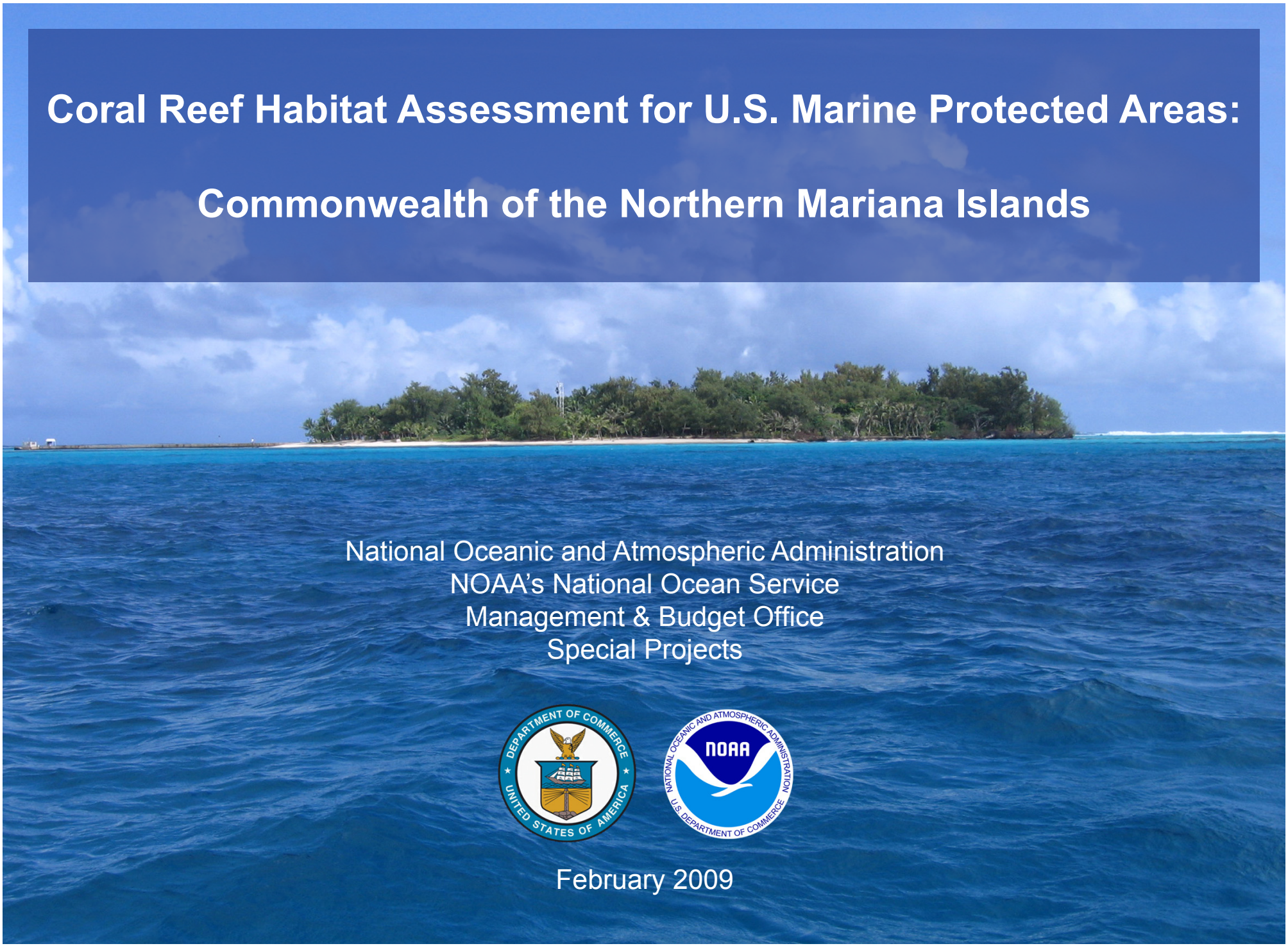
Coral Reef Habitat Assessment for U.S. Marine Protected Areas:

Commonwealth of the Northern Mariana Islands



National Oceanic and Atmospheric Administration
NOAA's National Ocean Service
Management & Budget Office
Special Projects

February 2009

Project Overview

About this Effort

The United States Coral Reef Task Force (USCRTF), in both its National Action Plan to Conserve Coral Reefs (2000) and its National Coral Reef Action Strategy (2002), established a key conservation objective of protecting at least 20% of U.S. coral reefs and associated habitat types in no-take marine reserves. NOAA's Coral Reef Conservation Program has been supporting efforts to assess current protection levels of coral reefs within Marine Protected Areas (MPAs) and quantify the area of U.S. coral reef ecosystems protected in no-take reserves. The official federal definition of an MPA, signed into law by Executive Order 13158, is "any area of the marine environment that has been reserved by federal, state, tribal, territorial, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." A significant source of information for these assessments has been the National MPA Center's Inventory of Marine Managed Areas (MMAs) in the U.S (2006a)[1]. This report provides a preliminary assessment of the areal extent of coral reef habitat and associated habitat types within MPAs, as well as the level of protection afforded them, by using GIS-based MPA boundaries from the MMA Inventory–MPA Classification System (2006a,b), and U.S. Coral Jurisdiction benthic habitat data developed by NOAA's National Centers for Coastal Ocean Science Biogeography Team (2005).

More information on the state and territory sites included in this assessment, including their goals and objectives and how they are established and managed is available in the NOAA Coral Reef Conservation Program Technical Memorandum, *Report on the Status of Marine Protected Areas in Coral Reef Ecosystems of the United States: Volume 1 Marine Protected Areas Managed by U.S. States, Territories and Commonwealths* (Wusinich-Mendez, D and C. Trappe. 2007). This document (pdf, 5.26 MB) is available for download at http://www.coralreef.noaa.gov/Library/Publications/cr%5Fmpa%5Freport%5Fvol%5F1.pdf.

1 Data for the MMA Inventory were collected by many individuals from a variety of sources. As a result, the content and level of detail of the overview text may vary from site to site.

NCCOS Habitat Mapping Effort

The National Oceanic and Atmospheric Administration (NOAA) National Ocean Service (NOS) initiated a coral reef research program in 1999 to map, assess, inventory, and monitor U.S. coral reef ecosystems (Monaco et al. 2001). These activities were implemented in response to requirements outlined in the Mapping Implementation Plan developed by the Mapping and Information Synthesis Working Group (MISWG) of the Coral Reef Task Force (CRTF) (MISWG 1999). NOS's National Centers for Coastal Ocean Science (NCCOS) Biogeography Team was charged with the development and implementation of a plan to produce comprehensive digital coral-reef ecosystem maps for all U.S. States, Territories, and Commonwealths within five to seven years. In response to Executive Order 13089 and the Coral Reef Conservation Act of 2000, NOS is conducting research to digitally map biotic resources and coordinate a long-term monitoring program that can detect and predict change in U.S. coral reefs and their associated habitats and biological communities (Monaco et al. 2001).

Acknowledgments

CNMI / Department of Land and Natural Resource / Division of Fish and Wildlife

NOAA / Coral Reef Conservation Program
NOAA / NOS / Special Projects
NOAA / NOS / NCCOS / Biogeography Team
NOAA / NOS / Ocean and Coastal Resource Management
NOAA / NOS / National Marine Protected Areas Center

Contents

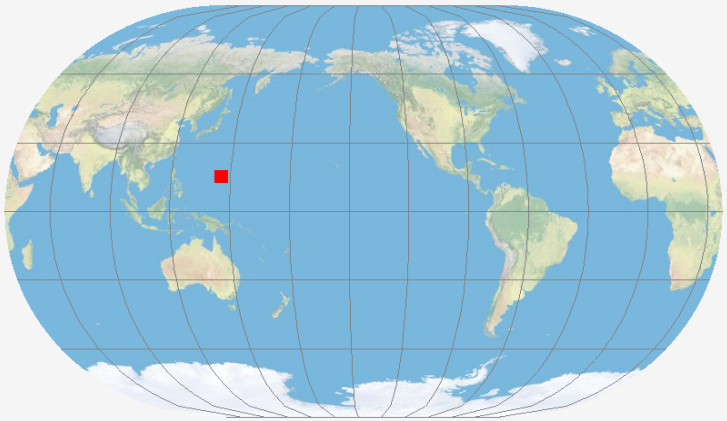
Commonwealth of the Northern Mariana Islands: Locations of MPAs

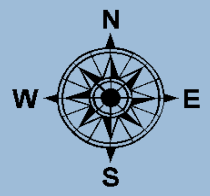
Commonwealth MPA

Island of Saipan

0 12.5 25 50 Kilometers

Global Extent





Island of Rota

Note: MPA numbers correspond to list in table of contents.

Commonwealth of the Northern Mariana Islands

Introduction

The Commonwealth of the Northern Mariana Islands (CNMI) is part of the 290-km long Mariana Islands Archipelago which encompasses the 14 islands of the CNMI, numerous offshore banks, and the U.S. Territory of Guam. The southern-most islands of the CNMI (Rota, Tinian, and Saipan) are volcanic in origin and are chiefly covered with uplifted limestone derived from coral reef. These islands have the oldest and most developed reefs in the CNMI (predominantly located along the western/leeward sides) and are also where the majority of CNMI residents live (Moretti, 2007). Currently there are eight MPAs established in the commonwealth (see map on page 1) with four sites designated as No-take MPAs (Appendix B)[1]. No-take MPAs allow human access and even some potentially harmful uses, but totally prohibit the extraction or significant destruction of natural or cultural resources. In the fall of 2007, after this assessment was completed, a new MPA was established in CNMI on the island of Tinian. This new MPA is not yet named, but will be geographically bound by the high-tide mark on shore to one-half mile out to sea between Southwest Carolinas Point and Puntan Diablo Point.

The table below shows the total area of each biological benthic cover type: 1) for all of CNMI, 2) for all MPAs in CNMI, and 3) for only No-take MPAs in CNMI. The percentages of the mapped benthic habitat within CNMI's MPAs and CNMI's No-take MPAs are also listed. Approximately 6% of the 162 square kilometers of mapped coral reef ecosystem (defined below) in CNMI is within MPAs and 3% is within No-take MPAs. To view the totals for each individual site, see Appendix C.

1 In this report, "No-take" MPAs are MPAs that have one of the following "Levels of Protection" under the U.S. MPA Classification System: 1) No Take, 2) No Impact, 3) No Access, or 4) Zoned Multiple-Use With No-Take Area(s). Out of 12 'Zoned Multiple-Use With No-Take Areas' in the U.S. Coral Jurisdictions only 4 had delineated No-take zones and thus were the only sites from this category to be included in the "No-take" calculations: East End Marine Park (VI), Kealakekua Bay MLCD (HI), Lapakahi MLCD (HI), and Molokini Shoal MLCD (HI).

Cover Types and Characterization

Coral	Substrates colonized by live reef building corals and other organisms. Habitats within this category have at least 10% live coral cover.
Coralline Algae	An area with 10% or greater coverage of any combination of numerous species of encrusting or coralline algae. May occur along reef crest, in shallow back reef, relatively shallow waters on the bank/shelf zone, and at depth.
Emergent Vegetation	Composed primarily of red mangrove and hau trees. Generally found in areas sheltered from high-energy waves, such as shoreline/intertidal or reef flat zones.
Macroalgae	Substrates with 10% or greater coverage of any combination of numerous species of red, green, or brown macroalgae. Usually occurs in shallow backreef and deeper waters on the bank/shelf zone.
Seagrass	Habitat with 10% or more of seagrass.
Turf	A community of low lying species of marine algae composed of any or a combination of algal divisions dominated by filamentous species lacking upright fleshy macroalgal thali.
Unclassified	Areas differentiated from other biological cover types because the major geomorphological structure is primarily terrestrial or artificially created (i.e., artificial).
Uncolonized	Substrates not covered with a minimum of 10% of any of the above biological cover types. This habitat is usually on sand or mud structures. Overall uncolonized cover is estimated at 90%-100% of the bottom.
Unknown	Cover uninterpretable due to turbidity, cloud cover, water depth, etc.

Benthic Cover Type	Total Mapped Benthic Habitat (km^2)	Total Mapped within All MPAs (km^2)	Percent of Mapped Area within all MPAs	Total Mapped within No-take MPAs (km^2)	Percent of Mapped Area within No-take MPAs
Coral	72.432	6.352	8.77%	3.964	5.47%
Coralline Algae	31.614	1.144	3.62%	0.504	1.59%
Emergent Vegetation	0.000	0.000	0.00%	0.000	0.00%
Macroalgae	19.825	1.090	5.50%	0.203	1.02%
Seagrass	6.711	0.009	0.13%	0.000	0.00%
Turf	31.768	0.873	2.75%	0.838	2.64%
Unclassified	475.536	0.098	0.02%	0.098	0.02%
Uncolonized	42.948	3.776	8.79%	3.408	7.94%
Unknown	955.205	1.027	0.11%	0.891	0.09%
Coral Reef Ecosystem*	162.350	9.468	5.83%	5.509	3.39%

* Coral Reef Ecosystem is defined as mapped coral, coralline algae, emergent vegetation, macroalgae, seagrass, and turf.

Commonwealth of the Northern Mariana Islands

Methods

The Coral Reef Habitat Assessment for the Commonwealth of the Northern Mariana Islands (CNMI) was conducted between August 2005 and August 2007 through the following actions:

1. *Created a Coral Jurisdiction MPA GIS Database utilizing the U.S. Marine Managed Areas Inventory*

   The Marine Managed Areas (MMA) Inventory contains information on more than 1,500 sites, and is the only such comprehensive dataset in the nation. The term "marine managed area," which was defined through a public comment process, generally refers broadly to an area of the marine environment with a marine resource conservation purpose. The MMA Inventory data collection is a joint collaboration between the National Oceanic and Atmospheric Administration (NOAA) and the Department of the Interior that began in 2001. Its purpose is to gather and make publicly available comprehensive information on place-based marine conservation efforts under U.S. federal, state, territorial, local, and tribal jurisdiction. For more information on the MMA Inventory, visit http://www.mpa.gov/helpful_resources/inventory.html.

2. *Identified which MPAs are No-Take Reserves utilizing the MPA Classification System*

   The National Marine Protected Areas Center has developed a Classification System that provides agencies and stakeholders with a straightforward means to describe MPAs in purely functional terms using five objective characteristics common to most MPAs:

   Conservation Focus – legally established goals, conservation objectives and intended purpose(s).
   Level of Protection – level and type of legal protections afforded to the site's natural and cultural resources and ecological processes.
   Permanence of Protection – length of time protections remain in effect.
   Constancy of Protection – year-round, seasonal or rotating.
   Ecological Scale of Protection – range from entire ecosystems and their associated biophysical processes, to focal habitats, species, or other resources deemed to be of economic or ecological importance.

   For most MPAs in the U.S. and elsewhere, these five functional characteristics provide an accurate picture of why the site was established, what it is intended to protect, how it achieves that protection, and how it may affect local ecosystems and local human uses.

3. *Used GIS software to identify area of spatial overlap between benthic habitat data and Coral Jurisdiction MPA boundaries*

   The National Oceanic and Atmospheric Administration (NOAA) National Ocean Service (NOS) initiated a coral reef research program in 1999 to map, assess, inventory, and monitor U.S. coral reef ecosystems (Monaco et al. 2001). These activities were implemented in response to requirements outlined in the Mapping Implementation Plan developed by the Mapping and Information Synthesis Working Group (MISWG) of the Coral Reef Task Force (CRTF) (MISWG 1999). NOS's Biogeography Team was charged with the development and implementation of a plan to produce comprehensive digital coral-reef ecosystem maps for all U.S. States, Territories, and Commonwealths within five to seven years. In response to Executive Order 13089 and the Coral Reef Conservation Act of 2000, NOS is conducting research to digitally map biotic resources and coordinate a long-term monitoring program that can detect and predict change in U.S. coral reefs and their associated habitats and biological communities. For more information on benthic habitat data produced by the NOS Biogeography Team, visit http://ccma.nos.noaa.gov/about/biogeography/proj_theme.html.

4. *Calculated areal extent of benthic habitat data within Coral Jurisdiction MPA GIS boundaries*

   The areal extent of benthic habitat data within MPAs was calculated in the Eckert IV WGS84 projection, using the polygon area calculation operation in XTools Pro 3.2.0 extension for ArcMap™ 9.1 GIS software.

Bird Island Sanctuary

Management Agency: CNMI Division Fish & Wildlife

Overview

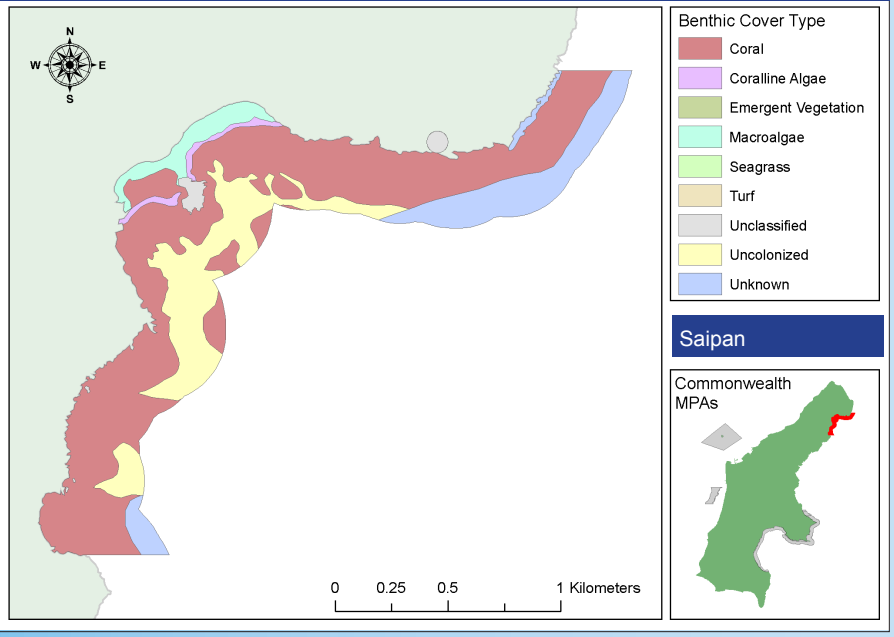
Located on the northeastern side of Saipan Island, Bird Island is a near shore limestone island with adjaceent fringing reefs. The island is 1 hectare in size and can be accessed at low tide by walking over the reef flat.

The site was designated as a marine sanctuary for the conservation of wildlife (particularly as a nesting bird sanctuary) and marine life and will serve as a natural laboratory for continued propagation of wildlife and marine species, which gradually and naturally can re-populate depopulated areas. The sanctuary will also provide a laboratory for students, teachers and research groups to study wildlife and marine species.

The area was originally designated by the Division of Fish and Wildlife (DFW) as a sea cucumber sanctuary (see next page). The subsequent public law to designate Bird Island as a nesting bird sanctuary was used to expand sanctuary designation for all marine species.

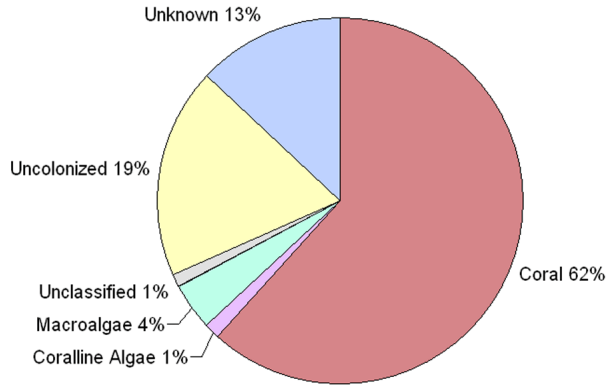
Source of Overview: U.S. Marine Managed Areas Inventory (2006a), NOAA's National Marine Protected Areas Center.

Bird Island Sanctuary



Percent Benthic Cover

This site contains 11.5% of the total area of CNMI's MPAs



Bird Island Sea Cucumber Sanctuary

Management Agency: CNMI Division of Fish & Wildlife

Overview

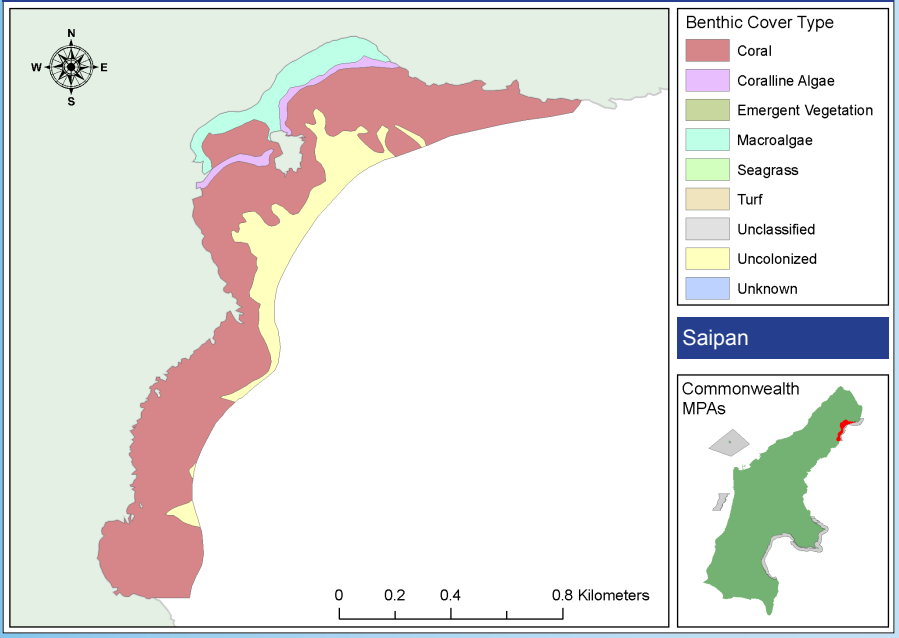
Located on the northeastern side of Saipan Island, Bird Island is a near shore limestone island with adjaceent fringing reefs. The island can be accessed at low tide by walking over the reef flat.

Designated as a species reserve, the area assures continuous high levels of productivity of sea cucumber. The taking or harvest of sea cucumber is prohibited. However, the site has subsequently been overlaid by the no-take Bird Island Sanctuary.

The boundaries of the Bird Island Sea Cucumber Sanctuary were originally determined via export permit condition in response to an incipient sea cucumber fishery on Saipan. The boundaries sought to encompass the entirety of Fañunchuluyan Bay so as to prevent any harvest of sea cucumber.

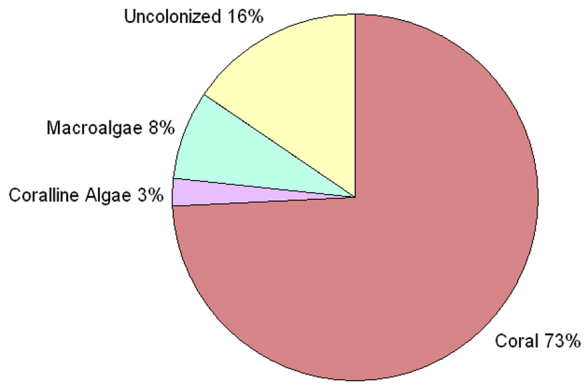
Source of Overview: U.S. Marine Managed Areas Inventory (2006a), NOAA's National Marine Protected Areas Center.

Bird Island Sea Cucumber Sanctuary



Percent Benthic Cover

This site contains 6.2% of the total area of CNMI's MPAs



Forbidden Island Sanctuary

Management Agency: CNMI Division of Fish & Wildlife

Overview

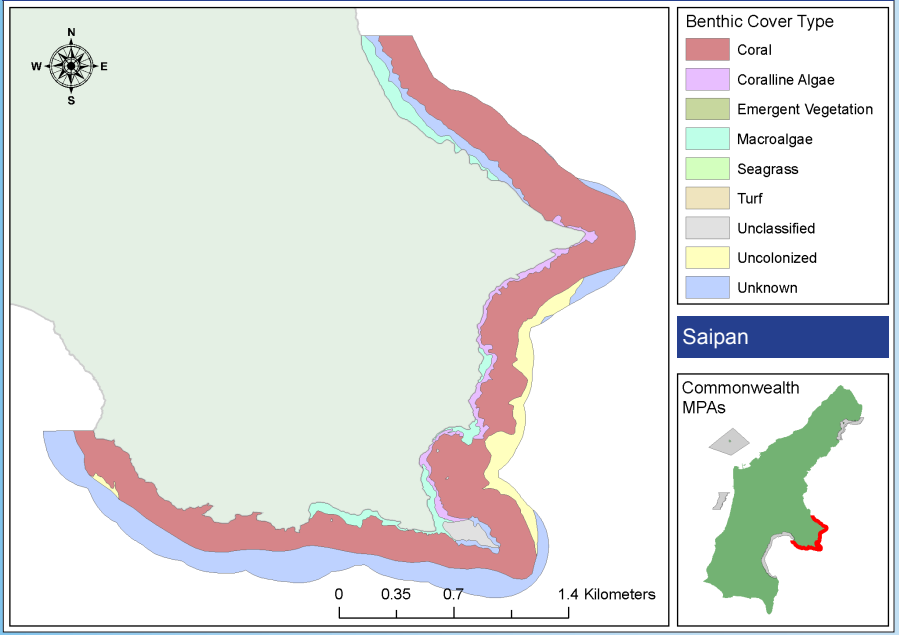
Located on the eastern side of Saipan Island, Forbidden Island is a near shore volcanic island with adjacent fringing reefs. The island is less than 1 hectare in size and can be accessed from the adjacent Kagman Wildlife Conservation Area or from the sea during calm weather.

The primary motivation was to create a nesting bird sanctuary at Forbidden Island, a large rock formation connected to the mainland by a tidally flooded isthmus. Subsequent deliberation and comment by community and government agency personnel extended the public law to include the marine waters not only surrounding the rock formation, but also extending north past Tank Beach (an important turtle nesting ground) and south into Laulau Bay.

The site will serve as a natural laboratory for continued propagation of wildlife and marine species, which gradually and naturally can re-populate depopulated areas. The sanctuary will also provide a laboratory for students, teachers and research groups to study wildlife and marine species.

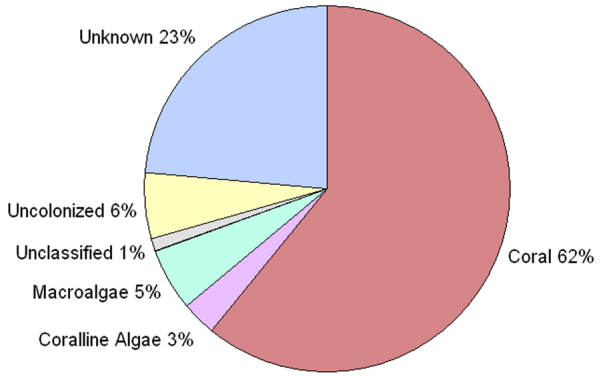
Source of Overview: U.S. Marine Managed Areas Inventory (2006a), NOAA's National Marine Protected Areas Center.

Forbidden Island Sanctuary



Percent Benthic Cover

This site contains 19.8% of the total area of CNMI's MPAs



Laulau Bay Sea Cucumber Sanctuary

Management Agency: CNMI Division of Fish & Wildlife

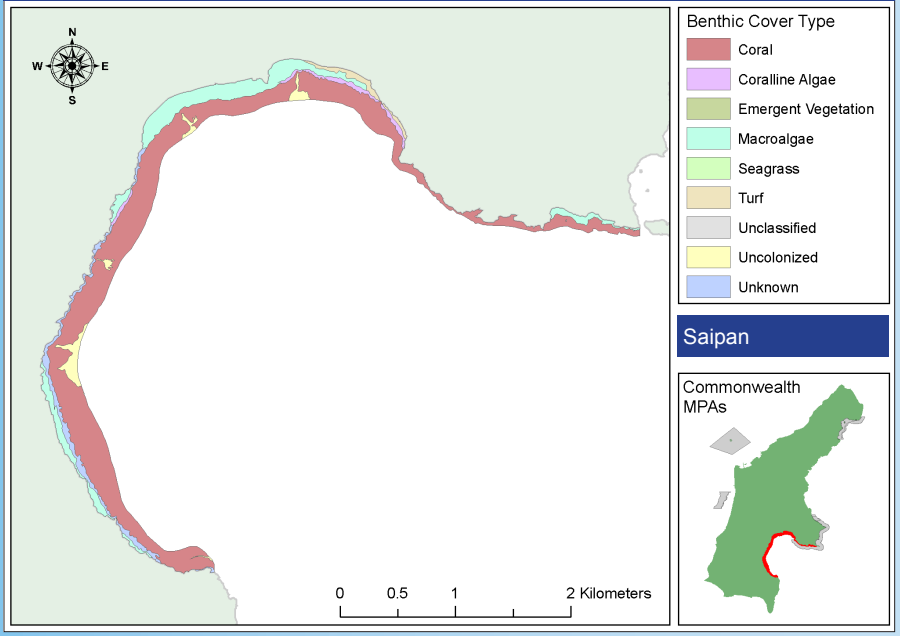
Overview

Laulau Bay is located on the eastern side of Saipan Island. Beginning at Puntan Hakmang and extending south to Puntan Dandan, the area runs from the mean high water mark seaward to the 40 foot depth contour and is partially overlapped by the no-take Forbidden Island Sanctuary at it's eastern-most portion.

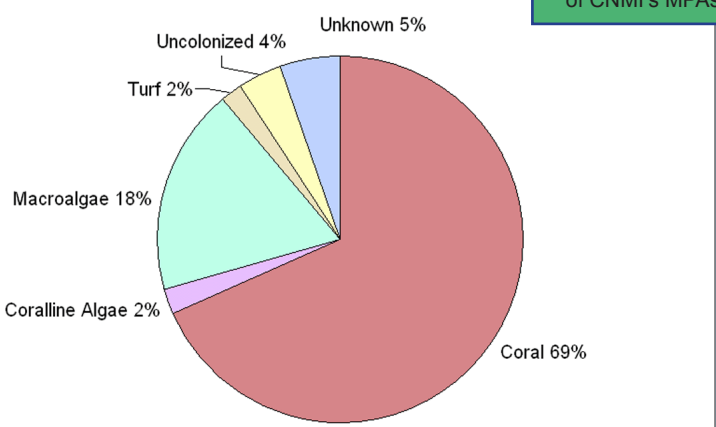
Designated as a species reserve, the area will serve to insure continuous high levels of productivity of sea cucumbers. There is currently a 10-year moratorium that began in 1999 on sea cucumber harvests in all CNMI waters.

Source of Overview: U.S. Marine Managed Areas Inventory (2006a), NOAA's National Marine Protected Areas Center.

Laulau Bay Sea Cucumber Sanctuary



Percent Benthic Cover



This site contains 15.3% of the total area of CNMI's MPAs

Lighthouse Reef Trochus Sanctuary

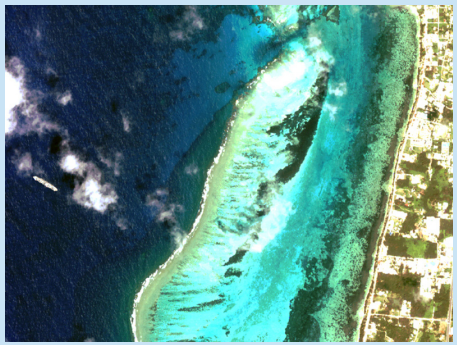
Management Agency: CNMI Division of Fish & Wildlife

Overview

Lighthouse Reef is a barrier reef located on the western side of the Saipan Lagoon. Beginning at the Garapan channel marker (Lighthouse) and extending south for one mile, the area encompasses the barrier reef from the inshore edge of the reef (Saipan Lagoon side) to the offshore side of the reef (seaward) to the 40-foot depth contour.

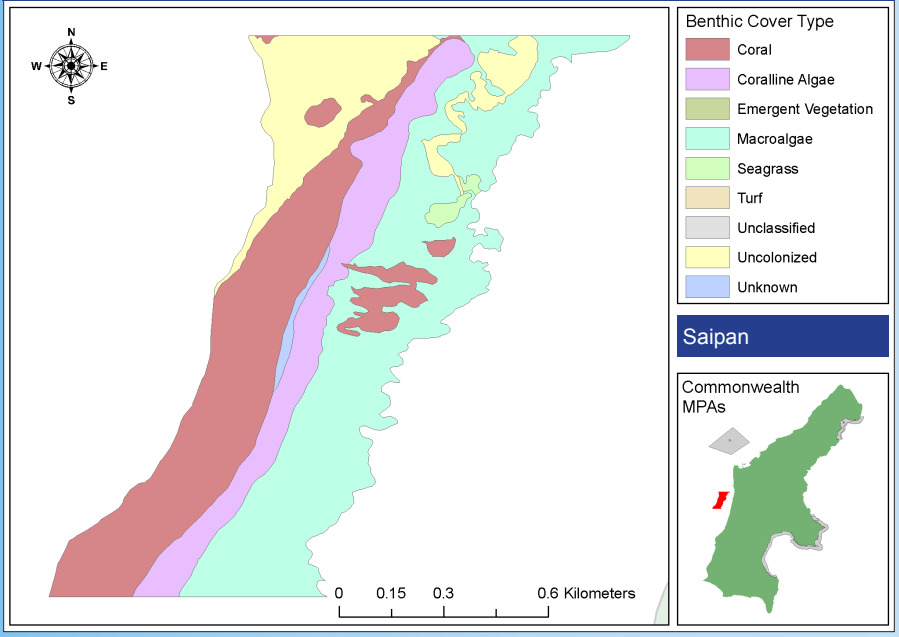
Designated as a species reserve, the area is designed to ensure continuous high levels of productivity of trochus. The taking or harvesting of trochus is prohibited.

Regulations were passed in 1981 that gave the Department of Fish and Wildlife management authority under the CNMI Department of Lands and Natural Resources (DLNR). The regulations contained a moratorium on the harvest of Trochus under the authority of the office of Secretary of the DLNR, which were to be enforced by the DFW. The moratorium regulation allowed for the Trochus season to be opened under permit, set the minimum size limit at 3 inches basal diameter the widest point, and established two no-take Trochus reseves, both on the island of Saipan. One reserve was placed on the east side of the island at Tank Beach, while the other was placed along a mile-long strip of the Saipan Lagoon barrier reef on the west side of the island, referred to as the Lighthouse Reserve.



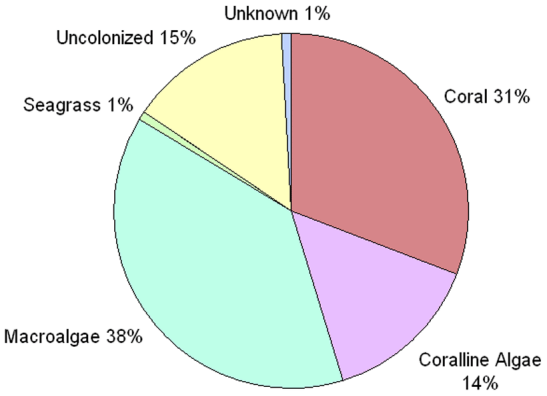
Source of Overview: U.S. Marine Managed Areas Inventory (2006a), NOAA's National Marine Protected Areas Center.

Lighthouse Reef Trochus Sanctuary



Percent Benthic Cover

This site contains 8.7% of the total area of CNMI's MPAs



Mañagaha Marine Conservation Area

Management Agency: CNMI Division of Fish & Wildlife

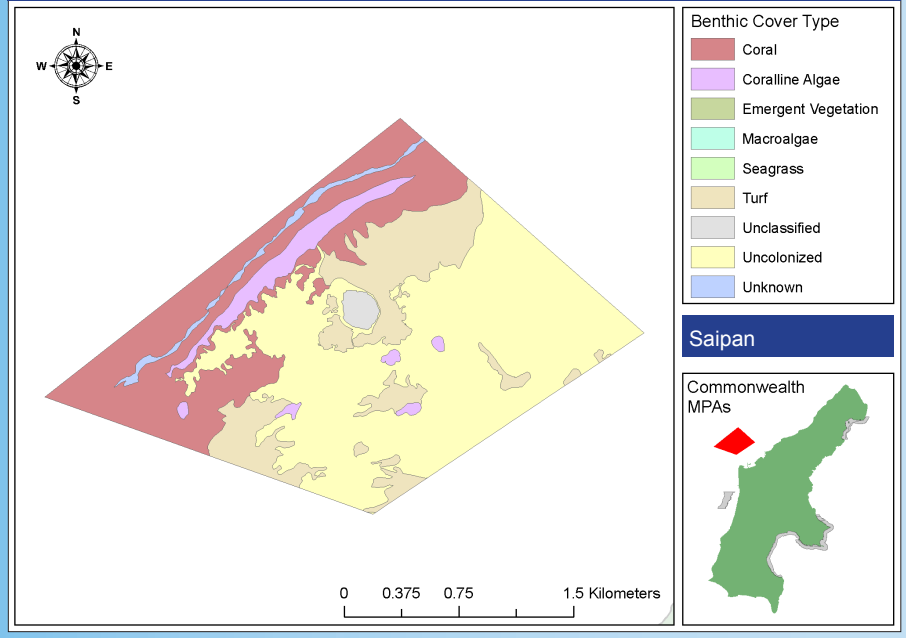
Overview

Located on the western side of Saipan Island and within the Saipan Lagoon, the Isle of Mañagaha is a sand island protected by barrier reef from storm surge and has both sandy shoal bottom and coral reef garden habitat surrounding the Isle.

Designated as a marine conservation area, the Island of Mañagaha is maintained as an uninhabited place and used only for cultural and recreational purposes. The Isle is the burial site of Carolinian Chief Aghirubw where traditional fishing, harvesting of medicinal plants, and conducting the ceremony of Fuirrurow occurred. The Isle and its surrounding waters exist as protected recreational and educational areas, safe habitats fo fish and other marine life to exist and propagate for the continued use and enjoyment of the people. No fishing, harvesting, taking, anchoring, vessel activity, deleterious activity, or human activity is allowed except as permitted by regulation. Aesthetic swimming and beach areas important to tourism are protected as the site is a major tourist attraction with high use by residents and visitors.

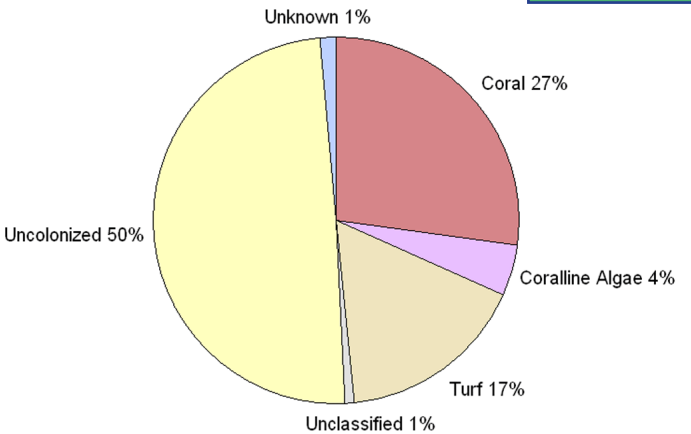
Source of Overview: U.S. Marine Managed Areas Inventory (2006a), NOAA's National Marine Protected Areas Center.

Mañagaha Marine Conservation Area



Percent Benthic Cover

This site contains 39.4% of the total area of CNMI's MPAs



Sasanhaya Bay Fish Reserve

Management Agency: CNMI Division of Fish & Wildlife

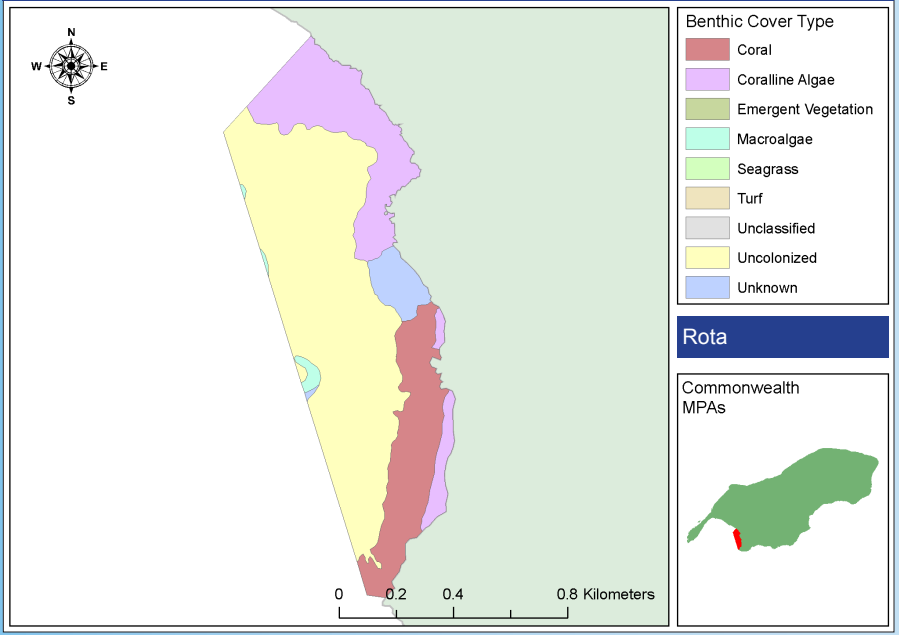
Overview

Sasanhaya Bay Fish Reserve lies between and including Puña Point and Coral Gardens and runs from the mean high tide line seaward 1000 feet. Coral Gardens is one of the most storm-sheltered and luxuriant areas of coral growth in the CNMI.

The site was, designated as a marine reserve to protect fish and aquatic species and their habitat, there is no killing, removing, or taking of any marine animal or plant, including corals (live or dead), lobster, shellfish, clams or octopus is allowed. Shell removal is also prohibited. Any activities that are exploitive or destructive to the marine life and/or World War II wrecks is prohibited.

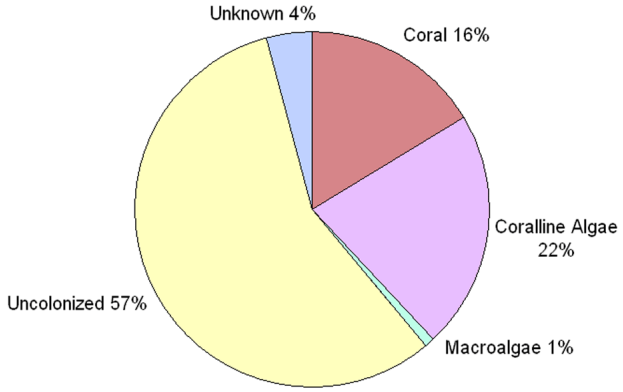
Source of Overview: U.S. Marine Managed Areas Inventory (2006a), NOAA's National Marine Protected Areas Center.

Sasanhaya Bay Fish Reserve



Percent Benthic Cover

This site contains 6.6% of the total area of CNMI's MPAs



Tank Beach Trochus Sanctuary

Management Agency: CNMI Division of Fish & Wildlife

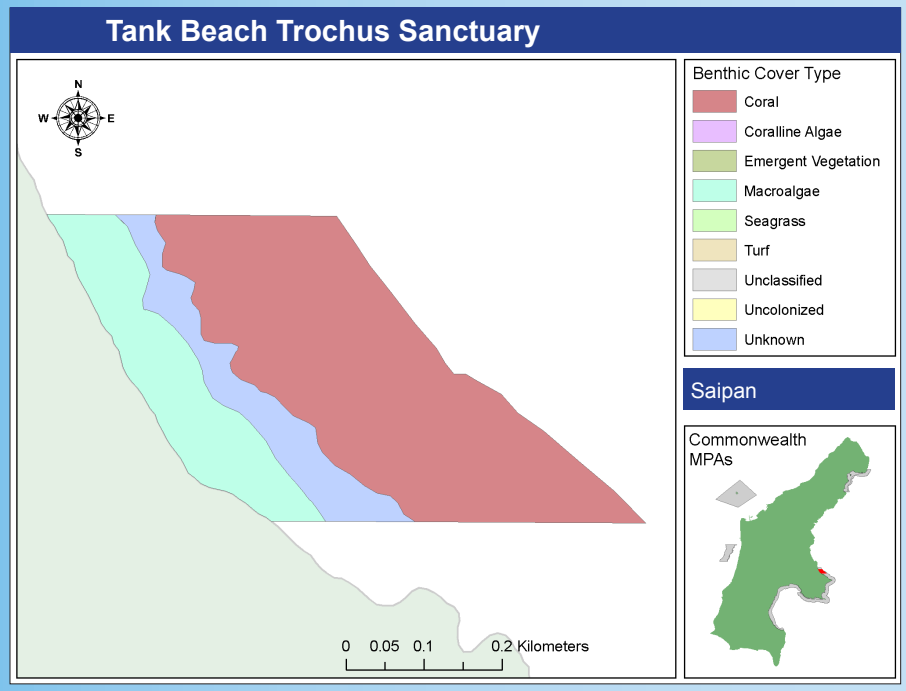
Overview

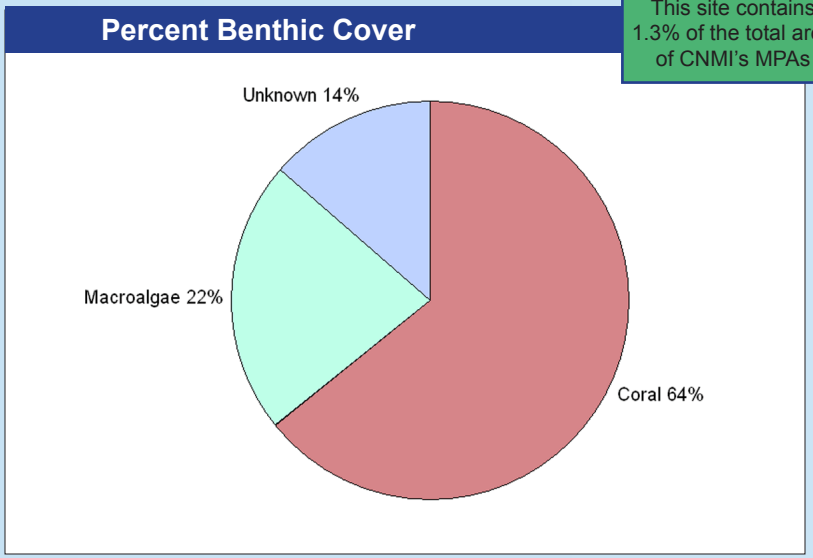
Tank Bay is a crescent shaped bay with fringing reefs and numerous tide pools, located on the eastern side of Saipan Island.

Designated as a species reserve, the area will serve to insure continuous high levels of productivity of trochus. The taking or harvest of trochus is prohibited. However, the site has subsequently been overlaid by the Forbidden Island Sanctuary.

Regulations were passed in 1981 that gave the Department of Fish & Wildlife (DFW) management authority under the CNMI Department of Lands and Natural Resources (DLNR). The regulations contained a moratorium on the harvest of Trochus under the authority of the office of Secretary of the DLNR, which were to be enforced by the DFW. The moratorium regulation allowed for the Trochus season to be opened under permit, set the minimum size limit at 3 inches basal diameter the widest point, and established two no-take Trochus reseves, both on the island of Saipan. One reserve was placed on the east side of the island at Tank Beach, while the other was placed along a mile-long strip of the Saipan Lagoon barrier reef on the west side of the island, referred to as the Lighthouse Reserve.

Source of Overview: U.S. Marine Managed Areas Inventory (2006a), NOAA's National Marine Protected Areas Center.





This site contains 1.3% of the total area of CNMI's MPAs

Appendix A: National MPA Classification System

The National Classification System was developed by the National MPA Center in an effort to develop a "straightforward and consistent language to accurately describe the many types of MPAs occurring in our waters and to understand their effects on ecosystems and the people that use them" (NOAA National MPA Center, 2006b). A full description of the classification system is available at www.mpa.gov. The system describes MPAs in purely functional terms using five objective characteristics common to most MPAs:

1) Conservation Focus – each site was assigned one or more of the following three attributes:
   a. *Natural Heritage* – established and managed to sustain, conserve, restore and understand the biodiversity, populations, communities, habitats, ecosystems, processes and services of an MPA or MPA zone
   b. *Cultural Heritage* – established and managed to protect and under stand submerged cultural resources
   c. *Sustainable Production* – established and managed to support the continued extraction of renewable living resources

2) Level of Protection Afforded – each site was assigned one of the following six attributes:
   a. *Uniform Multiple-Use* – Consistent level of protection and allowable activities throughout the MPA
   b. *Zoned Multiple-Use* – Some extractive activities allowed throughout entire site, but use marine zoning to allocate specific uses to compatible places or times
   c. *Zoned Multiple-Use with No-Take Areas* – Multiple-use MPAs that contain one or more zones where resource extraction is prohibited
   d. *No-Take* – MPA sites that allow human access but prohibit resource extraction throughout the area
   e. *No Impact* – MPAs that allow human access but prohibit all activities that could harm the site's resources or disrupt the service they provide
   f. *No Access* – MPAs that restrict all human access to the area unless specifically permitted for designated special uses

3) Permanence of Protection – each site was assigned one of the following three attributes:
   a. *Permanent* – MPAs whose legal authorities provide protection in perpetuity
   b. *Conditional* – MPAs that have the potential to persist over time but whose legal authority has a finite duration and must be actively renewed
   c. *Temporary* – MPAs that are designed to address relatively short-term conservation and management needs by protecting a specific habitat or species for a finite duration with no expectation or mechanism for renewal

4) Constancy of Protection – each site was assigned one of the following three attributes:
   a. *Year-round* – MPAs that provide constant protection throughout the year
   b. *Seasonal* – MPAs that protected specific habitats and resources during fixed seasons or periods
   c. *Rotating* – MPAs that cycle among a set of fixed geographic areas in order to meet short-term conservation and management goals

5) Ecological Scale of Protection – each site was assigned one of the following two attributes:
   a. *Ecosystem* – MPAs whose legal authorities and management measures are intended to protect all of the components and processes of the ecosystem(s) within its boundaries
   b. *Focal Resource* – MPAs whose legal authorities and management measures specifically target a particular habitat, species complex, or single resource

Appendix B: CNMI MPA Classification

Site Name	Conservation Goal	Level of Protection	Permanence of Protection	Constancy of Protection	Scale of Protection	Management Plan
1. Bird Island Sanctuary	Natural Heritage	No Take	Permanent	Year Round	Ecosystem	In Development
2. Bird Island Sea Cucumber Sanctuary	Sustainable Production	Uniform Multiple Use	Permanent	Year Round	Focal Resource	N/A
3. Forbidden Island Sanctuary	Natural Heritage	No Take	Permanent	Year Round	Ecosystem	In Development
4. Laulau Bay Sea Cucumber Sanctuary	Sustainable Production	Uniform Multiple Use	Permanent	Year Round	Focal Resource	No
5. Lighthouse Reef Trochus Sanctuary	Sustainable Production	Uniform Multiple Use	Permanent	Year Round	Focal Resource	No
6. Mañagaha Marine Conservation Area	Natural Heritage & Cultural Heritage	No Take	Permanent	Year Round	Ecosystem	Yes
7. Sasanhaya Bay Fish Reserve	Natural Heritage & Cultural Heritage	No Take	Permanent	Year Round	Ecosystem	No
8. Tank Beach Trochus Sanctuary	Sustainable Production	Uniform Multiple Use	Permanent	Year Round	Focal Resource	N/A

Appendix C: Benthic Cover (km^2) by Site

	Coral	Coralline Algae	Macroalgae	Seagrass	Turf	Unclassified	Uncolonized	Unknown	Total
1. Bird Island Sanctuary	0.9044	0.0209	0.0607	0.0000	0.0000	0.0203	0.2726	0.1927	1.472
2. Bird Island Sea Cucumber Sanctuary	0.5931	0.0209	0.0607	0.0000	0.0000	0.0000	0.1249	0.0000	0.800
3. Forbidden Island Sanctuary	1.5444	0.0783	0.1352	0.0000	0.0000	0.0295	0.1518	0.5951	2.534
4. Laulau Bay Sea Cucumber Sanctuary	1.3421	0.459	0.3626	0.0000	0.0350	0.0000	0.0767	0.1046	1.967
5. Lighthouse Reef Trochus Sanctuary	0.3426	0.1599	0.4250	0.0085	0.0000	0.0000	0.1657	0.0084	1.110
6. Mañagaha Marine Conservation Area	1.3763	0.2224	0.0000	0.0000	0.8382	0.0481	2.5022	0.0685	5.056
7. Sasanhaya Bay Fish Reserve	0.1384	0.1825	0.0073	0.0000	0.0000	0.0000	0.4818	0.0341	0.844
8. Tank Beach Trochus Sanctuary	0.1104	0.0000	0.0381	0.0000	0.0000	0.0000	0.0000	0.0236	0.172

* Area calculated in Eckert IV, WGS84 using XTools Pro 3.2.0 extension for ArcMap™ 9.1

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