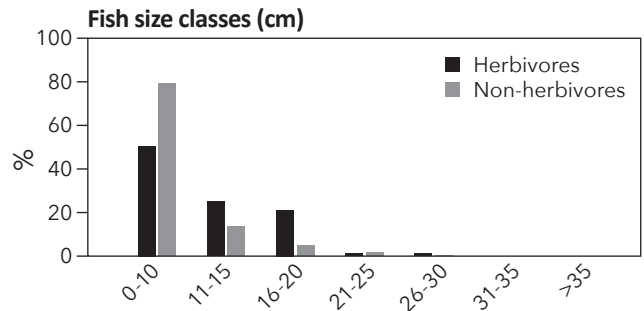
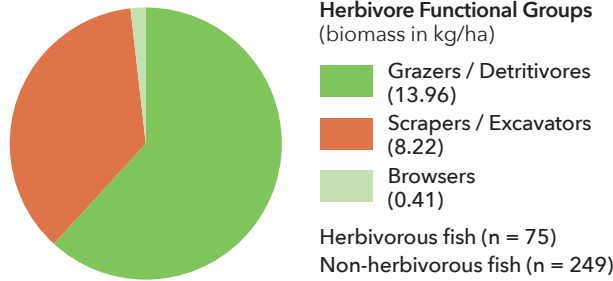


### Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
1.45	1.45	0	0	0

Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

### Fish community



**Coral Quads:** *Acanthastrea echinata, Acropora surculosa, Astreopora myriophthalma, Cyphastrea microphthalma, Favia danae, Favia fava, Favia pallida, Favia stelligera, Favites abdita, Favites russelli, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea retiformis, Heliopora coerulea, Leptastrea purpurea, Leptoria Phrygia, Montipora foveolata, Pavona varians, Platygyra pini, Pocillopora danae, Porites australiensis, Porites lobata, Porites lutea, Porites vaughani, Stylocoeniella armata*

**Coral Swim:** *Acropora gemmifera, Acropora humilis, Acropora latistella, Acropora monticulosa, Acropora tenuis, Cyphastrea serailia, Diploastrea heliopora, Echinopora lamellosa, Favia matthaii, Favites flexuosa, Fungia scutaria, Hydnothopora microconos, Millepora platyphylla, Montipora cf. hoffmeisteri, Pocillopora elegans, Pocillopora eydouxi, Pocillopora meandrina, Pocillopora verrucosa, Porites annae, Psammocora haimeana, Stylophora mordax*

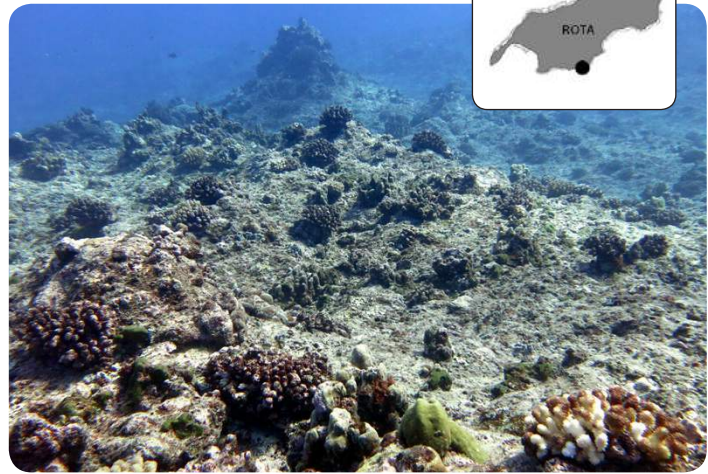
**Fish SPCs:** *Acanthurus nigrofuscus, Acanthurus olivaceus, Acanthurus sp., Aphareus furca, Centropyge flavissima, Cephalopholis urodeta, Chaetodon auriga, Chaetodon citrinellus, Chaetodon lunula, Chaetodon reticulatus, Chlorurus sordidus, Chromis agilis, Chromis margaritifera, Chrysiptera brownriggii, Cirrhitichthys falco, Coris gaimard, Ctenochaetus striatus, Epinephelus hexagonatus, Gomphosus varius, Halichoeres hortulanus, Halichoeres margaritaceus, Halichoeres ornatus, Labroides dimidiatus, Macolor niger, Melichthys vidua, Naso lituratus, Nemaoteletris magnifica, Oxycheilinus digrammus, Paracirrhites arcatus, Paracirrhites forsteri, Parupeneus insularis, Parupeneus multifasciatus, Plectroglyphidodon johnstonianus, Plectroglyphidodon lacrymatus, Pomacentrus vaiuli, Pomachromis guamensis, Ptereleotris evides, Pygoplites diacanthus, Scarus forsteri, Scarus psittacus, Stegastes fasciolatus, Sufflamen bursa, Sufflamen chrysopterum, Sufflamen fraenatum, Thalassoma amblycephalum, Thalassoma lutescens, Thalassoma quinquevittatum, Zanclus cornutus, Zebrasoma flavescens*

**Fish Swim:** *Acanthurus blochii, Acanthurus guttatus, Acanthurus nigricans, Acanthurus pyroferus, Acanthurus xanthopterus, Bodianus axillaris, Chaetodon punctatofasciatus, Cheilinus trilobatus, Dascyllus reticulatus, Decapterus macarellus, Epinephelus fasciatus, Forcipiger longirostris, Gnathodentex aureolineatus, Hemigymnus fasciatus, Lethrinus xanthochilus, Lutjanus bohar, Lutjanus gibbus, Monotaxis grandoculis, Parupeneus cyclostomus, Ptereleotris zebra, Sargocentron caudimaculatum, Scarus rubroviolaceus, Stethojulis bandanensis*

OVERALL SCORE: MED-LOW

# 64 - Malilok Point, Rota

Malilok Point is located on the south coast of Rota. This site features a gently sloping reef, which eventually drops off to a steep wall. Several large Napoleon Wrasse have been sighted here and are always a welcome sight to divers. This site has a low score for temperature variability and medium-low scores for bleaching resistance and coral recruitment. Greater than half of the benthic community is made up by live coral and crustose coralline algae. Roughly 90% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site did not meet any of the criteria we set to identify targets for various types of management action. This site may warrant management attention for reasons distinct from the resilience assessment results. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

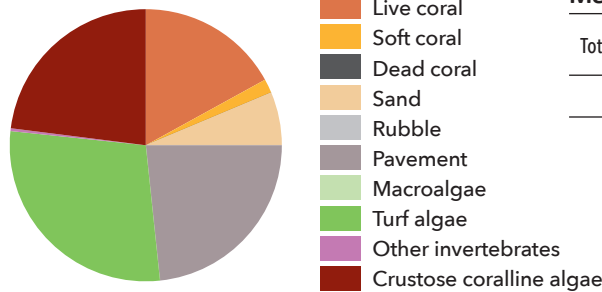


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	64/78	0.77	1.00	0.59	0.14	0.96	0.72	0.27	0.19	0.20
Intra-Island	11/24	0.86	1.00	0.59	0.27	0.96	0.78	0.47	0.19	0.68

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg + 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community

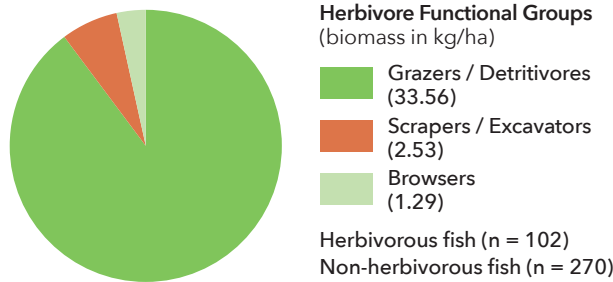


## Mean disease prevalence (%)

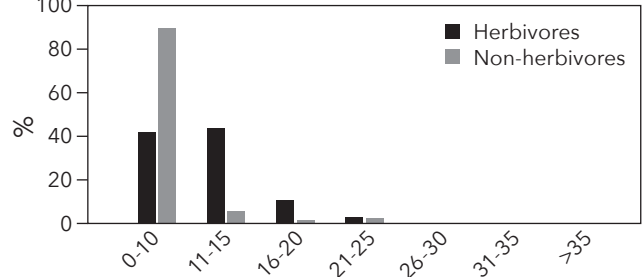
Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
0.61	0.61	0	0	0

Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



## Fish size classes (cm)



**Coral Quads:** *Acanthastrea echinata, Acropora surculosa, Acropora tenuis, Astreopora myriophthalma, Cyphastrea microphthalma, Cyphastrea serailia, Favia pallida, Favia stelligera, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea retiformis, Leptastrea purpurea, Millepora tuberosa, Pavona varians, Platygyra pini, Pocillopora verrucosa, Porites australiensis, Porites lichen, Porites lobata, Porites lutea, Porites vaughani, Psammocora haimeana*

**Coral Swim:** *Acropora cophyactyla, Acropora gemmifera, Acropora globiceps, Acropora humilis, Acropora monticulosa, Acropora robusta, Acropora samoensis, Echinopora lamellosa, Favia favus, Favia helianthoides, Favites abdita, Favites flexuosa, Heliopora coerulea, Hydnothopora microconos, Leptoria Pbrygia, Montipora aequituberculata, Montipora c.f. monasteriata, Montipora floweri, Montipora hoffmeisteri, Montipora venosa, Pavona venosa, Pocillopora anكلي, Pocillopora damicornis, Pocillopora danae, Pocillopora elegans, Pocillopora meandrina, Stylophora mordax*

**Fish SPCs:** *Acanthurus lineatus, Acanthurus nigricans, Acanthurus nigrofuscus, Acanthurus olivaceus, Acanthurus sp., Acanthurus triostegus, Canthigaster solandri, Centropyge flavissima, Cephalopholis urodeta, Chaetodon citrinellus, Chlorurus sordidus, Chromis margaritifera, Chrysiptera brownriggii, Cirripectes variolosus, Coris gaimard, Ctenochaetus striatus, Dascyllus reticulatus, Forcipiger longirostris, Gobiid sp., Halichoeres hortulanus, Halichoeres margaritaceus, Labroides dimidiatus, Lutjanus kasmira, Naso lituratus, Neocirrhites armatus, Oxycheilinus digrammus, Paracirrhites arcatus, Paracirrhites forsteri, Parupeneus multifasciatus, Plectroglyphidodon johnstonianus, Pomacanthus imperator, Pomacentrus vaiuli, Pomachromis guamensis, Ptereleotris evides, Rhinacanthus rectangularis, Scarus forsteri, Stegastes fasciolatus, Sufflamen bursa, Synodus sp., Thalassoma purpuraceum, Thalassoma quinquevittatum, Variola louti, Zanclus cornutus, Zebrasoma veliferum*

**Fish Swim:** *Acanthurus pyroferus, Acanthurus thompsoni, Cephalopholis argus, Chaetodon ephippium, Chaetodon lunula, Chaetodon ornatissimus, Chaetodon quadrimaculatus, Chaetodon reticulatus, Cheilinus trilobatus, Cheilio inermis, Chromis agilis, Coris aygula, Epinephelus hexagonatus, Halichoeres ornatissimus, Lutjanus bohar, Macolor niger, Melichthys vidua, Monotaxis grandoculis, Naso tonganus, Naso unicornis, Novaculichthys taeniourus, Oxycheilinus unifasciatus, Pygoplites diacanthus, Sargocentron caudimaculatum, Scarus oviceps, Scarus psittacus, Scarus rubroviolaceus, Siganus argenteus, Sufflamen chrysopterum, Valenciennesa strigata*

OVERALL SCORE: MED-LOW

# 65 - South Point\_MMT, Tinian

South Point\_MMT is located near Carolinas Point, which is the southernmost point on the island of Tinian. This site is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. This is a geologically unique reef among the sites surveyed, consisting primarily of large boulders and limited reef structure. This site has medium-low scores for bleaching resistance, coral diversity, temperature variability and herbivore biomass. Roughly 75% of the benthic community was made up in near equal parts by live coral, sand, and rubble. Greater than 60% of the total herbivorous fish biomass was comprised of grazers/detritivores. This site is a target for fishery regulations and enforcement and bleaching monitoring and supporting recovery activities. Examples of actions that can be considered for implementation at this location include: size regulations and bag and catch limits and increased monitoring during warm seasons.

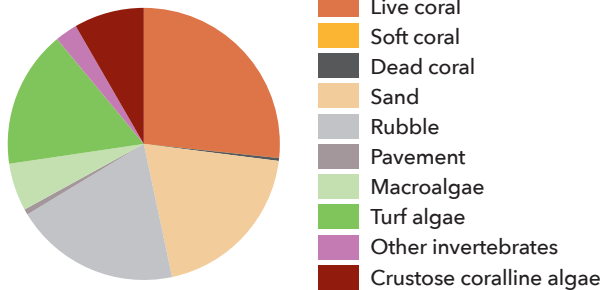


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	65/78	0.76	0.92	0.63	0.26	0.88	0.82	0.12	0.60	0.19
Intra-Island	20/25	0.80	0.89	0.68	0.45	0.88	0.82	0.26	0.47	0.56

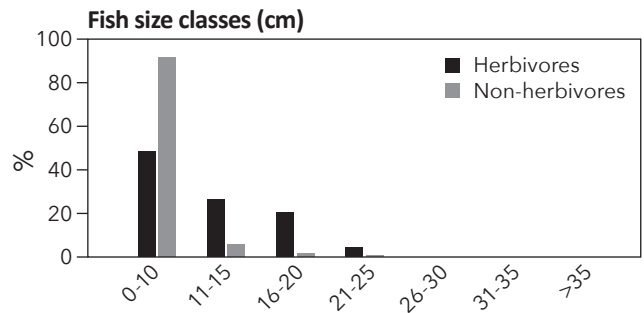
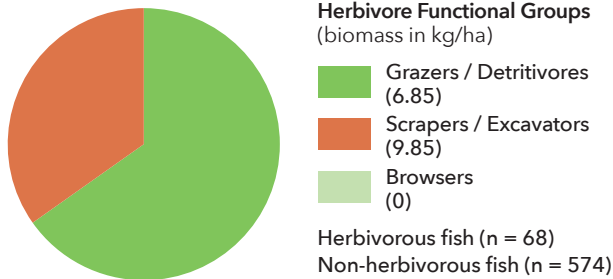
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Astreopora myriophthalma*, *Cyphastrea serailia*, *Favia fava*, *Favia matthaii*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Hydnophora microconos*, *Leptastrea purpurea*, *Montastrea valenciennesi*, *Montipora efflorescens*, *Montipora nodosa*, *Montipora studeri*, *Montipora monasteriata*, *Pavona varians*, *Porites lichen*, *Porites lobata*, *Stylophora mordax*

**Coral Swim:** *Favia stelligera*, *Montipora foveolata*, *Montipora verrucosa*, *Pavona duerdeni*, *Platygyra daedalea*, *Pocillopora elegans*, *Porites lutea*

**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus* sp., *Aphareus furca*, *Balistapus undulatus*, *Centropyge flavissima*, *Centropyge shepardii*, *Cephalopholis urodeta*, *Chaetodon reticulatus*, *Cheilinus chlorourus*, *Chlorurus sordidus*, *Chromis acares*, *Chromis margaritifer*, *Chrysiptera brownriggii*, *Chrysiptera traceyi*, *Cirrhitichthys falco*, *Coris gaimard*, *Ctenochaetus striatus*, *Gobiid* sp., *Halichoeres biocellatus*, *Halichoeres hortulanus*, *Halichoeres ornatissimus*, *Labroides dimidiatus*, *Lethrinus rubrioperculatus*, *Melichthys vidua*, *Paracirrhites arcatus*, *Parupeneus multifasciatus*, *Pomachromis guamensis*, *Scarus forsteni*, *Scarus oviceps*, *Scarus psittacus*, *Stethojulis bandanensis*, *Sufflamen bursa*, *Sufflamen chrysopterum*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Zebrasoma flavescens*

**Fish Swim:** *Acanthurus olivaceus*, *Cephalopholis argus*, *Chaetodon ephippium*, *Chaetodon lunula*, *Epibulus insidiator*, *Forcipiger longirostris*, *Hemigymnus fasciatus*, *Hemigymnus melapterus*, *Odonus niger*, *Paracanthurus hepatus*, *Paracirrhites forsteri*, *Scarus frenatus*, *Scarus rubroviolaceus*, *Stethojulis bandanensis*, *Sufflamen bursa*, *Zanclus cornutus*

OVERALL SCORE: MED-LOW

# 66 - Barcinas Bay\_MMT, Tinian

Barcinas Bay\_MMT is named for the Barcinas clan, which is one of the major families on Tinian. The Barcinas family owns much of the land surrounding this bay. This site is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. This site has a high score for bleaching resistance but medium-low or low scores for all other resilience indicators. Roughly 50% of the benthic community is made up by live coral. Roughly 90% of the total herbivorous fish biomass is comprised in near equal parts by grazers/detritivores and scrapers/excavators. This site is a target for fishery regulations and enforcement. Examples of actions that can be considered for implementation at these locations include increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas.

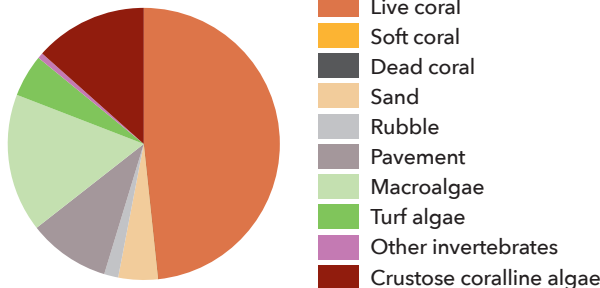


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>66/78</b>	0.76	0.77	0.93	0.13	0.75	0.81	0.13	0.57	0.24
Intra-Island	<b>23/25</b>	0.78	0.68	1.00	0.22	0.76	0.81	0.28	0.43	0.70

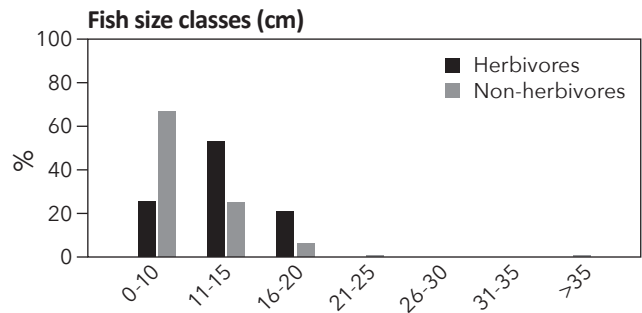
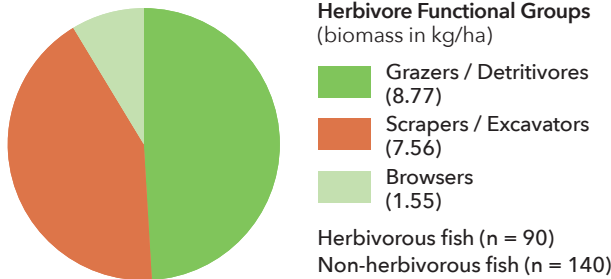
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acanthastrea echinata, Acropora gemmifera, Acropora surculosa, Favia danae, Favia matthaii, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea retiformis, Goniopora fruticosa, Leptastrea purpurea, Leptoria Phrygia, Pavona varians, Platygyra pini, Porites rus*

**Coral Swim:** *Acropora cerealis, Acropora robusta, Acropora tenuis, Cyphastrea serailia, Fungia scutaria, Hydnothpora microconos, Isopora palifera, Lobophyllia corymbosa, Lobophyllia hemprichii, Montastrea valenciennesi, Montipora venosa, Pavona duerdeni, Platygyra daedalea, Pocillopora danae, Pocillopora verrucosa, Porites australiensis, Porites lutea, Stylophora mordax*

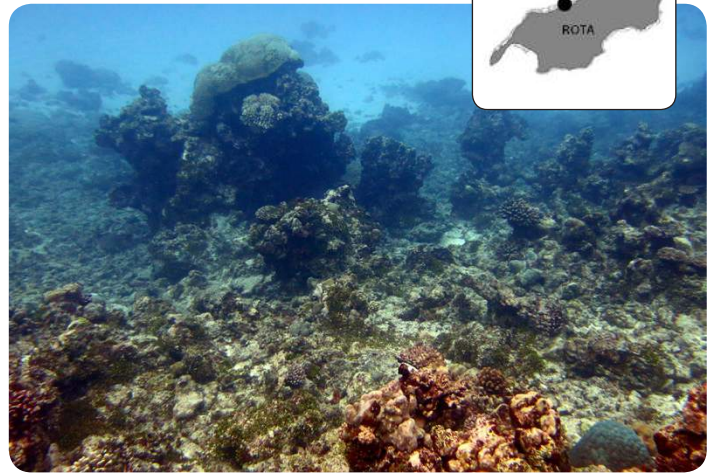
**Fish SPCs:** *Acanthurus nigricans, Acanthurus nigrofuscus, Aphareus furca, Balistapus undulatus, Bodianus axillaris, Carcharhinus melanopterus, Centropyge flavissima, Cephalopholis urodeta, Chaetodon auriga, Chaetodon lunulatus, Chaetodon ornatissimus, Chaetodon reticulatus, Cheilinus trilobatus, Chlorurus sordidus, Chromis agilis, Chrysiptera brownriggii, Ctenochaetus cyanocheilus, Ctenochaetus striatus, Gompbosus varius, Halichoeres hortulanus, Halichoeres ornatissimus, Hemigymnus fasciatus, Labroides dimidiatus, Lethrinus rubrioperculatus, Melichthys niger, Monotaxis grandoculis, Naso lituratus, Neonippon argenteus, Oxycheilinus digrammus, Paracirrhites forsteri, Parupeneus cyclostomus, Plectroglyphidodon lacrymatus, Pomacentrus vaiuli, Ptereleotris evides, Sargocentron tiere, Scarus psittacus, Stegastes fasciolatus, Stethojulis bandanensis, Thalassoma Hardwicke, Thalassoma lutescens, Thalassoma quinquevittatum, Zebrasoma flavescens, Zebrasoma veliferum*

**Fish Swim:** *Abudefduf sexfasciatus, Chaetodon ephippium, Chaetodon lunula, Kyphosus sp., Lethrinus xanthochilus, Meiacanthus atrodorsalis, Myripristis berndti, Myripristis violacea, Naso hexacanthus*

OVERALL SCORE: MED-LOW

# 67 - Teteto, Rota

Teteto is one of the most popular recreational beaches on the island of Rota. Family gatherings are commonly held here, year round. This site has a low score for bleaching resistance and medium-low scores for coral diversity and herbivore biomass. Roughly 50% of the benthic community is made up by live coral. Roughly 90% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site is a target for bleaching monitoring and supporting recovery so should be monitored during upcoming warm seasons. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

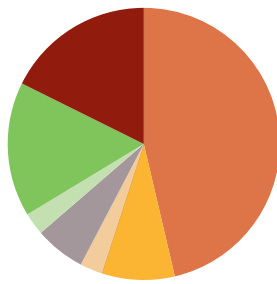


ISLAND SCORE: MED-HIGH

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	67/78	0.75	0.96	0.53	0.25	0.88	0.85	0.12	0.23	0.20
Intra-Island	13/24	0.84	0.94	0.53	0.47	0.88	0.92	0.23	0.23	0.68

● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

## Benthic community



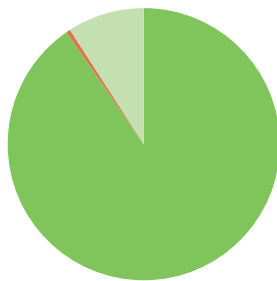
- Live coral
- Soft coral
- Dead coral
- Sand
- Rubble
- Pavement
- Macroalgae
- Turf algae
- Other invertebrates
- Crustose coralline algae

## Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
4.93	4.38	0.28	0	0.28

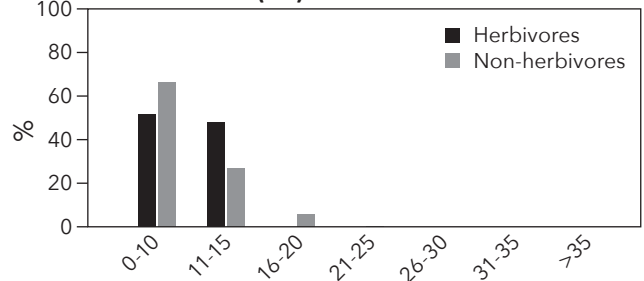
Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



- Herbivore Functional Groups (biomass in kg/ha)**
- Grazers / Detritivores (15.2)
  - Scrapers / Excavators (0.08)
  - Browsers (1.54)
- Herbivorous fish (n = 77)  
Non-herbivorous fish (n = 204)

## Fish size classes (cm)



**Coral Quads:** *Acanthastrea echinata, Acropora digitifera, Acropora robusta, Acropora surculosa, Acropora verweyi, Astreopora myriophthalma, Cyphastrea c.f. ocellina, Cyphastrea micropthalma, Favia danae, Favia pallida, Favia stelligera, Favites abdita, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea retiformis, Lobophyllia corymbosa, Montipora hoffmeisteri, Oulophyllia crista, Platygyra pini, Pocillopora damicornis, Pocillopora danae, Pocillopora elegans, Pocillopora verrucosa*

**Coral Swim:** *Acropora globiceps, Acropora tenuis, Favia favus, Favia matthaii, Favites flexuosa, Fungia repanda, Heliopora coerulea, Hydnothpora microconus, Leptastrea transversa, Millepora platyphylla, Pavona varians, Platygyra daedalea, Pocillopora ankei, Pocillopora meandrina, Porites lobata, Turbinaria stellulata*

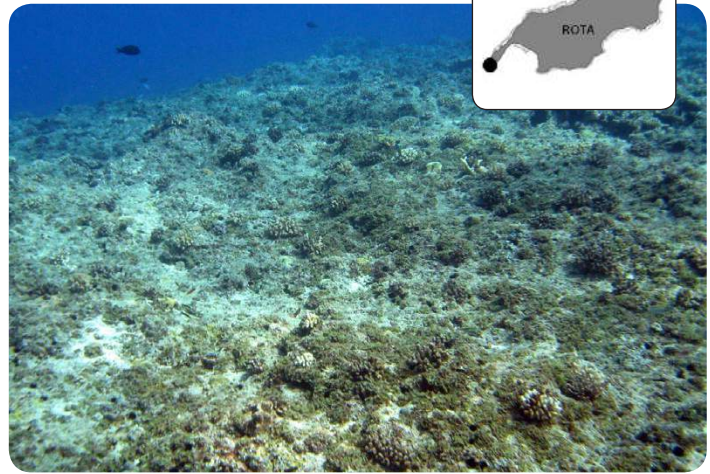
**Fish SPCs:** *Acanthurus guttatus, Acanthurus lineatus, Acanthurus nigricans, Acanthurus nigrofuscus, Acanthurus sp., Anampses caeruleopunctatus, Anampses twistii, Balistapus undulatus, Centropyge flavissima, Chaetodon auriga, Chaetodon bennetti, Chaetodon reticulatus, Cheilinus chlorourus, Chlorurus sordidus, Chromis margaritifer, Chrysiptera brownriggii, Chrysiptera traceyi, Cirrhitilabrus katherinae, Cirripectes variolosus, Ctenochaetus cyanocheilus, Ctenochaetus striatus, Gnathodentex aureolineatus, Gomphosus varius, Halichoeres hortulanus, Labroides dimidiatus, Naso lituratus, Neocirrhites armatus, Oxycheilinus digrammus, Paracirrhites arcatus, Paracirrhites forsteri, Parupeneus cyclostomus, Parupeneus multifasciatus, Pempheris ovalensis, Plectroglyphidodon dickii, Plectroglyphidodon lacrymatus, Scolopsis lineata, Stegastes fasciolatus, Tetraodontid sp., Thalassoma quinquevittatum*

**Fish Swim:** *Abudefduf vaigiensis, Acanthurus olivaceus, Caesio teres, Cephalopholis urodeta, Chaetodon citrinellus, Cheilinus trilobatus, Cheilodipterus macrodon, Coris aygula, Hemigymnus fasciatus, Lethrinus sp., Lutjanus bohar, Melichthys vidua, Myripristis berndti, Myripristis kumtee, Novaculichthys taeniourus, Ptereleotris evides, Sargocentron diadema, Scarus psittacus, Scarus rubroviolaceus, Stethojulis bandanensis, Thalassoma purpurum*

OVERALL SCORE: MED-LOW

# 68 - Harnom Point, Rota

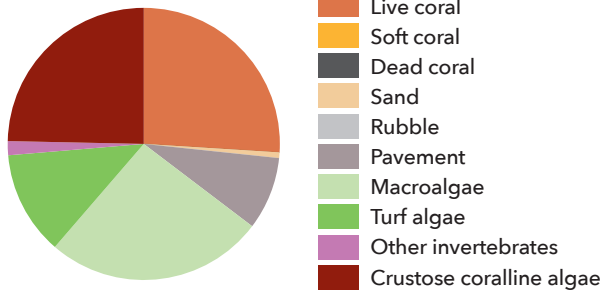
Harnom Point is one of Rota's most well-known dive sites because this is a dynamic wall dive that often includes encounters with pelagic fish. Adult Napoleon wrasse (*Cheilinus undulatus*) kept their distance below us during surveys at this site. This site has medium-low scores for coral recruitment and diversity and for temperature variability and has above average macroalgae cover. Greater than 50% of the benthic community is made up by live coral and crustose coralline algae. Greater than 50% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>68/78</b>	0.75	0.64	0.78	0.19	0.86	0.79	0.25	0.31	0.19
Intra-Island	<b>17/24</b>	0.80	0.45	0.78	0.37	0.87	0.86	0.48	0.31	0.67

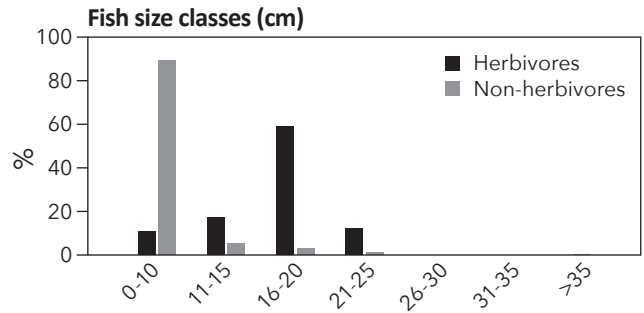
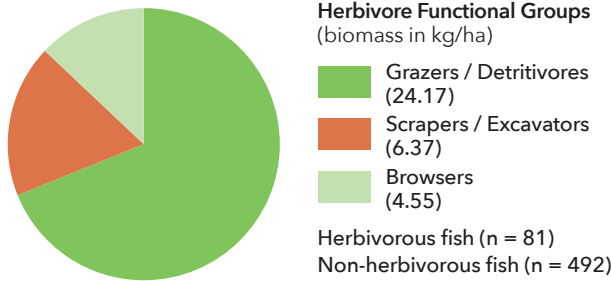
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acanthastrea echinata*, *Acropora digitifera*, *Cyphastrea serailia*, *Favia favus*, *Favia matthaii*, *Favia stelligera*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Hydnophora microconos*, *Leptastrea purpurea*, *Montipora verrilli*, *Pavona duerdeni*, *Pavona varians*, *Pocillopora danae*, *Pocillopora elegans*, *Pocillopora verrucosa*, *Porites lichen*, *Porites massive (australensis, lobata, lutea complex)*, *Psammocora haimeana*

**Coral Swim:** *Acropora humilis*, *Acropora surculosa*, *Astreopora myriophthalma*, *Cyphastrea agassizi*, *Favia pallida*, *Favites flexuosa*, *Galaxea fascicularis*, *Platygyra pini*, *Pocillopora meandrina*, *Porites lobata*, *Porites vaughani*

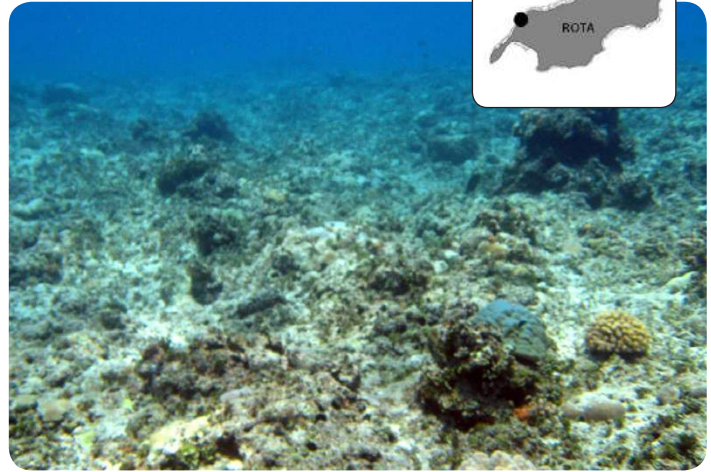
**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus olivaceus*, *Acanthurus sp.*, *Aphareus furca*, *Canthigaster solandri*, *Centropyge flavissima*, *Centropyge shepardi*, *Cephalopholis urodeta*, *Chaetodon auriga*, *Chaetodon ephippium*, *Chaetodon lunula*, *Chaetodon reticulatus*, *Chlorurus sordidus*, *Chromis acares*, *Chromis margaritifer*, *Cirrhitichthys falco*, *Ctenochaetus cyanocheilus*, *Ctenochaetus striatus*, *Halichoeres biocellatus*, *Halichoeres hortulanus*, *Labroides bicolor*, *Labroides dimidiatus*, *Melichthys vidua*, *Naso brevirostris*, *Naso lituratus*, *Neocirrhites armatus*, *Oxycheilinus digrammus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Parupeneus insularis*, *Parupeneus multifasciatus*, *Plectroglyphidodon dickii*, *Plectroglyphidodon johnstonianus*, *Pomacanthus imperator*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Ptereleotris eoides*, *Rhinecanthus rectangulus*, *Sargocentron caudimaculatum*, *Scarus forsteni*, *Scarus psittacus*, *Stegastes fasciolatus*, *Sufflamen bursa*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Valenciennesa strigata*, *Zanclus cornutus*

**Fish Swim:** *Balistoides conspicillum*, *Balistoides viridescens*, *Cephalopholis argus*, *Chaetodon quadrimaculatus*, *Cheilinus trilobatus*, *Cheilinus undulatus*, *Chromis agilis*, *Coris gaimard*, *Decapterus macarellus*, *Epibulus insidiator*, *Forcipiger longirostris*, *Hemigymnus melapterus*, *Lethrinus xanthurus*, *Lutjanus gibbus*, *Lutjanus monostigma*, *Monotaxis grandoculis*, *Myripristis kuntee*, *Naso tonganus*, *Parupeneus cyclostomus*, *Pseudanthias pascalus*, *Pygoplites diacanthus*, *Sargocentron spiniferum*, *Sargocentron tiere*, *Scarus altipinnis*, *Scarus oviceps*, *Scarus rubroviolaceus*, *Scarus sp.*, *Variola louti*, *Zebrasoma veliferum*



## 69 - Cave Museum\_MMT, Rota

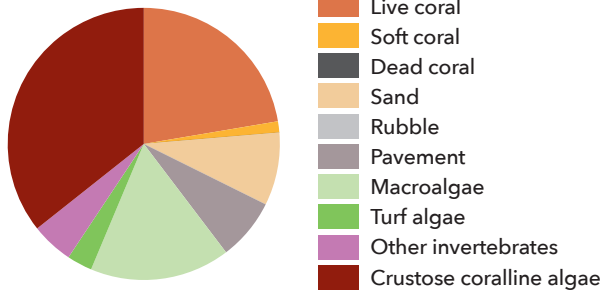
Cave Museum\_MMT is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. The Rota Cave Museum is located onshore near this reef. Large bluefin trevallies (*Caranx melampygus*) were seen at this site. This site has medium-low scores for coral recruitment, temperature variability and herbivore biomass and has above average macroalgae cover. Greater than 50% of the benthic community is made up by live coral and crustose coralline algae. Greater than 50% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site did not meet any of the criteria we set to identify targets for various types of management actions. This site may warrant management attention for reasons distinct from the resilience assessment results. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	69/78	0.74	0.77	0.72	0.13	0.95	0.83	0.07	0.31	0.22
Intra-Island	18/24	0.77	0.65	0.72	0.24	0.96	0.89	0.17	0.31	0.75

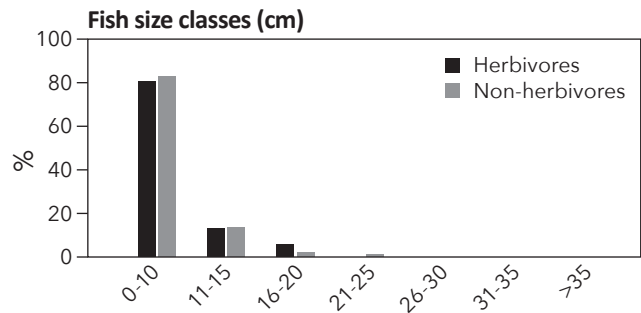
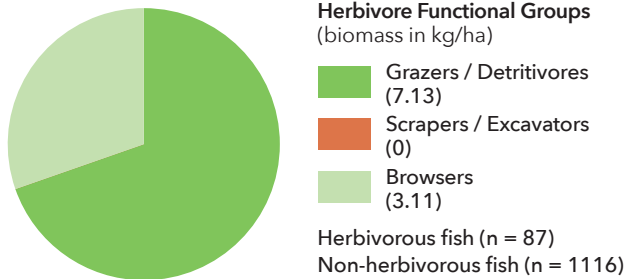
● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

### Fish community



**Coral Quads:** *Acanthastrea echinata, Acropora gemmifera, Acropora surculosa, Astreopora listeri, Astreopora myriophthalma, Cyphastrea chalcidicum, Cyphastrea microphthalma, Favia danae, Favia javus, Favia matthaii, Favia stelligera, Favites russelli, Galaxea fascicularis, Goniastrea edwardsi, Goniastrea retiformis, Leptastrea purpurea, Leptoria Phrygia, Montastrea valenciennesi, Pavona varians, Plesiastrea versipora, Pocillopora danae, Pocillopora eydouxi, Porites lichen, Porites lobata, Porites vaughani, Psammocora haimeana*

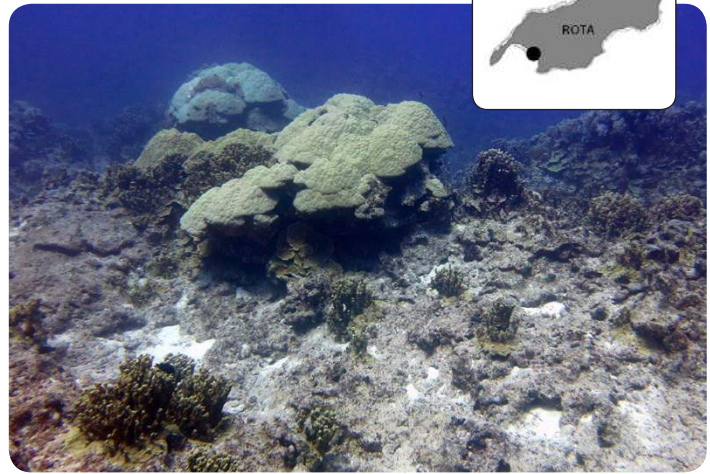
**Coral Swim:** *Cyphastrea serailia, Favites flexuosa, Fungia scutaria, Hydnohpora microconos, Montipora floweri, Platygyra daedalea, Pocillopora elegans, Porites lutea, Stylophora mordax, Turbinaria stellulata*

**Fish SPCs:** *Acanthurus nigrofusus, Acanthurus olivaceus, Acanthurus sp., Caranx melampygus, Cephalopholis argus, Cephalopholis urodeta, Chaetodon quadrimaculatus, Chromis acares, Chromis margaritifera, Chrysiptera brownriggii, Cirrhitichthys falco, Cirripectes variolosus, Halichoeres biocellatus, Halichoeres ornatus, Labroides dimidiatus, Macropharyngodon meleagris, Melichthys vidua, Naso lituratus, Nemateleotris magnifica, Neocirrhites armatus, Oxycheilinus digrammus, Paracanthurus hepatus, Paracirrhites arcatus, Paracirrhites forsteri, Parupeneus insularis, Plectroglyphidodon johnstonianus, Pomacanthus imperator, Pomacentrus vaiuli, Pomachromis guamensis, Rhinecanthus rectangulus, Stegastes fasciatus, Sufflamen bursa, Sufflamen chrysopterum, Synodus sp., Thalassoma amblycephalum, Thalassoma quinquevittatum, Valenciennesia strigata*

**Fish Swim:** *Acanthurus blochii, Acanthurus pyroferus, Anampses caeruleopunctatus, Aphaeus furca, Centropyge flavissima, Cheilinus trilobatus, Coris aygula, Coris gaimard, Ctenochaetus striatus, Decapterus macarellus, Epibulus insidiator, Hemigymnus melapterus, Malacanthus latovittatus, Melichthys niger, Monoctaxis grandoculis, Naso hexacanthus, Naso tonganus, Plectroglyphidodon lacrymatus, Ptereleotris evides, Scarus altipinnis, Scarus forsteni, Scarus psittacus, Scarus rubroviolaceus, Thalassoma lutescens, Variola louti, Zanclus cornutus, Zebbrasoma veliferum*

# 70 - Takta Sagua, Rota

Takta Sagua is just inside the Sasanhaya Fish Preserve in Rota. *Sagua* is the Chamorro word for a channel through the reef; the name is used here due to the many channels that lead from the reef flat to the forereef. This site has high scores for bleaching resistance low scores for coral recruitment and diversity and medium-low scores for temperature variability and herbivore biomass. Roughly 50% of the benthic community was made up by live coral. Greater than 50% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site did not meet any of the criteria we set to identify targets for various types of management action. This site may warrant management attention for reasons distinct from the resilience assessment results.

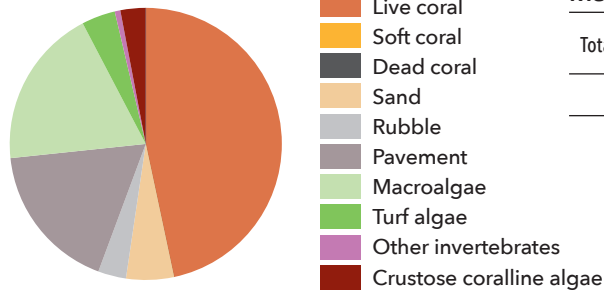


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	70/78	0.73	0.74	0.85	0.04	0.80	0.83	0.11	N/A - MPA	0.19
Intra-Island	20/24	0.74	0.60	0.85	0.07	0.81	0.89	0.26	N/A - MPA	0.67

● Low (<avg - 1 SD) 
 ● Med-Low (<avg and >avg - 1 SD) 
 ● Med-High (>avg and <avg - 1 SD) 
 ● High (>avg + 1 SD) 
 ● Low 
 ● Med-High 
 ● Med-Low 
 ● High

### Benthic community

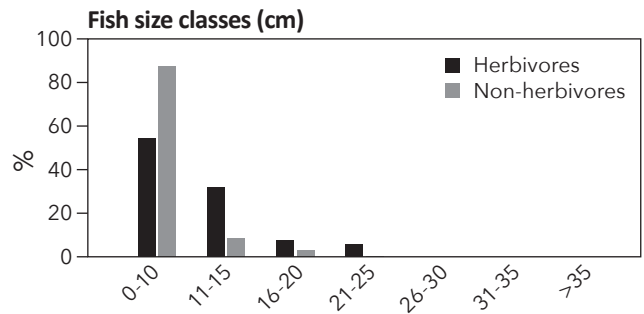
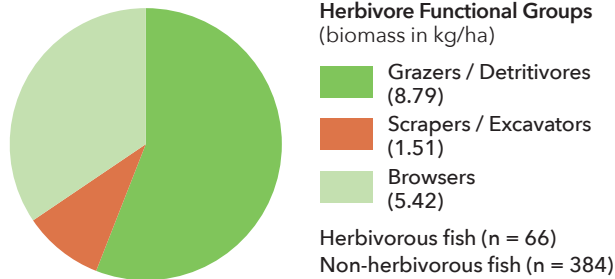


### Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
5.73	4.09	0.65	0.99	0

Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Astreopora myriophthalma*, *Favia danae*, *Favia fava*, *Favia stelligera*, *Favites abdita*, *Goniastrea edwardsi*, *Leptastrea purpurea*, *Montipora nodosa*, *Pavona varians*, *Porites australiensis*, *Porites lobata*, *Porites lutea*, *Porites rus*, *Porites vaughani*, *Stylocoeniella armata*

**Coral Swim:** *Acropora gemmifera*, *Acropora surculosa*, *Cyphastrea microphthalma*, *Galaxea fascicularis*, *Montipora foveolata*, *Pavona venosa*, *Platygyra pini*, *Pocillopora danae*, *Pocillopora elegans*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites cylindrical*, *Turbinaria stellulata*

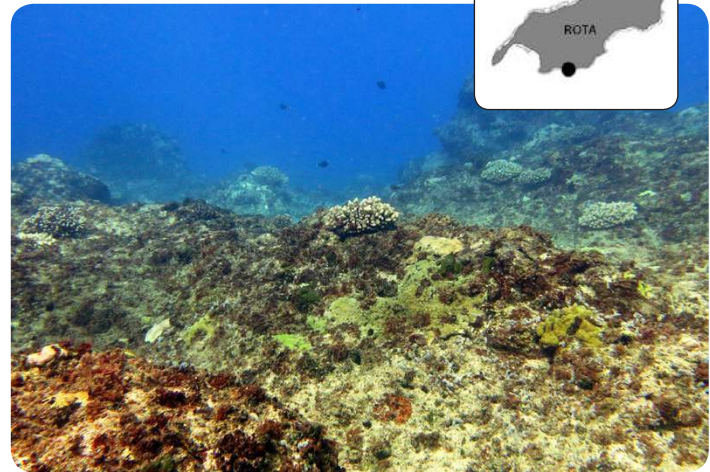
**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus pyroferus*, *Acanthurus sp.*, *Balistapus undulatus*, *Bodianus axillaris*, *Canthigaster janthinoptera*, *Centropyge flavissima*, *Centropyge shepardi*, *Cephalopholis sommerati*, *Cephalopholis urodeta*, *Chaetodon auriga*, *Chaetodon citrinellus*, *Chaetodon lunula*, *Chaetodon ornatissimus*, *Chaetodon punctatofasciatus*, *Chaetodon reticulatus*, *Chaetodon ulietensis*, *Cheilinus chlorourus*, *Chlorourus sordidus*, *Chromis acares*, *Chromis agilis*, *Chromis margaritifer*, *Chrysiptera brownriggii*, *Chrysiptera traceyi*, *Ctenochaetus cyanocheilus*, *Ctenochaetus striatus*, *Epinephelus fasciatus*, *Epinephelus sp.*, *Forcipiger flavissimus*, *Gnathodentex aureolineatus*, *Gomphosus varius*, *Halichoeres hortulanus*, *Halichoeres ornatissimus*, *Hemitaurichthys polylepis*, *Heniochus chrysostratus*, *Labroides bicolor*, *Labroides dimidiatus*, *Meiacanthus atrodorsalis*, *Melichthys vidua*, *Naso lituratus*, *Nemateleotris magnifica*, *Oxycheilinus digrammus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Parupeneus multifasciatus*, *Plagiotremus tapeinosoma*, *Plectroglyphidodon lacrymatus*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Ptereleotris evides*, *Ptereleotris heteroptera*, *Ptereleotris zebra*, *Sargocentron caudimaculatum*, *Stegastes fasciolatus*, *Sufflamen chrysopterum*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Valenciennesa strigata*, *Zebbrasoma flavescens*

**Fish Swim:** *Acanthurus nigricauda*, *Acanthurus olivaceus*, *Aphareus furca*, *Cheilinus oxycephalus*, *Coris aygula*, *Hemigymnus fasciatus*, *Macolor niger*, *Monotaxis grandoculis*, *Pygoplites diacanthus*, *Scarus psittacus*, *Stethojulis bandanensis*

OVERALL SCORE: LOW

# 71 - Talakhaya\_MMT, Rota

Talakhaya\_MMT is near Talakhaya, which is a large watershed on the island of Rota that faces south, towards Guam; *Talakhaya* is the Chamorro word for 'look south'. This site is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. The Large blunthead parrotfish (*Chlorurus microrhinos*) can be observed swimming at this site. This site has a high score for bleaching resistance but has low scores for temperature variability and herbivore biomass and has above average macroalgae cover. Roughly half of the benthic community at the site is made up by turfing algae and macroalgae. Greater than 50% of the total herbivorous fish biomass is comprised of grazers/detritivores. Talakhaya is a secondary target for conservation efforts because it is a low resilience site that is outside established marine protected areas. The primary targets are the high resilience sites outside established marine protected areas (see p. 1 for example). The resilience indicators suggest this site is among the least likely to resist and recover as disturbance frequencies increase under climate change. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

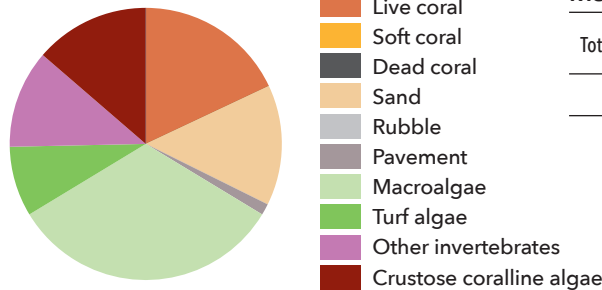


ISLAND SCORE: MED-LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	71/78	0.72	0.55	0.86	0.31	0.92	0.67	0.05	0.22	0.19
Intra-Island	19/24	0.75	0.31	0.86	0.58	0.93	0.73	0.12	0.22	0.67

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community

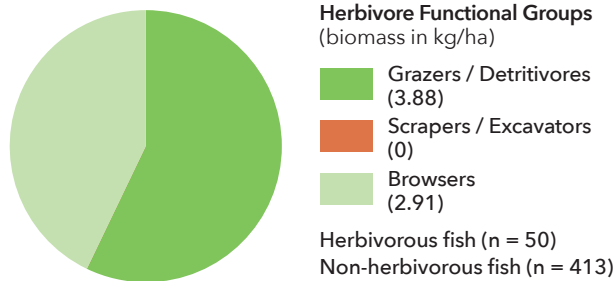


## Mean disease prevalence (%)

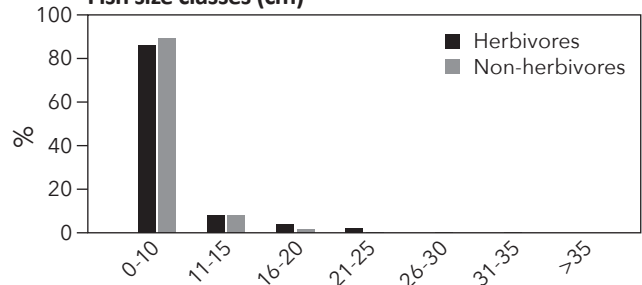
Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
3.11	2.35	0	0.76	0

Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



## Fish size classes (cm)



**Coral Quads:** *Acanthastrea echinata*, *Acropora humilis*, *Astreopora myriophthalma*, *Cyphastrea microphthalma*, *Favia danae*, *Favia fava*, *Favia helianthoides*, *Favia matthaii*, *Favia pallida*, *Favia speciosa*, *Favia stelligera*, *Goniastrea retiformis*, *Leptastrea purpurea*, *Montipora boffmeisteri*, *Pavona varians*, *Pocillopora danae*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites australiensis*, *Porites lichen*, *Porites lobata*, *Porites lutea*, *Porites vaughani*, *Psammocora haimeana*, *Stylocoeniella armata*, *Stylophora mordax*

**Coral Swim:** *Acropora abrottenoides*, *Acropora secale*, *Acropora surculosa*, *Cyphastrea serailia*, *Favites abdita*, *Goniastrea edwardsi*, *Heliopora coerulea*, *Hydnophora microconos*, *Millepora platyphylla*, *Montipora efflorescens*, *Montipora floweri*, *Montipora monasteriata*, *Montipora nodosa*, *Platygyra pini*, *Pocillopora elegans*, *Pocillopora eydouxi*

**Fish SPCs:** *Acanthurus nigrofuscus*, *Acanthurus* sp., *Aphareus furca*, *Canthigaster solandri*, *Cephalopholis urodeta*, *Chaetodon auriga*, *Chaetodon citrinellus*, *Chaetodon ephippium*, *Chaetodon lunula*, *Chrysiptera brownriggii*, *Coris gaimard*, *Ctenochaetus* sp., *Ctenochaetus striatus*, *Epinephelus hexagonatus*, *Forcipiger flavissimus*, *Gobiid* sp., *Halichoeres hortulanus*, *Halichoeres ornatus*, *Labroides dimidiatus*, *Lutjanus bohar*, *Melichthys vidua*, *Naso lituratus*, *Neocirrhites armatus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Parupeneus cyclostomus*, *Parupeneus multifasciatus*, *Plagiotremus tapeinosoma*, *Plectroglyphidodon johnstonianus*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Rhinocanthus rectangulus*, *Stegastes fasciolatus*, *Stethojulis strigiventer*, *Sufflamen bursa*, *Sufflamen chrysopterum*, *Thalassoma quinquevittatum*, *Valenciennesa strigata*, *Variola louti*

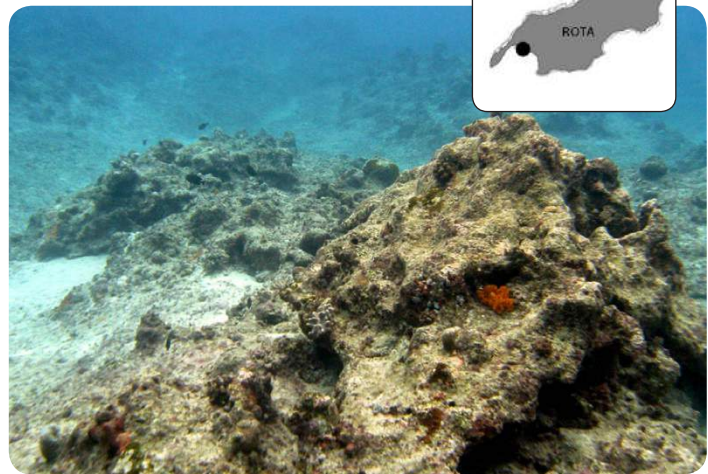
**Fish Swim:** *Acanthurus nigricans*, *Acanthurus olivaceus*, *Acanthurus pyroferus*, *Anampses twitii*, *Carangoides ferdau*, *Caranx melampygus*, *Cheilinus trilobatus*, *Chlorurus microrhinos*, *Chlorurus sordidus*, *Coris aygula*, *Lutjanus fulvus*, *Macolor niger*, *Malacanthus latovittatus*, *Monotaxis grandoculis*, *Naso hexacanthus*, *Pomacanthus imperator*, *Pygoplites diacanthus*, *Scarus forsteri*, *Scarus rubroviolaceus*, *Synodus* sp., *Zanclus cornutus*, *Zebrasoma flavescens*

Observers: S. McKagan, J. Maynard, S. Johnson, and L. Raymundo

OVERALL SCORE: LOW

## 72 - Joanne's Reef, Rota

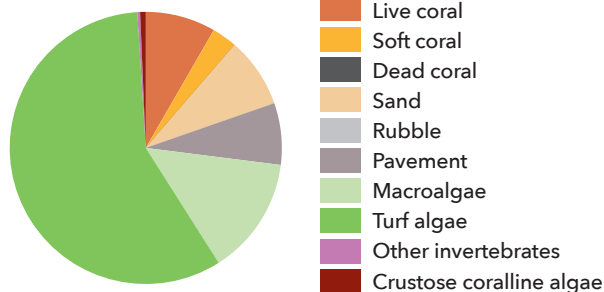
Joanne's Reef is characterized by calm and clear water and there is a wide variety of reef fish here. Lionfish, sting rays and octopus are commonly seen at this site. A large round ribbontail ray (*Taeniura meyeni*) came right up to our diver teams during fish surveys at this site. This site has low coral recruitment and diversity, medium-low temperature variability and herbivore biomass and above average macroalgae cover. Nearly 75% of the benthic community at this site is comprised of turf algae and macroalgae. Greater than 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. Joanne's Reef is a secondary target for conservation efforts because it is a low resilience site that is outside established marine protected areas. The primary targets are the high resilience sites outside established marine protected areas (see p. 1 for example). The resilience indicators suggest this site is among the least likely to resist and recover as disturbance frequencies increase under climate change.



Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	72/78	0.71	0.81	0.80	0.00	0.76	0.83	0.12	0.33	0.21
Intra-Island	22/24	0.71	0.71	0.80	0.00	0.77	0.89	0.22	0.33	0.73

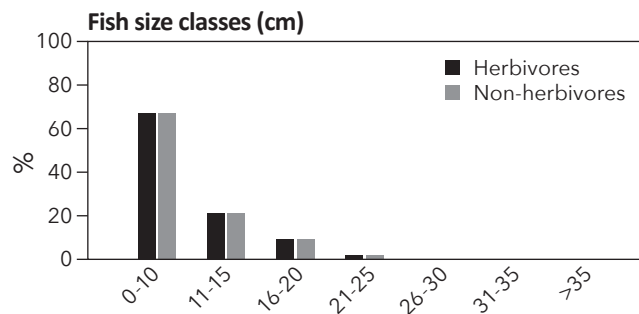
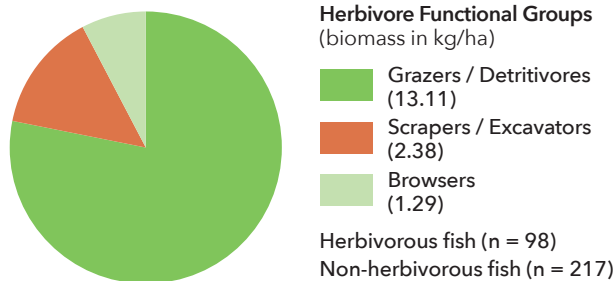
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Astreopora myriophthalma*, *Cyphastrea agassizi*, *Favia matthaii*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Leptastrea purpurea*, *Montastrea valenciennesi*, *Porites lichen*, *Porites lobata*

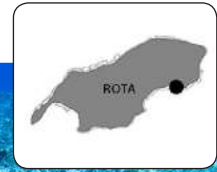
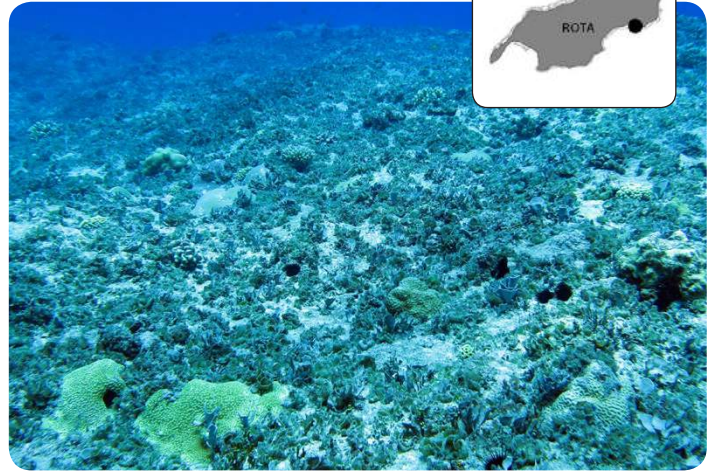
**Coral Swim:** *Acanthastrea echinata*, *Acropora cerealis*, *Acropora digitifera*, *Acropora gemmifera*, *Acropora tenuis*, *Astreopora listeri*, *Cyphastrea serailia*, *Favia stelligera*, *Galaxea fascicularis*, *Heliopora coerulea*, *Leptoria Phrygia*, *Millepora platyphylla*, *Montipora* sp. 0722, *Montipora* sp. 0794, *Montipora* sp. 0806, *Pavona varians*, *Platygyra daedalea*, *Pocillopora elegans*, *Porites rus*, *Psammocora haimeana*, *Stylophora mordax*, *Turbinaria stellulata*

**Fish SPCs:** *Acanthurus nigrofasciatus*, *Acanthurus olivaceus*, *Acanthurus pyroferus*, *Acanthurus* sp., *Aphareus furca*, *Caranx melampygus*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon citrinellus*, *Chaetodon lunula*, *Chlorurus sordidus*, *Chromis agilis*, *Chromis margaritifer*, *Chrysiptera brownriggii*, *Cirrhitichthys falco*, *Coris aygula*, *Ctenochaetus striatus*, *Decapterus macarellus*, *Forcipiger longirostris*, *Gobiid* sp., *Halichoeres hortulanus*, *Halichoeres margaritaceus*, *Labroides dimidiatus*, *Melichthys vidua*, *Monotaxis grandoculis*, *Myripristis kuntee*, *Naso lituratus*, *Oxycheilinus unifasciatus*, *Paracirrhites arcatus*, *Parupeneus insularis*, *Parupeneus multifasciatus*, *Plagiotremus tapeinosoma*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Ptereleotris evides*, *Scarus forsteri*, *Stegastes fasciolatus*, *Stethojulis strigiventer*, *Sufflamen chrysopterum*, *Taeniura meyeni*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Valenciennesa strigata*, *Zebbrasoma flavescens*

**Fish Swim:** *Acanthurus blochii*, *Apogon* sp., *Chaetodon auriga*, *Chaetodon ornatissimus*, *Chromis acares*, *Dascyllus trimaculatus*, *Gomphosus varius*, *Hemigymnus fasciatus*, *Heniochus chrysostomus*, *Labroides bicolor*, *Lutjanus bohar*, *Lutjanus kasmira*, *Lutjanus monostigma*, *Macropharyngodon meleagris*, *Meiacanthus atrodorsalis*, *Mulloidichthys vanicolensis*, *Myripristis murdjan*, *Naso unicornis*, *Neoniphon opercularis*, *Paracirrhites forsteri*, *Pempheris oualensis*, *Plectroglyphidodon lacrymatus*, *Pseudodax moluccanus*, *Ptereleotris zebra*, *Pygoplites diacanthus*, *Scarus altipinnis*, *Scarus frenatus*, *Scarus gjobban*, *Scarus psittacus*, *Scarus rubroviolaceus*, *Stethojulis bandanensis*, *Zanclus cornutus*

# 73 - South I Chenchon Park, Rota

South I Chenchon Park is located just off the southern point of the I Chenchon Park, which is a bird sanctuary on the island of Rota. This site had a wide range of marine fauna including green sea turtles, grey reef sharks and large bluefin trevally (*Caranx melampygus*). This site has medium-low scores for coral diversity, temperature variability and herbivore biomass and has above average macroalgae cover. Nearly 50% of the benthic community at this site is made up by turf algae and macroalgae. Greater than 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. South I Chenchon Park is a secondary target for conservation efforts because it is a low resilience site that is outside established marine protected areas. The primary targets are the high resilience sites outside established marine protected areas (see p. 1 for example). The resilience indicators suggest this site is among the least likely to resist and recover as disturbance frequencies increase under climate change. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

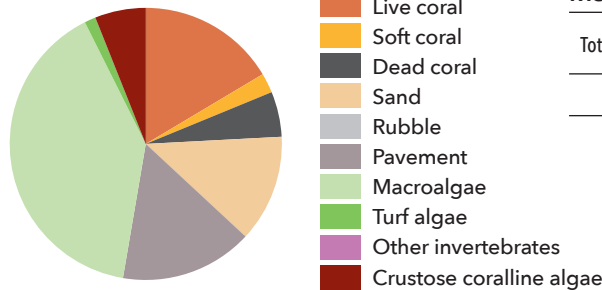


ISLAND SCORE: LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>73/78</b>	0.71	0.45	0.71	0.27	0.87	0.82	0.19	0.07	0.19
Intra-Island	<b>21/24</b>	0.73	0.17	0.71	0.51	0.88	0.89	0.30	0.07	0.67

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community

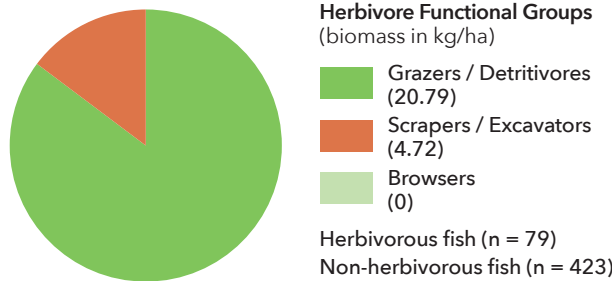


## Mean disease prevalence (%)

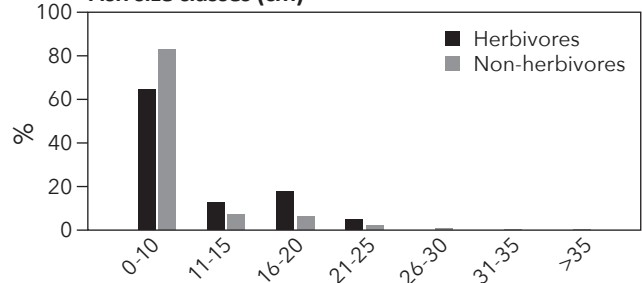
Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
2.57	2.30	0.26	0	0

Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



## Fish size classes (cm)



**Coral Quads:** *Acanthastrea echinata, Astreopora myriophthalma, Favia danae, Favia fava, Favia heliantoides, Favia matthaii, Favia pallida, Favia stelligera, Favites abdita, Goniastrea retiformis, Hydrophora microconos, Leptastrea purpurea, Leptoria Phrygia, Millepora tuberosa, Montipora turgescens, Pavona varians, Platygyra pini, Pocillopora elegans, Psammocora nierstraszi, Stylophora mordax*

**Coral Swim:** *Acropora gemmifera, Acropora globiceps, Acropora surculosa, Cyphastrea microphthalma, Favites russelli, Galaxea fascicularis, Goniastrea edwardsi, Goniopora fruticosa, Heliopora coerulea, Millepora platyphylla, Montipora floweri, Pavona duerdeni, Pocillopora meandrina, Porites australiensis, Porites lobata, Porites lutea, Porites vaughani, Turbinaria stellulata*

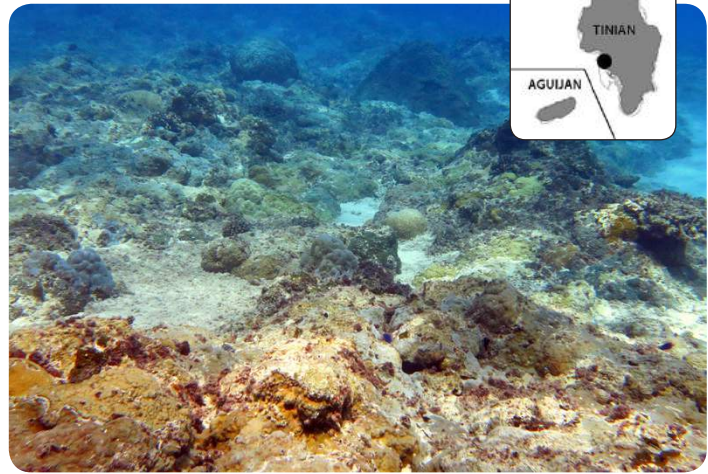
**Fish SPCs:** *Abudefduf vaigiensis, Acanthurus blochii, Acanthurus guttatus, Acanthurus nigricans, Acanthurus nigrofuscus, Acanthurus olivaceus, Acanthurus sp., Acanthurus triostegus, Aphareus furca, Balistapus undulatus, Canthigaster solandri, Caranx melampygus, Centropyge flavissima, Cephalopholis urodeta, Chaetodon auriga, Chaetodon citrinellus, Chaetodon lunula, Cheilio inermis, Chlorurus sordidus, Chromis margaritifera, Chrysiptera brownriggii, Cirripectes variolosus, Coris aygula, Coris gaimard, Ctenochaetus striatus, Forcipiger longirostris, Halichoeres biocellatus, Halichoeres hortulanus, Halichoeres ornatissimus, Leihrinus obsoletus, Macolor niger, Melichthys vidua, Paracirrhites arcatus, Paracirrhites hemisticus, Parupeneus cyclostomus, Parupeneus insularis, Parupeneus multifasciatus, Plectroglyphidodon dickii, Pomacanthus imperator, Pomachromis guamensis, Pygoplites diacanthus, Rhinecanthus rectangulus, Scarus rubroviolaceus, Spratelloides delicatulus, Stegastes fasciolatus, Sufflamen bursa, Sufflamen fraenatum, Thalassoma amblycephalum, Thalassoma lutescens, Thalassoma quinquevittatum, Zanclus cornutus, Zebrasoma flavescens*

**Fish Swim:** *Acanthurus lineatus, Acanthurus pyroferus, Anampses caeruleopunctatus, Carcharhinus amblyrhynchus, Chaetodon ornatissimus, Chelonia sp., Gnatbodontex aureolineatus, Kyphosus vaigiensis, Lutjanus fulvus, Monotaxis grandoculis, Mulloidichthys vanicolensis, Naso hexacanthus, Naso lituratus, Oxycheilinus digrammus, Paracanthurus hepatus, Scarus forsteni, Siganus argenteus, Siganus sp., Thalassoma purpureum*

OVERALL SCORE: LOW

# 74 - Leprosarium, Tinian

Leprosarium is located offshore from where an old leper colony was established during the Spanish colonial times. A friendly green sea turtle approached us at this site, close enough to get counted during one of the fish surveys. This site has low scores for bleaching resistance, coral recruitment and herbivore biomass but has low macroalgae cover. Roughly 50% of the benthic community is made up by live coral. Uniquely, 100% of the herbivorous fish biomass is comprised of grazers/detritivores. Leprosarium is a secondary target for conservation efforts because it is a low resilience site that is outside established marine protected areas. The primary targets are the high resilience sites outside established marine protected areas (see p. 1 for example). The resilience indicators suggest this site is among the least likely to resist and recover as disturbance frequencies increase under climate change. This site is also a target for fishery regulations and enforcement as well as bleaching monitoring and supporting recovery. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

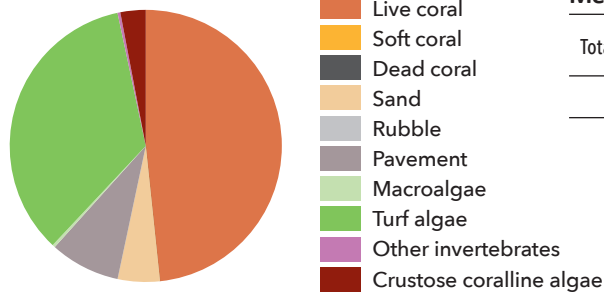


ISLAND SCORE: LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	74/78	0.69	1.00	0.54	0.00	0.89	0.81	0.04	0.59	0.34
Intra-Island	24/25	0.68	0.99	0.58	0.00	0.89	0.81	0.05	0.46	1.00

● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community

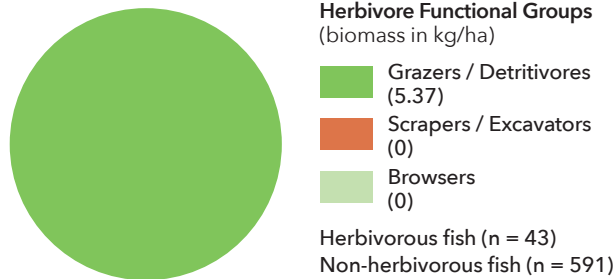


### Mean disease prevalence (%)

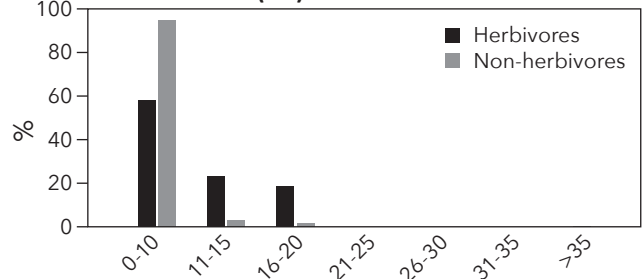
Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
1.96	1.96	0	0	0

Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

### Fish community



### Fish size classes (cm)



**Coral Quads:** *Astreopora myriophthalma*, *Cyphastrea chalcidicum*, *Favia favus*, *Favia matthaii*, *Goniastrea edwardsi*, *Leptastrea purpurea*, *Montastrea valenciennesi*, *Montipora efflorescens*, *Montipora foveolata*, *Montipora tuberculosa*, *Montipora venosa*, *Pavona duerdeni*, *Pavona varians*, *Pocillopora verrucosa*, *Porites lutea*

**Coral Swim:** *Acanthastrea echinata*, *Acropora digitifera*, *Acropora gemmifera*, *Acropora surculosa*, *Acropora tenuis*, *Cyphastrea serailia*, *Favia danae*, *Favia pallida*, *Galaxea fascicularis*, *Leptoria Phrygia*, *Pavona explanulata*, *Porites rus*

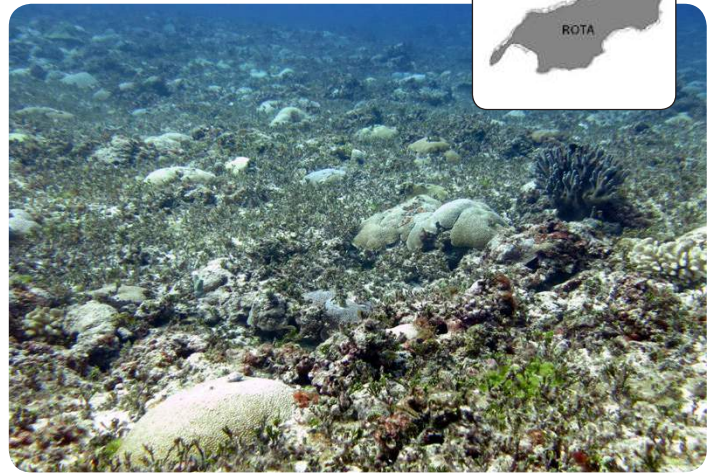
**Fish SPCs:** *Acanthurus lineatus*, *Acanthurus nigrofuscus*, *Acanthurus olinaceus*, *Acanthurus sp.*, *Apogon angustatus*, *Apogon sp.*, *Balistapus undulatus*, *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon ornatus*, *Chaetodon reticulatus*, *Cheilinus chlorourus*, *Cheilinus trilobatus*, *Chelonia sp.*, *Chromis margaritifer*, *Chrysiptera brownriggii*, *Cirripectes variolosus*, *Ctenochaetus cyanocheilus*, *Ctenochaetus striatus*, *Ecsenius bicolor*, *Forcipiger longirostris*, *Gobiid sp.*, *Gomphosus varius*, *Halichoeres hortulanus*, *Halichoeres margaritaceus*, *Labroides dimidiatus*, *Lutjanus bohar*, *Macropharyngodon meleagris*, *Meiacanthus atrodorsalis*, *Melichthys vidua*, *Oxycheilinus digrammus*, *Oxycheilinus unifasciatus*, *Paracirrhites arcatus*, *Parupeneus multifasciatus*, *Plagiotremus tapeinosoma*, *Plectroglyphidodon dickii*, *Plectroglyphidodon johnstonianus*, *Plectroglyphidodon lacrymatus*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Spratelloides delicatulus*, *Stegastes fasciolatus*, *Steihojulis bandanensis*, *Sufflamen bursa*, *Sufflamen chrysopterum*, *Thalassoma amblycephalum*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Valenciennesia strigata*

**Fish Swim:** *Acanthurus nigricauda*, *Anampses caeruleopunctatus*, *Aphareus furca*, *Caesio caeruleaurea*, *Chaetodon auriga*, *Chlorurus sordidus*, *Coris aygula*, *Ecsenius opsifrontalis*, *Naso lituratus*, *Paracirrhites forsteri*, *Parupeneus insularis*, *Sargocentron caudimaculatum*, *Scarus psittacus*, *Scarus rubroviolaceus*, *Zanclus cornutus*

OVERALL SCORE: LOW

# 75 - Rota Resort\_MMT, Rota

Rota Resort\_MMT is located just offshore from the Rota Resort & Golf Club on the northern coast of Rota. This is one of the few sites where we saw eagle rays during our surveys. This site is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. This site has a low score for herbivore biomass and medium-low scores for all other indicators excepting temperature variability, which is medium-high. Greater than 50% of the benthic community is made up by crustose coralline algae and live coral. Uniquely, 100% of the herbivorous fish biomass was comprised of grazers/detritivores. Rota Resort\_MMT is a secondary target for conservation efforts because it is a low resilience site that is outside established marine protected areas. The primary targets are the high resilience sites outside established marine protected areas (see p. 1 for example). The resilience indicators suggest this site is among the least likely to resist and recover as disturbance frequencies increase under climate change. This site is also a target for bleaching monitoring and supporting recovery so should be monitored during upcoming warm seasons. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

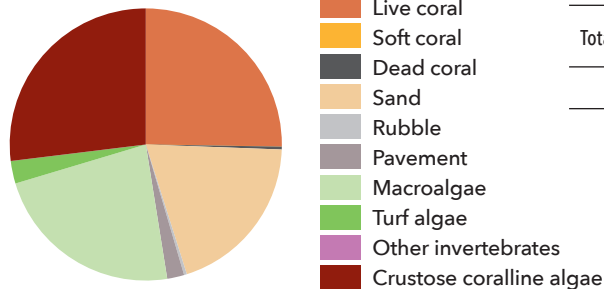


ISLAND SCORE: LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	75/78	0.69	0.69	0.57	0.21	0.91	0.85	0.01	0.19	0.29
Intra-Island	23/24	0.71	0.52	0.57	0.40	0.91	0.92	0.02	0.19	1.00

● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

## Benthic community

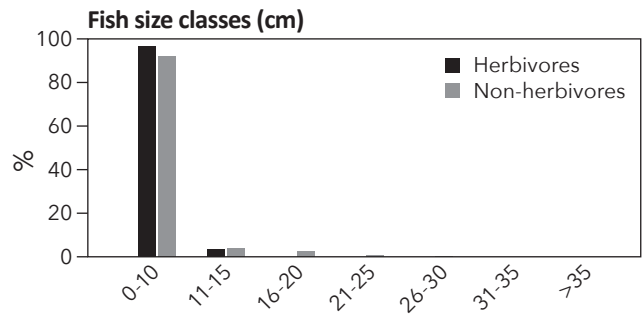
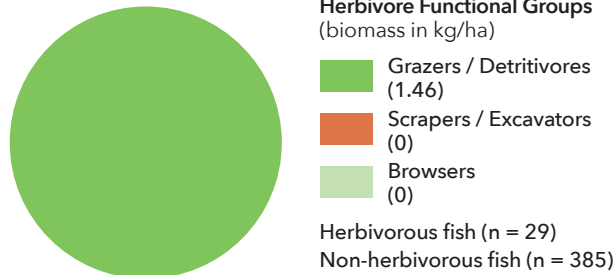


## Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
1.75	1.40	0.00	0.00	0.35

Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



**Coral Quads:** *Astreopora listeri*, *Astreopora myriophthalma*, *Cyphastrea serailia*, *Favia danae*, *Favia fava*, *Favia pallida*, *Favites abdita*, *Favites russelli*, *Fungia scutaria*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Leptastrea purpurea*, *Montipora foveolata*, *Pavona varians*, *Platygyra daedalea*, *Pocillopora elegans*, *Pocillopora verrucosa*, *Porites australiensis*, *Porites lichen*, *Porites lobata*, *Porites lutea*, *Stylophora mordax*

**Coral Swim:** *Acanthastrea echinata*, *Acropora cophyactyla*, *Acropora humilis*, *Acropora tenuis*, *Astreopora randalli*, *Favia matthaii*, *Goniopora djiboutiensis*, *Heliopora coerulea*, *Pocillopora meandrina*, *Porites vaughani*

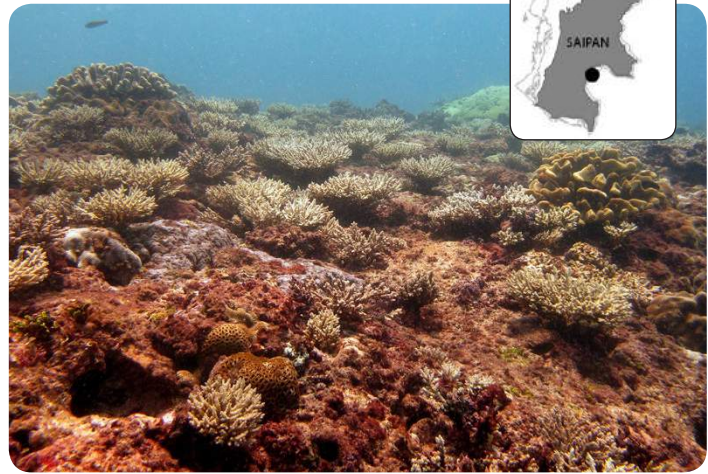
**Fish SPCs:** *Acanthurus nigrofuscus*, *Acanthurus* sp., *Centropyge flavissima*, *Cephalopholis urodeta*, *Chaetodon citrinellus*, *Cheilinus trilobatus*, *Chromis agilis*, *Chrysiptera brownriggii*, *Coris gaimard*, *Halichoeres biocellatus*, *Halichoeres hortulanus*, *Labrid* sp., *Labroides dimidiatus*, *Lethrinus olivaceus*, *Melichthys vidua*, *Oxycheilinus unifasciatus*, *Paracirrhites arcatus*, *Parupeneus multifasciatus*, *Plagiotremus tapeinosoma*, *Plectroglyphidodon johnstonianus*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Pygoplites diacanthus*, *Rhinecanthus rectangulus*, *Stegastes fasciolatus*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Zebbrasoma flavescens*

**Fish Swim:** *Acanthurus olivaceus*, *Aetobatus narinari*, *Anampses caeruleopunctatus*, *Aphareus furca*, *Balistapus undulatus*, *Cephalopholis argus*, *Chromis acares*, *Naso lituratus*, *Naso unicornis*, *Paracirrhites forsteri*, *Pomacanthus imperator*, *Scarus psittacus*, *Scarus rubroviolaceus*, *Variola louti*

OVERALL SCORE: LOW

## 76 - Tutturam, Saipan

Tutturam is located in Laolao Bay. A natural stream drainage once flowed right through the reef, but construction of an access road changed this, causing heavy sedimentation issues for this and other parts of the Bay. The only pastel ring wrasse (*Hologymnosus doliatus*) seen during our surveys was observed at this site. This site has a high score for coral recruitment but medium-low scores for temperature variability and herbivore biomass and has very high macroalgae cover. Roughly 75% of the benthic community was made up by macroalgae cover. Greater than 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. Tutturam is a secondary target for conservation efforts because it is a low resilience site that is outside established marine protected areas. The primary targets are the high resilience sites outside established marine protected areas (see p. 1 for example). The resilience indicators suggest this site is among the least likely to resist and recover as disturbance frequencies increase under climate change. Recent road and drainage improvements have been made and the natural stream has been realigned. Even so, this site is a target for continued reduction in land-based sources of pollution.

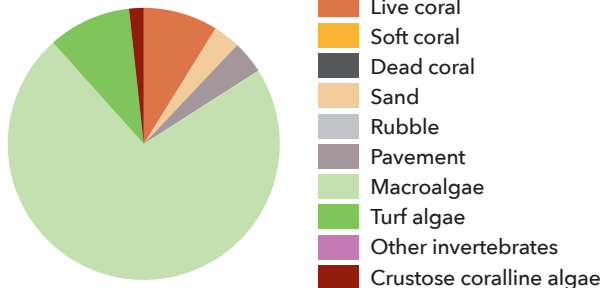


ISLAND SCORE: LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>76/78</b>	0.67	0.00	0.72	0.48	0.98	0.76	0.12	0.28	0.42
Intra-Island	<b>29/29</b>	0.68	0.00	0.84	0.48	0.98	0.79	0.13	0.24	0.42

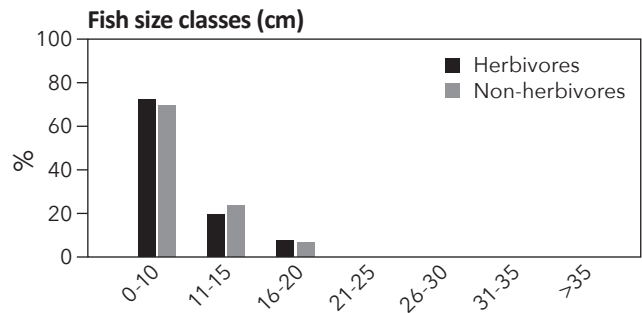
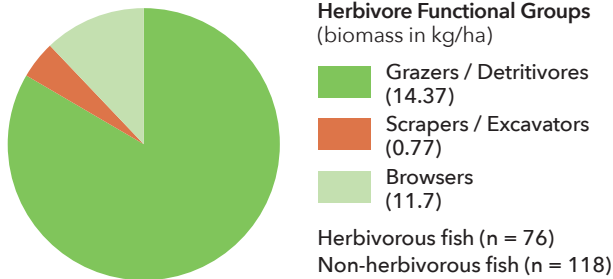
● Low (<avg - 1 SD)   
 ● Med-Low (<avg and >avg - 1 SD)   
 ● Med-High (>avg and <avg - 1 SD)   
 ● High (>avg + 1 SD)   
 ● Low   
 ● Med-High   
 ● Med-Low   
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Acanthastrea echinata*, *Acropora digitifera*, *Acropora humilis*, *Acropora nasuta*, *Acropora tenuis*, *Astreopora listeri*, *Astreopora myriophthalma*, *Astreopora randalli*, *Cyphastrea chalcidicum*, *Cyphastrea ocellina*, *Cyphastrea serailia*, *Echinopora lamellosa*, *Favia fava*, *Favia matthaii*, *Favia speciosa*, *Favia stelligera*, *Favites abdita*, *Favites russelli*, *Fungia scutaria*, *Galaxea fascicularis*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Leptastrea purpurea*, *Leptastrea transversa*, *Leptoria Phrygia*, *Montipora floweri*, *Montipora boffmeisteri*, *Montipora nodosa*, *Pavona divaricata*, *Pavona varians*, *Pocillopora damicornis*, *Porites lobata*, *Psammocora haimeana*, *Stylocoeniella armata*, *Stylophora mordax*

**Coral Swim:** *Goniastrea pectinata*

**Fish SPCs:** *Acanthurus lineatus*, *Acanthurus nigrofuscus*, *Acanthurus olivaceus*, *Balistapus undulatus*, *Cantherhines dumerilii*, *Cephalopholis urodeta*, *Chaetodon punctatofasciatus*, *Chaetodon quadrimaculatus*, *Cheilinus chlorourus*, *Cheilinus trilobatus*, *Coris gaimard*, *Ctenochaetus striatus*, *Halichoeres hortulanus*, *Halichoeres margaritaceus*, *Hologymnosus doliatus*, *Labroides dimidiatus*, *Melichthys vidua*, *Naso lituratus*, *Naso unicornis*, *Oxycheilinus unifasciatus*, *Pomacanthus imperator*, *Rhinecanthus rectangulus*, *Scarus psittacus*, *Stethojulis bandanensis*, *Sufflamen chrysopterum*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Zanclus cornutus*

OVERALL SCORE: LOW



# 77 - Puntan Diablo, Tinian

Puntan Diablo, which translates to “Devil’s Point”, is named for the treacherous waters that have to be passed to leave/enter Tinian. This site had a wide range of marine fauna including a blacktip reef shark, anemonefish and the only skipjack tuna to be observed during our surveys. This site has a low score for herbivore biomass, and medium-low or low scores for all other resilience indicators except bleaching resistance, which is medium-high. Roughly 50% of the benthic community is made up by macroalgae. Greater than 50% of the total herbivorous fish biomass is comprised of grazers/detritivores. Puntan Diablo is a secondary target for conservation efforts because it is a low resilience site outside established marine protected areas. The primary targets are the high resilience sites outside established MPAs (see p. 1 for example). The resilience indicators suggest this site is among the least likely to resist and recover as disturbance frequencies increase under climate change. This site is also a target for fishery regulations and enforcement. Examples of actions that can be considered for implementation at this location include: increased enforcement, size regulations and bag and catch limits, and mooring and no-anchoring areas. The Threatened coral species *Acropora globiceps* was seen at this site during our surveys in May/June of 2014.

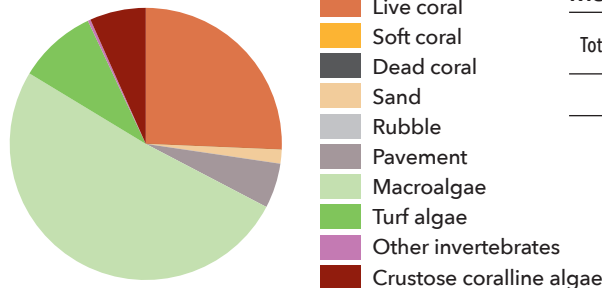


ISLAND SCORE: LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	77/78	0.64	0.30	0.72	0.23	0.85	0.81	0.05	0.54	0.19
Intra-Island	25/25	0.62	0.00	0.77	0.40	0.85	0.81	0.11	0.39	0.56

● Low (<avg - 1 SD) ● Med-Low (<avg and >avg - 1 SD) ● Med-High (>avg and <avg - 1 SD) ● High (>avg + 1 SD) ● Low ● Med-High ● Med-Low ● High

## Benthic community

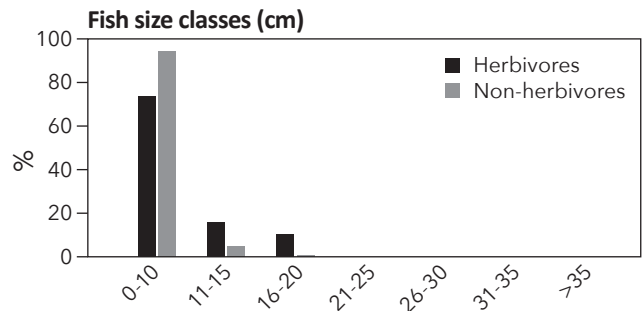
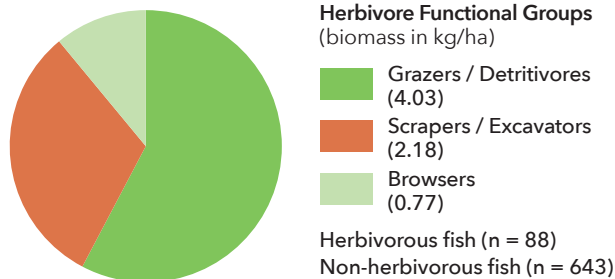


## Mean disease prevalence (%)

Total Prevalence	White Syndromes	Skeletal Eroding Band	Black Band	Growth Anomalies
0.75	0.60	0.15	0	0

Observed coral species listed under the NMFS ESA listing of 2014: *Acropora globiceps*.

## Fish community



**Coral Quads:** *Astreopora listeri*, *Astreopora myriophthalma*, *Cyphastrea senailia*, *Favia favus*, *Favia helianthoides*, *Favia matthaii*, *Favia stelligera*, *Leptastrea purpurea*, *Montipora efflorescens*, *Montipora tuberculosa*, *Pocillopora elegans*, *Psanmmocora haimiana*, *Stylophora mordax*

**Coral Swim:** *Acanthastrea echinata*, *Acropora cerealis*, *Acropora digitifera*, *Acropora gemmifera*, *Acropora humilis*, *Acropora latistella*, *Acropora tenuis*, *Astreopora gracilis*, *Cyphastrea chalcidicum*, *Favia danae*, *Favites flexuosa*, *Favites russelli*, *Galaxea fascicularis*, *Goniopora minor*, *Goniopora pendulus*, *Leptoria Phrygia*, *Millepora platyphylla*, *Montipora foveolata*, *Montipora nodosa*, *Montipora verrucosa*, *Pavona varians*, *Platygyra daedalea*, *Platygyra pini*, *Pocillopora eydouxi*, *Pocillopora meandrina*, *Pocillopora verrucosa*, *Porites lobata*, *Porites lutea*, *Stylocoeniella guentheri*, *Turbinaria stellulata*

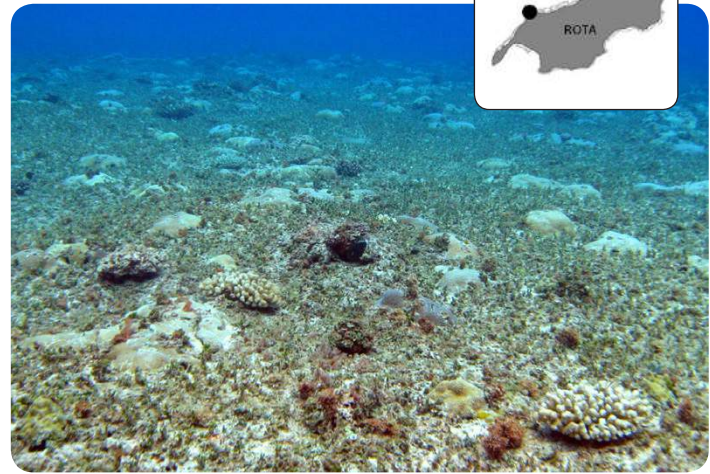
**Fish SPCs:** *Acanthurus nigrofuscus*, *Acanthurus olivaceus*, *Acanthurus* sp., *Amphiprion chrysopterus*, *Bothus mancus*, *Centropyge flavissima*, *Cephalopholis argus*, *Cephalopholis wodeta*, *Chaetodon auriga*, *Chaetodon reticulatus*, *Cheilinus chlouvous*, *Chromis margaritifer*, *Chrysiptera brownriggii*, *Ctenochaetus striatus*, *Dascyllus reticulatus*, *Dascyllus trimaculatus*, *Halichoeres hortulanus*, *Halichoeres margaritaceus*, *Labroides dimidiatus*, *Melichthys vidua*, *Naso lituratus*, *Naso unicornis*, *Oxycheilinus digrammus*, *Paracanthurus hepatus*, *Paracirrhites arcatus*, *Parupeneus insularis*, *Parupeneus multifasciatus*, *Plagiotremus tapeinosoma*, *Pomacanthus imperator*, *Pomacentrus vaiuli*, *Pomachromis guamensis*, *Ptereleotris zebra*, *Rhinecanthus rectangulus*, *Scarus psittacus*, *Spratelloides delicatulus*, *Segastes fasciolatus*, *Sufflamen bursa*, *Sufflamen chrysopteryum*, *Thalassoma amblycephalum*, *Thalassoma quinquevittatum*, *Valenciennea strigata*, *Zebrasoma flavescens*

**Fish Swim:** *Acanthurus nigricans*, *Acanthurus xanthopterus*, *Balistapus undulatus*, *Canthigaster solandri*, *Carcharhinus melanopterus*, *Chaetodon citrinellus*, *Chaetodon ephippium*, *Coris gaimard*, *Ctenochaetus cyanocheilus*, *Epibulus insidiator*, *Forcipiger longirostris*, *Halichoeres ornatisimus*, *Heniochus chryostomus*, *Katsuwonus pelamis*, *Macropharyngodon meleagris*, *Malacanthus latovittatus*, *Neocirrhites armatus*, *Plectrogyphidodon phoenixensis*, *Scarus forsteni*, *Scarus gibbon*, *Scarus oviceps*, *Scarus rubroviolaceus*, *Siphamia* sp., *Stethojulis strigiventer*, *Variola louti*, *Zanclus cornutus*

OVERALL SCORE: LOW

## 78 - Sailigai Point, Rota

Sailigai Point is named for Sailigai, which is Chamorro name for the Goldspot seabream (*Gnathodentex aureolineatus*). These fish are commonly observed at this site. This is one of the few sites where a green sea turtle was observed during the fish surveys. This site is assessed as having the lowest resilience potential relative to the other 77 fore reef sites surveyed. This site has high temperature variability but has low or medium-low scores for all other resilience indicators. Roughly 50% of the benthic community is made up by macroalgae. Roughly 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. Sailigai Point is a secondary target for conservation efforts because it is a low resilience site that is outside established marine protected areas. The primary targets are the high resilience sites outside established marine protected areas (see p. 1 for example). The resilience indicators suggest this site is among the least likely to resist and recover as disturbance frequencies increase under climate change.

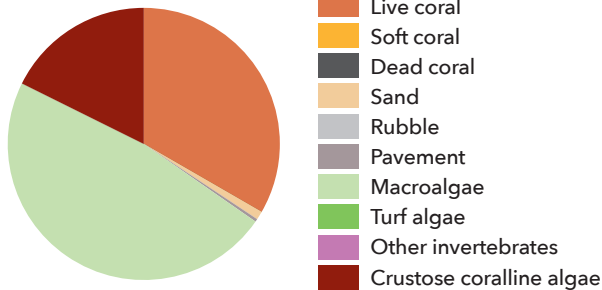


ISLAND SCORE: LOW

Analysis	Rank	Resilience Score	Macroalgae Cover	Bleaching Resistance	Coral Recruitment	Coral Diversity	Temperature Variability	Herbivore Biomass	Accessibility (wave exposure)	LBSP
Inter-Island	<b>78/78</b>	0.62	0.34	0.59	0.00	0.89	0.92	0.10	0.30	0.19
Intra-Island	<b>24/24</b>	0.56	0.00	0.59	0.00	0.89	1.00	0.18	0.30	0.67

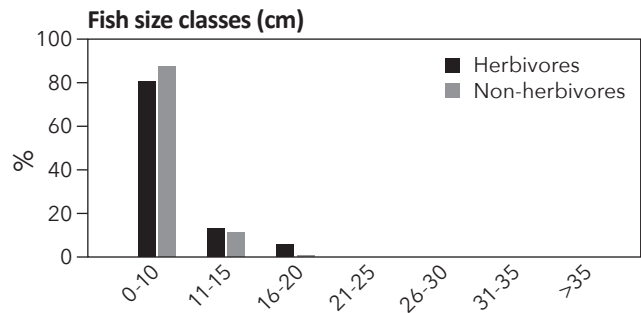
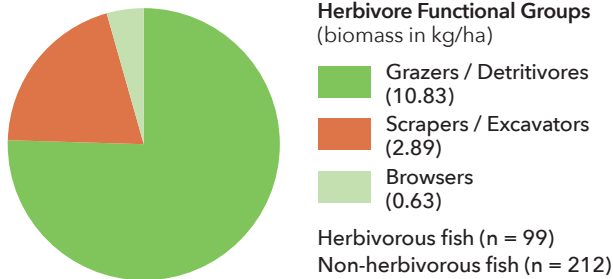
● Low (<avg - 1 SD)  
 ● Med-Low (<avg and >avg - 1 SD)  
 ● Med-High (>avg and <avg - 1 SD)  
 ● High (>avg + 1 SD)  
 ● Low  
 ● Med-High  
 ● Med-Low  
 ● High

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Astreopora listeri*, *Astreopora myriophthalma*, *Favia danae*, *Favia favaus*, *Favia matthaii*, *Goniastrea retiformis*, *Goniopora minor*, *Heliopora coerulea*, *Montastrea valenciennesi*, *Pavona varians*, *Platygyra daedalea*, *Platygyra pini*, *Pocillopora verrucosa*, *Porites c.f. densa (grl)*, *Porites deformis*, *Porites vaughani*

**Coral Swim:** *Acanthastrea echinata*, *Acropora gemmifera*, *Acropora quelchi*, *Acropora tenuis*, *Acropora verweyi*, *Cyphastrea chalcidicum*, *Favites abdita*, *Fungia scutaria*, *Galaxea fascicularis*, *Hydnophora microconos*, *Pocillopora ankei*, *Pocillopora elegans*, *Pocillopora eydouxi*, *Porites lichen*, *Porites lobata*, *Porites lutea*, *Stylophora mordax*

**Fish SPCs:** *Acanthurus nigrofuscus*, *Acanthurus olivaceus*, *Acanthurus* sp., *Apogon angustatus*, *Cephalopholis urodeta*, *Chaetodon auriga*, *Chaetodon citrinellus*, *Chaetodon ornatissimus*, *Chlorurus sordidus*, *Chromis margaritifer*, *Chrysiptera brownriggii*, *Cirrhitichthys falco*, *Coris gaimard*, *Ctenochaetus striatus*, *Forcipiger longirostris*, *Halichoeres biocellatus*, *Halichoeres hortulanus*, *Halichoeres ornatissimus*, *Labroides dimidiatus*, *Melichthys vidua*, *Naso lituratus*, *Paracirrhites arcatus*, *Paracirrhites forsteri*, *Plagiotremus tapeinosoma*, *Plectroglyphidodon johnstonianus*, *Pomacanthus imperator*, *Pomachromis guamensis*, *Rhinecanthus rectangulus*, *Scarus psittacus*, *Stegastes fasciolatus*, *Sufflamen bursa*, *Sufflamen chrysopterum*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Zanclus cornutus*

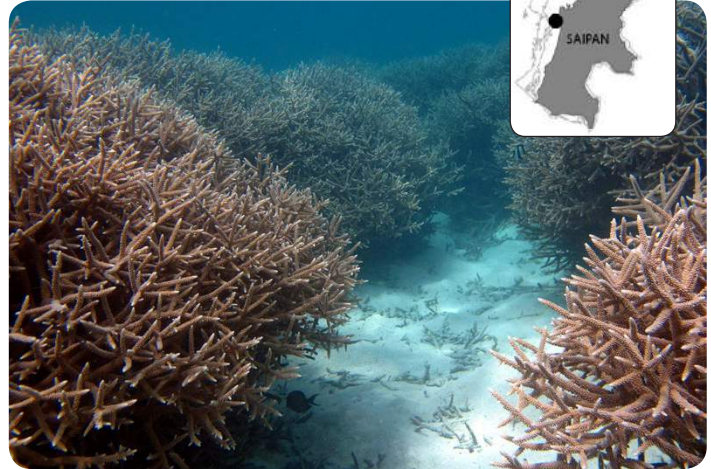
**Fish Swim:** *Acanthurus triostegus*, *Centropyge flavissima*, *Chaetodon bennetti*, *Chaetodon lunula*, *Chaetodon quadrimaculatus*, *Chaetodon ulietensis*, *Cheilinus trilobatus*, *Chelonia* sp., *Chromis acares*, *Coris aygula*, *Lethrinus obsoletus*, *Macropharyngodon meleagris*, *Monotaxis grandoculis*, *Neocirrhites armatus*, *Novaculichthys taeniourus*, *Oxycheilinus digrammus*, *Paracanthurus hepatus*, *Parupeneus multifasciatus*, *Scarus rubroviolaceus*

OVERALL SCORE: LOW

# 79 - Fishing Base Staghorn\_MMT, Saipan



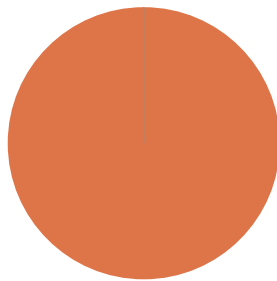
Fishing Base Staghorn is near the Fishing Base Boat Ramp, which is one of four small boat launching areas for accessing the Saipan Lagoon. This site, just a few hundred yards from the pier onshore, contains one of Saipan's largest stands of staghorn *Acropora*. The reef extends well over 500 meters and is a preferred spot for juvenile Napoleon Wrasse (*Cheilinus undulatus*). Uniquely, the benthic community at this site consisted of 100% coral cover (all staghorn *Acropora*) at the time of surveys. This site is highly bleaching susceptible given branching *Acropora* species are among the most susceptible of all coral types to thermal bleaching. There are bleaching reports from this site in 2013 so the benthic community is likely to have changed since these surveys were conducted in May/June of 2012. Greater than 75% of the total herbivorous fish biomass is comprised of scrapers/excavators. This site has high fishing access (given the adjacent boat ramp) and also has high values for LBSP.



Analysis	Accessibility (wave exposure)	LBSP
Inter-Island	0.77	1.00

- Low (<avg - 1 SD)
- Med-High (>avg and <avg - 1 SD)
- Med-Low (<avg and >avg - 1 SD)
- High (>avg + 1 SD)

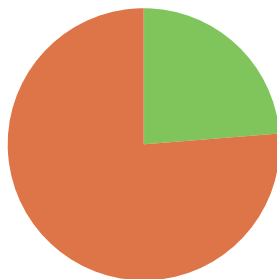
## Benthic community



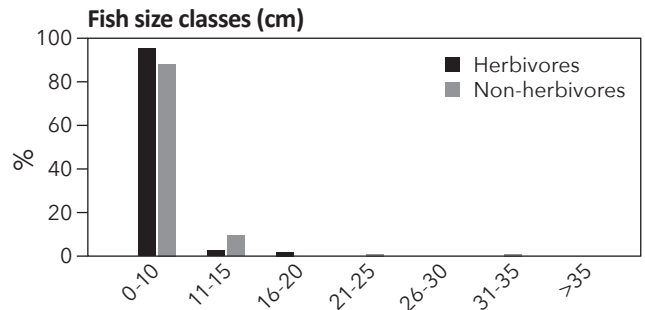
- Live coral
- Soft coral
- Dead coral
- Sand
- Rubble
- Pavement
- Macroalgae
- Turf algae
- Other invertebrates
- Crustose coralline algae

Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



- Herbivore Functional Groups (biomass in kg/ha)**
- Grazers / Detritivores (3.08)
  - Scrapers / Excavators (9.90)
  - Browsers (0)
- Herbivorous fish (n = 196)  
Non-herbivorous fish (n = 94)



**Coral Quads:** *Acropora aspera*, *Acropora muricata*

**Coral Swim:** *Goniastrea retiformis*, *Heliopora coerulea*

**Fish SPCs:** *Acanthurus blochii*, *Arothron nigropunctatus*, *Aulostomus chinensis*, *Chaetodon auriga*, *Chaetodon ephippium*, *Chaetodon lunula*, *Chaetodon lunulatus*, *Chaetodon melanotus*, *Chaetodon punctatofasciatus*, *Chlorurus sordidus*, *Ctenochaetus striatus*, *Halichoeres trimaculatus*, *Hemigymnus melapterus*, *Heniochus chrysostomus*, *Hyporhamphus Species*, *Labrid sp.*, *Myripristis violacea*, *Neoniphon argenteus*, *Neoniphon opercularis*, *Oxyrrhites typus*, *Parupeneus barberinus*, *Scarus psittacus*, *Scolopsis lineata*, *Stethojulis bandanensis*, *Stethojulis strigiventer*, *Thalassoma Hardwicke*, *Zanclus cornutus*, *Zebрасoma flavescens*, *Zebрасoma velifer*

## 80 - Marianas Resort\_MMT, Saipan

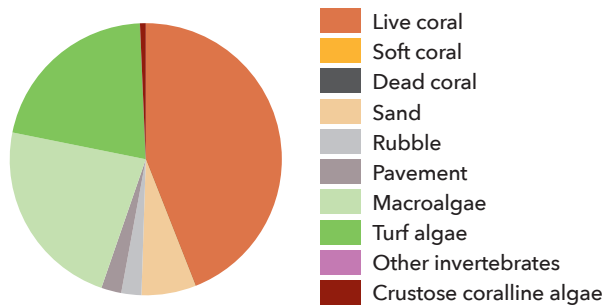
Marianas Resort is named for the adjacent Marianas Resort Hotel & Spa, which opened on Saipan nearly 40 years ago. This site lies near a secluded little beach where guests and residents can snorkel or kayak over to the reef, which is home to stands of staghorn *Acropora* species. Tawny nurse sharks (*Nebrius ferrugineus*) can often be seen at this site. Nearly 50% of the benthic community is made up by live coral with most of the remainder split between turfing algae and macroalgae. There are bleaching reports from this site in 2013 so the benthic community is likely to have changed since these surveys were conducted in May/June of 2012. Greater than 75% of the total herbivorous fish biomass is comprised of scrapers/excavators. This site has the highest scores possible for both fishing access and LBSP.



Analysis	Accessibility (wave exposure)	LBSP
Inter-Island	1.00	1.00

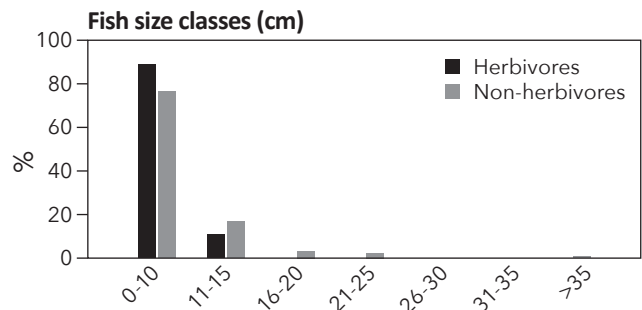
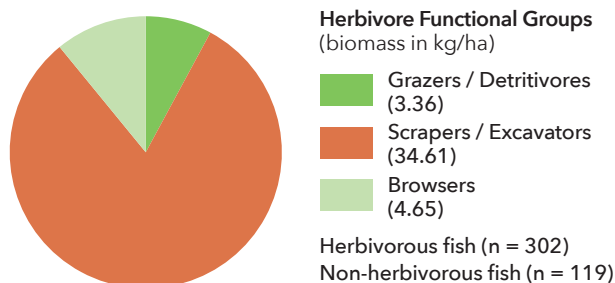
- Low (<avg - 1 SD)
- Med-High (>avg and <avg - 1 SD)
- Med-Low (<avg and >avg - 1 SD)
- High (>avg + 1 SD)

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



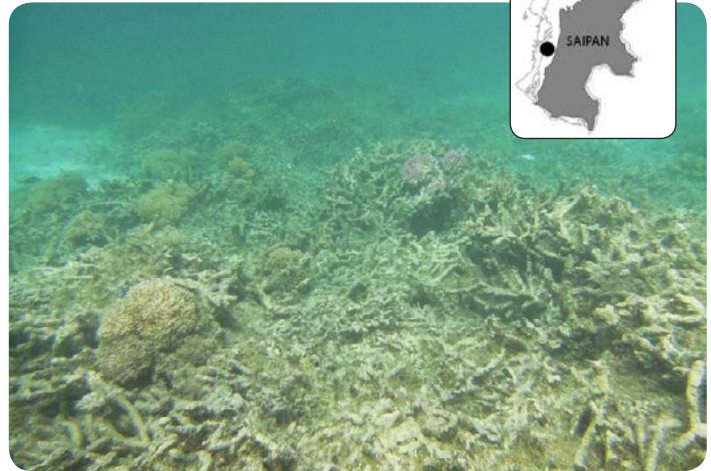
**Coral Quads:** *Goniastrea retiformis*, *Pavona divaricata*, *Pocillopora damicornis*, *Pocillopora juv.*, *Porites lobata*, *Porites lutea*

**Coral Swim:** *Platygyra pini*, *Psammocora stellata*

**Fish SPCs:** *Arothron nigropunctatus*, *Carcharhinus melanopterus*, *Centropyge flavissima*, *Chaetodon auriga*, *Chaetodon lunula*, *Chaetodon melanotus*, *Cheilinus trilobatus*, *Cheilio inermis*, *Chlorurus sordidus*, *Ctenochaetus striatus*, *Gomphosus varius*, *Halichoeres hortulanus*, *Halichoeres trimaculatus*, *Hemigymnus melapterus*, *Lethrinus harak*, *Myripristis sp.*, *Naso lituratus*, *Naso unicornis*, *Neoniphon samara*, *Rhinecanthus rectangulus*, *Scarus psittacus*, *Scolopsis lineata*, *Siganus spinus*, *Stethojulis bandanensis*, *Thalassoma Hardwicke*, *Thalassoma lutescens*, *Thalassoma quinquevittatum*, *Zebbrasoma flavescens*

# 81 - Oleai Staghorn\_MMT, Saipan

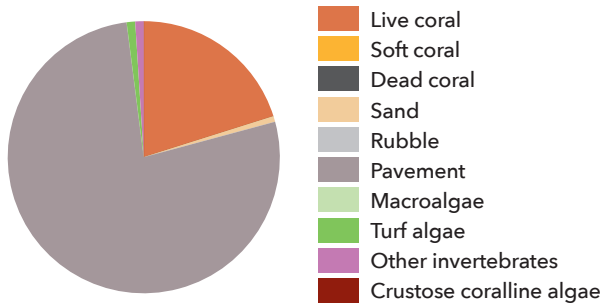
Oleai Staghorn is named for a village established on the southern part of Saipan known as Oleai. Residents of the Micronesian atoll Woleai moved to Saipan and established this village after a typhoon devastated their home. The staghorn *Acropora* reef that forms this site is just offshore from the village and is a prime fishing ground for parrotfish and wrasses. Roughly 20% of the benthic community is live coral and nearly all of the remainder is bare pavement. There are bleaching reports from this site in 2013 so the benthic community is likely to have changed since these surveys were conducted in May/June of 2012. Roughly 75% of the herbivorous fish community is comprised of scrapers/excavators. This site has high scores for both LBSP and fishing access.



Analysis	Accessibility (wave exposure)	LBSP
Inter-Island	0.75	1.00

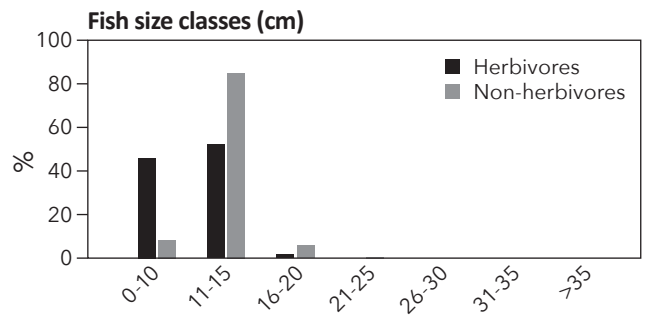
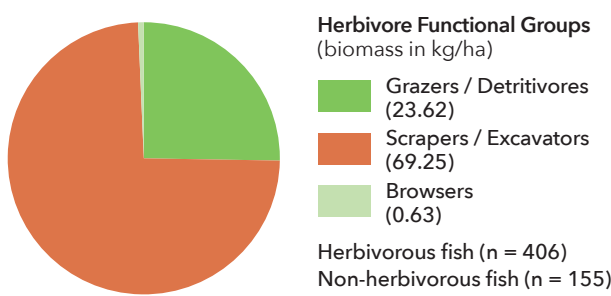
- Low (<avg - 1 SD)
- Med-High (>avg and <avg - 1 SD)
- Med-Low (<avg and >avg - 1 SD)
- High (>avg + 1 SD)

## Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

## Fish community



**Coral Quads:** *Acropora aspera*, *Favia favus*, *Goniastrea retiformis*, *Leptastrea purpurea*, *Pocillopora damicornis*, *Stylocoeniella armata*

**Coral Swim:** *Favia speciosa*, *Favites abdita*, *Favites russelli*, *Lobophyllia hemprichii*, *Montipora hoffmeisteri*, *Pavona varians*, *Platygyra pini*, *Porites rus*

**Fish SPCs:** *Abudefduf sexfasciatus*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus triostegus*, *Chaetodon bennetti*, *Chaetodon ephippium*, *Chaetodon lunula*, *Chaetodon lunulatus*, *Cheilinus trilobatus*, *Chlorurus sordidus*, *Ctenochaetus striatus*, *Epibulus insidiator*, *Fistularia commersonii*, *Halichoeres trimaculatus*, *Hemigymnus fasciatus*, *Hemigymnus melapterus*, *Lutjanus kasmira*, *Myripristis sp.*, *Myripristis violacea*, *Naso lituratus*, *Neoniphon opercularis*, *Neoniphon samara*, *Oxyrrhites typus*, *Scarus psittacus*, *Scolopsis lineata*, *Siganus spinus*, *Stethojulis bandanensis*, *Stethojulis strigiventer*, *Thalassoma Hardwicke*, *Zanclus cornutus*, *Zebrasoma flavescens*, *Zebrasoma velifer*

## 82 - Pak Pak Beach\_MMT, Saipan

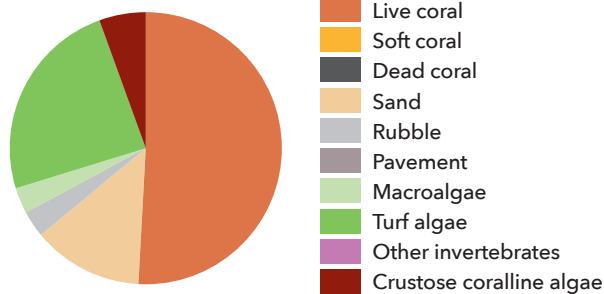
Pak Pak Beach\_MMT is named for Pak Pak Beach, which is the southernmost beach of the Saipan Lagoon. *Pak Pak* is Chamorro for “popping sound”. One theory as to how the beach received its name is due to the popping noises that would be made as the US military would dump scrap metal and waste off of the cliffs just south of this beach. This site is one of the long-term monitoring sites of the Marine Monitoring Team of CNMI BECQ. Nearly 50% of the benthic community is made up by live coral. There are bleaching reports from this site in 2013 so the benthic community is likely to have changed since these surveys were conducted in May/June of 2012. Greater than 75% of the total herbivorous fish biomass is comprised of grazers/detritivores. This site has high scores for both LBSP and fishing access.



Analysis	Accessibility (wave exposure)	LBSP
Inter-Island	0.68	1.00

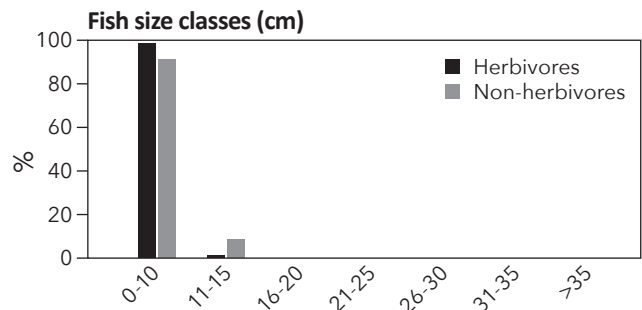
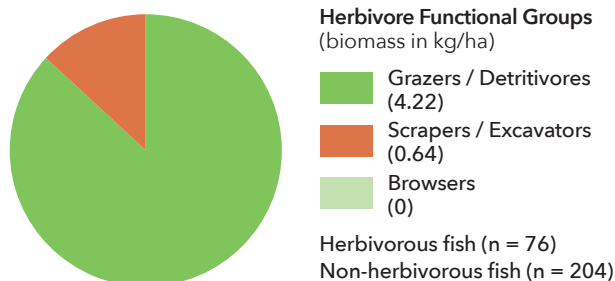
- Low (<avg - 1 SD)
- Med-High (>avg and <avg - 1 SD)
- Med-Low (<avg and >avg - 1 SD)
- High (>avg + 1 SD)

### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



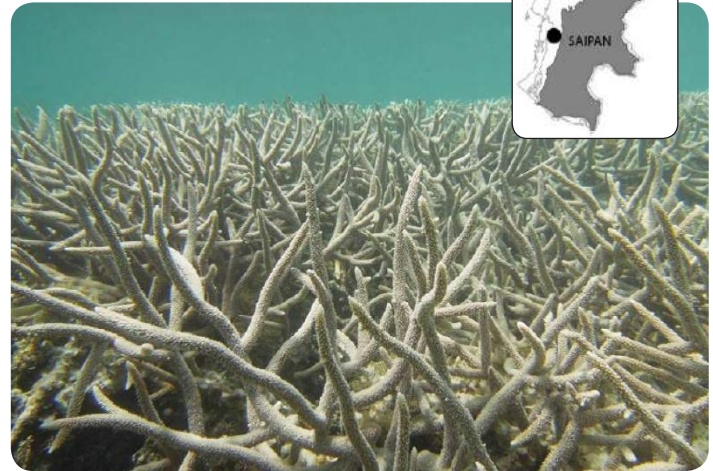
**Coral Quads:** *Acanthastrea echinata*, *Acropora aspera*, *Acropora monticulosa*, *Acropora pulchra*, *Acropora tenuis*, *Acropora vaughani*, *Cyphastrea* sp. 1, *Favites russelli*, *Goniastrea edwardsi*, *Goniastrea retiformis*, *Heliopora coerulea*, *Hydnophora microconos*, *Leptoria Phrygia*, *Montipora nodosa*, *Pavona divaricata*, *Pocillopora damicornis*, *Porites lutea*, *Stylocoeniella armata*, *Stylophora mordax*

**Coral Swim:** *Astropora myriophthalma*, *Favia matthaii*, *Favites abdita*, *Fungia scutaria*, *Leptastrea purpurea*, *Pavona varians*, *Platygyra pini*, *Porites lobata*, *Porites rus*, *Porites vaughani*, *Psammacora digitata*

**Fish SPCs:** *Abudefduf septemfasciatus*, *Abudefduf sexfasciatus*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus triostegus*, *Canthigaster solandri*, *Chaetodon auriga*, *Chaetodon citrinellus*, *Chaetodon ephippium*, *Chaetodon lunula*, *Chaetodon lunulatus*, *Chaetodon melanotus*, *Cheilinus chlorourus*, *Cheilinus trilobatus*, *Cheilinus inermis*, *Chlorurus sordidus*, *Ctenochaetus striatus*, *Gomphosus varius*, *Halichoeres trimaculatus*, *Hemigymmus melapterus*, *Heniochus chrysostomus*, *Myripristis kuntee*, *Myripristis* sp., *Myripristis vittata*, *Naso lituratus*, *Neoniphon argenteus*, *Oxycirrhites typus*, *Sargocentron microstoma*, *Scarus psittacus*, *Siganus spinus*, *Stethojulis bandanensis*, *Stethojulis strigiventer*, *Thalassoma Hardwicke*, *Zebbrasoma flavescens*

## 83 - Quartermaster Staghorn\_MMT, Saipan

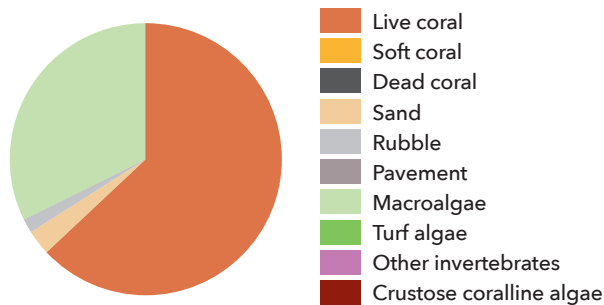
Quartermaster Staghorn is named for Quartermaster Road, which is a short secondary road that connects the two main roads of Saipan, Beach Road and Chalan Pale Arnold. An old American M4 Sherman Tank from World War II is on display where Quartermaster and Beach Road meet. This is a well known landmark on the island and is used to help identify the location of this staghorn *Acropora* reef. Roughly 60% of the benthic community is made up by live coral. There are bleaching reports from this site in 2013 so the benthic community is likely to have changed since these surveys were conducted in May/June of 2012. Greater than 75% of the total herbivorous fish biomass is comprised of scrapers/excavators. This site has high scores for both LBSP and fishing access.



Analysis	Accessibility (wave exposure)	LBSP
Inter-Island	0.84	1.00

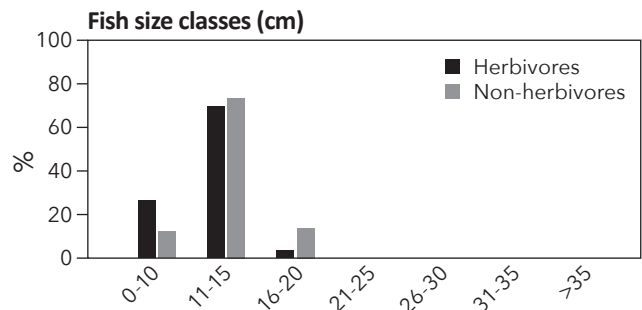
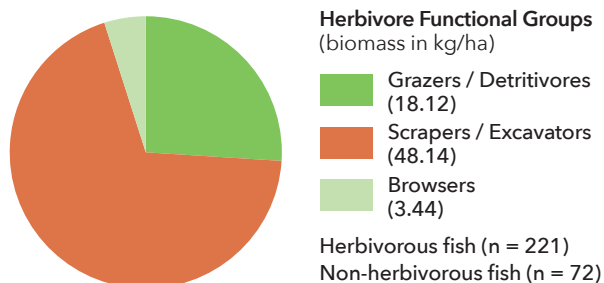


### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE**.

### Fish community



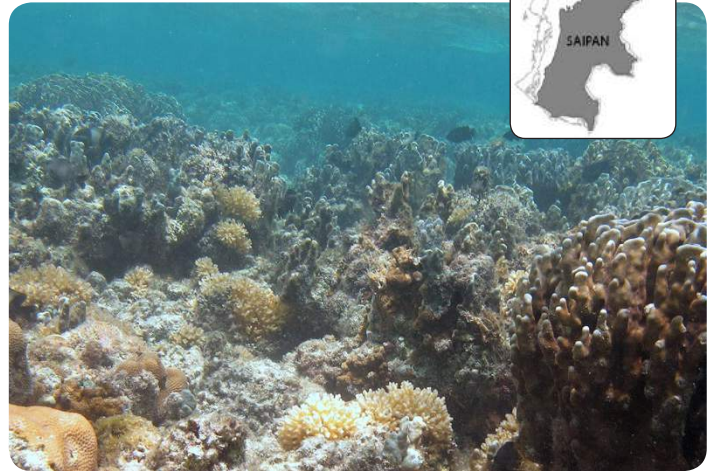
**Coral Quads:** *Acropora aspera*, *Favia favaus*, *Favia matthaii*, *Goniastrea retiformis*, *Leptastrea purpurea*

**Coral Swim:** *Acropora azurea*, *Acropora tenuis*, *Astreopora myriophthalma*, *Favites abdita*, *Isopora palifera*, *Leptastrea transversa*, *Lobophyllia corymbosa*, *Montipora hoffmeisteri*, *Platygyra daedalea*, *Platygyra pini*, *Pocillopora damicornis*, *Porites cylindrical*, *Porites lobata*, *Porites rus*

**Fish SPCs:** *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Acanthurus triostegus*, *Canthigaster solandri*, *Chaetodon melanotus*, *Chaetodon miliaris*, *Chaetodon ornatissimus*, *Cheilinus chlorourus*, *Cheilinus trilobatus*, *Chlorurus sordidus*, *Ctenochaetus striatus*, *Epibulus insidiator*, *Gomphosus varius*, *Halichoeres trimaculatus*, *Hemigymnus melapterus*, *Heniochus chrysostomus*, *Labroides dimidiatus*, *Leptoscarus vaigiensis*, *Mulloidichthys flavolineatus*, *Myripristis violacea*, *Naso lituratus*, *Neoniphon opercularis*, *Oxyrrhites typus*, *Parupeneus barberinus*, *Scarus psittacus*, *Scolopsis lineata*, *Siganus spinus*, *Stethojulis bandanensis*, *Thalassoma Hardwicke*, *Zanclus cornutus*, *Zebrasoma flavescens*, *Zebrasoma velifer*

## 84 - Tanapag Staghorn\_MMT, Saipan

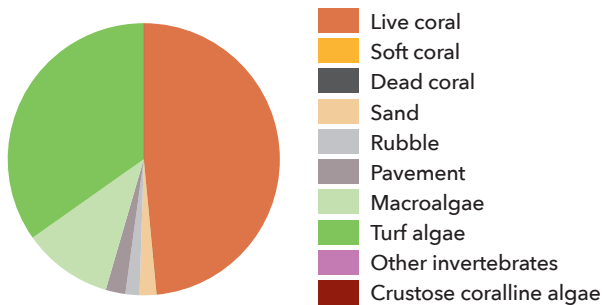
Tanapag Staghorn is named for a village in the north of Saipan called Tanapag: In the early 19th century, the Refaluwasch people migrated from their home atolls (Satawal and Woleai) after a typhoon devastated their islands. They landed on Guam and received permission from the Spanish governor to settle recently vacated Saipan. The residents of Stawal settled to the north of Saipan, in the village now called Tanapag. Roughly 50% of the benthic community is made up by live coral. Roughly 70% of the total herbivorous fish biomass is comprised of grazers/detritivores with the remainder equally split between scrapers/excavators and browsers. There are bleaching reports from this site in 2013 so the benthic community is likely to have changed since these surveys were conducted in May/June of 2012. This site has high scores for both LBSP and fishing access.



Analysis	Accessibility (wave exposure)	LBSP
Inter-Island	0.79	1.00

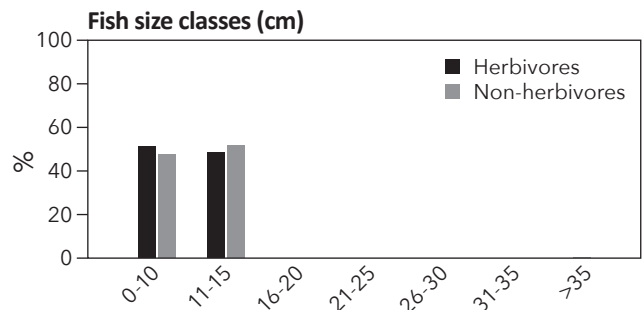
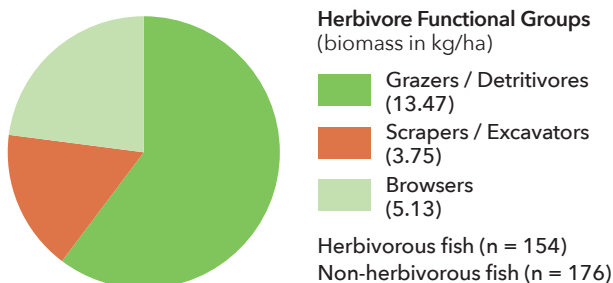


### Benthic community



Observed coral species listed under the NMFS ESA listing of 2014: **NONE.**

### Fish community



**Coral Quads:** *Acanthastrea brevis*, *Acropora aspera*, *Acropora cuneata*, *Acropora surculosa*, *Fungia scutaria*, *Goniastrea retiformis*, *Heliopora coerulea*, *Isopora palifera*, *Montipora hoffmeisteri*, *Montipora monasteriata*, *Montipora nodosa*, *Pavona cactus*, *Pavona divaricata*, *Pocillopora damicornis*, *Stylocoeniella armata*

**Coral Swim:** *Acropora gemmifera*, *Acropora humilis*, *Acropora tenuis*, *Favia matthaii*, *Galaxea fascicularis*, *Leptoria Phrygia*, *Lobophyllia hemprichii*, *Pavona varians*

**Fish SPCs:** *Abudefduf sexfasciatus*, *Acanthurus lineatus*, *Acanthurus nigricans*, *Acanthurus nigrofuscus*, *Amphiprion chrysopterus*, *Canthigaster solandri*, *Chaetodon auriga*, *Chaetodon ephippium*, *Chaetodon lunula*, *Chaetodon melannotus*, *Chaetodon ulietensis*, *Chaetodon unimaculatus*, *Chlorurus sordidus*, *Ctenochaetus striatus*, *Gymnothorax undulatus*, *Halichoeres trimaculatus*, *Hemigymnus melapterus*, *Heniochus chrysostomus*, *Labrid sp.*, *Labroides dimidiatus*, *Myripristis kuntee*, *Myripristis sp.*, *Myripristis violacea*, *Naso lituratus*, *Neoniphon argenteus*, *Oxycirrhites typus*, *Sargocentron caudimaculatum*, *Scarus ghobban*, *Scarus psittacus*, *Siganus spinus*, *Stethojulis bandanensis*, *Stethojulis strigiventer*, *Thalassoma Hardwicke*, *Zanclus cornutus*, *Zebrasoma flavescens*





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