

# Coral Reef Habitat Assessment for U.S. Marine Protected Areas: U.S. Territory of Guam

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



February 2009



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## Project Overview

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### 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)<sup>1</sup>. 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>.

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<sup>1</sup> 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).

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## Acknowledgments

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Guam / Department of Agriculture / Division of Aquatic and Wildlife Resources  
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National Park Service  
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NOAA / NOS / Special Projects  
NOAA / NOS / NCCOS / Biogeography Team  
NOAA / NOS / Ocean and Coastal Resource Management  
NOAA / NOS / National Marine Protected Areas Center  
U.S. Fish & Wildlife Service  
U.S. Navy

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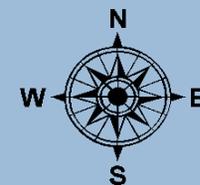
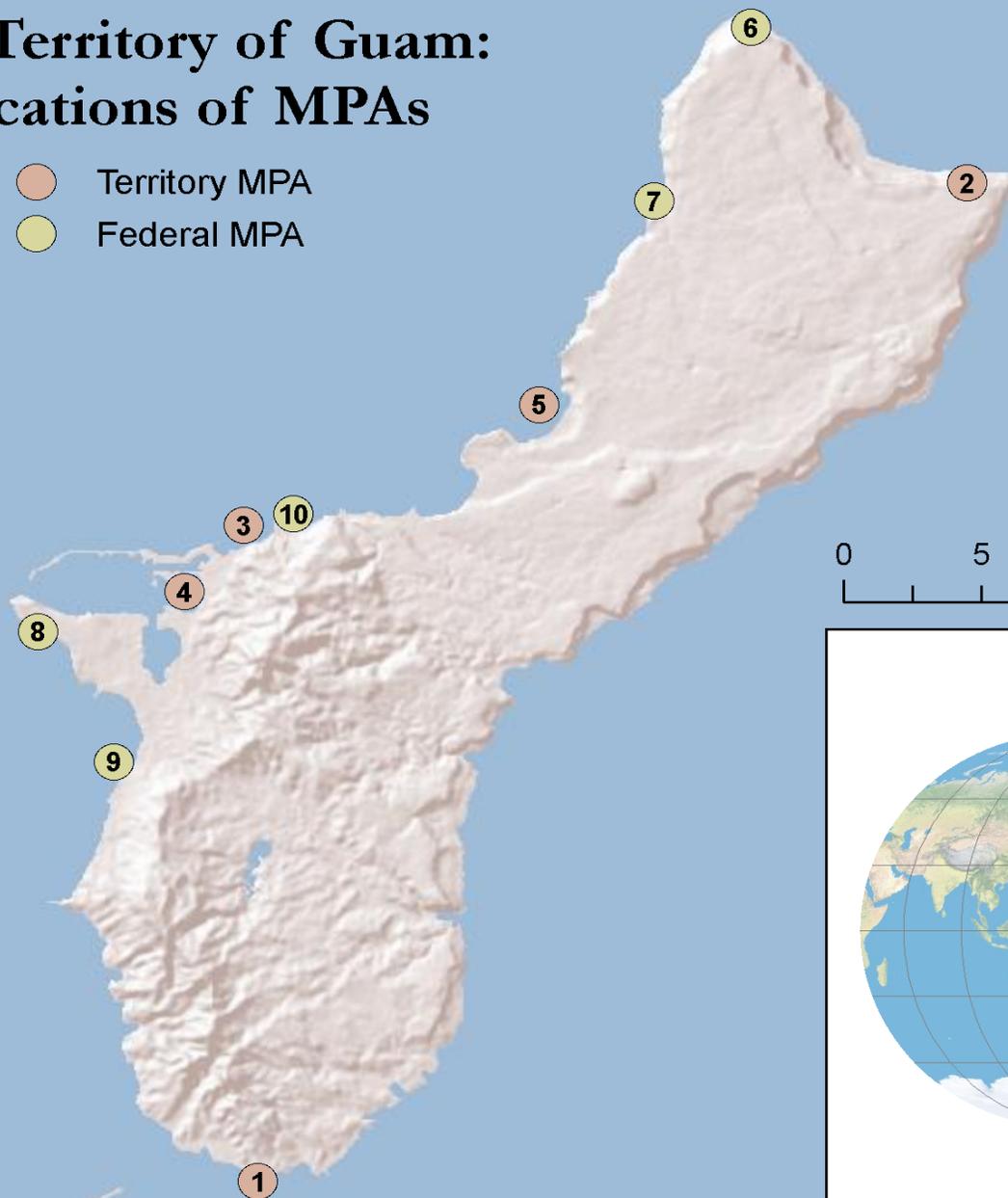
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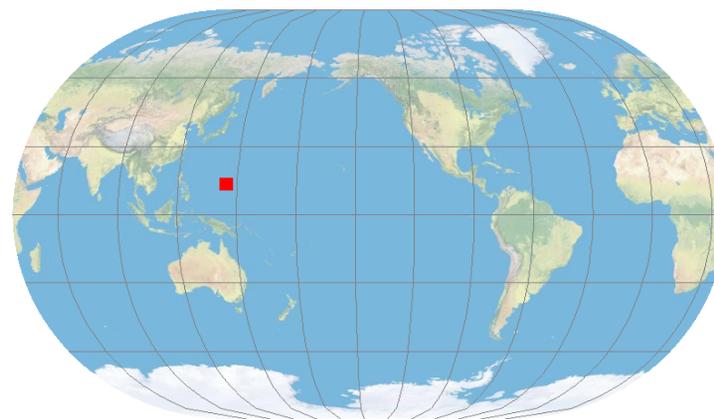
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# U.S. Territory of Guam: Locations of MPAs

-  Territory MPA
-  Federal MPA



*Global Extent*



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

# U.S. Territory of Guam

## Introduction

The U.S Territory of Guam is the southernmost island of the Mariana Archipelago and the largest and most populated island in Micronesia. Guam is surrounded by offshore banks, as well as fringing, patch, submerged, and barrier reefs. Traditionally, fishing on coral reefs had been an important part of local Chamorro culture, and fish were valued as an important food source. While dependence on the fishery has decreased, these resources remain economically and culturally important today (Gombos et al. 2007). Currently there are 10 MPAs established in the territory (see map on page 1) with 1 site designated as a No-take area (Appendix B)<sup>1</sup>. 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.

The table below shows the total area of each biological benthic cover type: 1) for all of Guam, 2) for all MPAs in Guam, and 3) for only No-take MPAs in Guam. The percentages of the mapped benthic habitat within Guam's MPAs and Guam's No-take MPAs are also listed. Approximately 28% of the 76 square kilometers of mapped coral reef ecosystem (defined below) in Guam is within MPAs and 3% is within No-take MPAs. To view the totals for each individual site, see Appendix C.

<sup>1</sup> 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

<i>Coral</i>	Substrates colonized by live reef building corals and other organisms. Habitats within this category have at least 10% live coral cover.
<i>Coralline Algae</i>	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.
<i>Emergent Vegetation</i>	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.
<i>Macroalgae</i>	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.
<i>Seagrass</i>	Habitat with 10% or more of seagrass.
<i>Turf</i>	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.
<i>Unclassified</i>	Areas differentiated from other biological cover types because the major geomorphological structure is primarily terrestrial or artificially created (i.e., artificial).
<i>Uncolonized</i>	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.
<i>Unknown</i>	Cover uninterpretable due to turbidity, cloud cover, water depth, etc.

Benthic Cover Type	Total Mapped Benthic Habitat (km <sup>2</sup> )	Total Mapped within All MPAs (km <sup>2</sup> )	Percent of Mapped Area within all MPAs	Total Mapped within No-take MPAs (km <sup>2</sup> )	Percent of Mapped Area within No-take MPAs
Coral	26.161	5.752	21.99%	0.018	0.07%
Coralline Algae	3.838	1.237	32.23%	0.000	0.00%
Emergent Vegetation	0.206	0.169	82.04%	0.148	71.84%
Macroalgae	16.406	3.937	24.00%	0.136	0.83%
Seagrass	3.729	1.573	42.18%	0.544	14.59%
Turf	25.721	8.360	32.50%	1.205	4.68%
Unclassified	547.360	4.285	0.78%	1.086	0.20%
Uncolonized	29.118	3.964	13.61%	0.000	0.00%
Unknown	308.680	18.534	6.00%	3.137	1.02%
<b>Coral Reef Ecosystem*</b>	<b>76.061</b>	<b>21.028</b>	<b>27.65%</b>	<b>2.051</b>	<b>2.70%</b>

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

# U.S. Territory of Guam

## Methods

The Coral Reef Habitat Assessment for U.S. Marine Protected Areas in Guam 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](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](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.

# Achang Reef Flat Marine Preserve

Management Agency: Guam Department of Agriculture

## Overview

Located in Merizo, the preserve consists of inner and outer reef flats, which are exposed at low tide and separated by a depressed middle-reef flat and a low-tide moat. There are estuarine habitats including mangroves. Sea-grass beds are also present on the site.

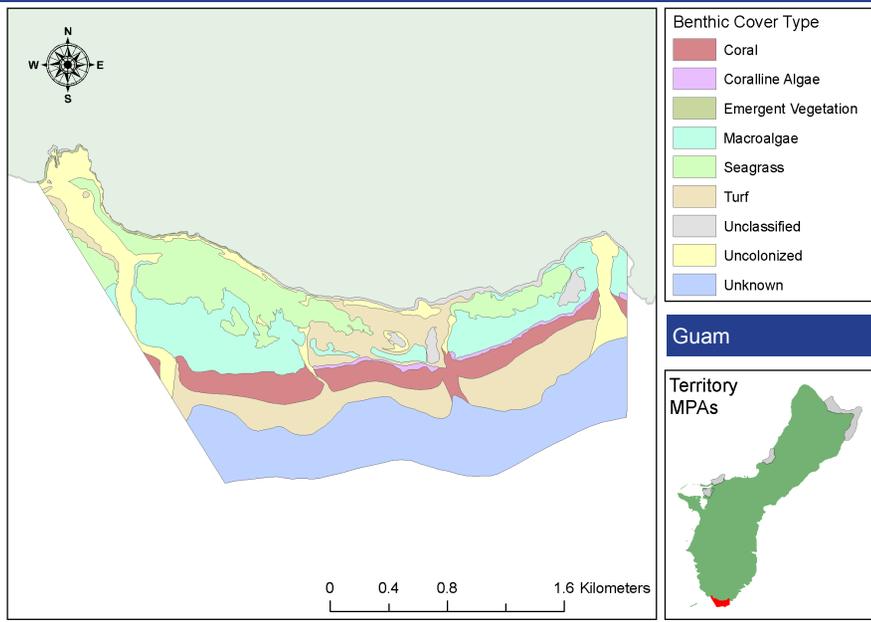
In 1986, the Division of Aquatic and Wildlife Resources determined that fish stocks were beginning to show signs of degradation. Over a 15-year period there had been a 70% decline in harvest and catch per unit effort (CPUE) values. Thus actions were taken to reverse the decline of the coral reef fishery. An evaluation of practical approaches was conducted to identify suitable sites for the establishment of marine preserves. The study looked at 60 sites with the ultimate goal of protecting 10% of the shoreline and adjacent reef. The results of this study were based on criteria that included habitat diversity, species richness, enforceability, cultural practices, and

economic benefit. Five marine preserves were established including Achang Reef Flat.

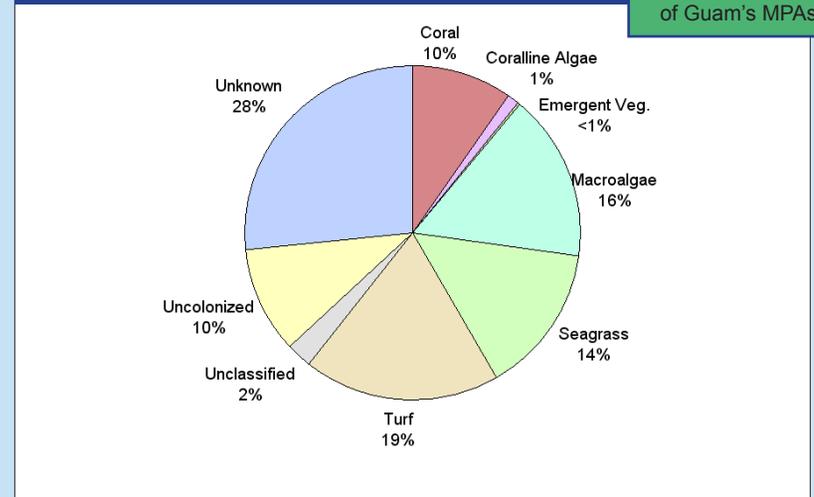
Source of Overview: U.S. Marine Managed Areas Inventory (2006a), NOAA's National Marine Protected Areas Center.



## Achang Reef Flat Marine Preserve



## Percent Benthic Cover



This site contains 10.1% of the total area of Guam's MPAs

# Pati Point Marine Preserve

Management Agency: Guam Department of Agriculture

## Overview

Located on Anderson Airforce Base (AFB), the preserve extends along the perimeter of the AFB property coastline on northeastern Guam. Geomorphology and habitat are diverse with seagrass and shallow- and deep-water coral ecosystems. A well-defined channel is also found within the preserve.

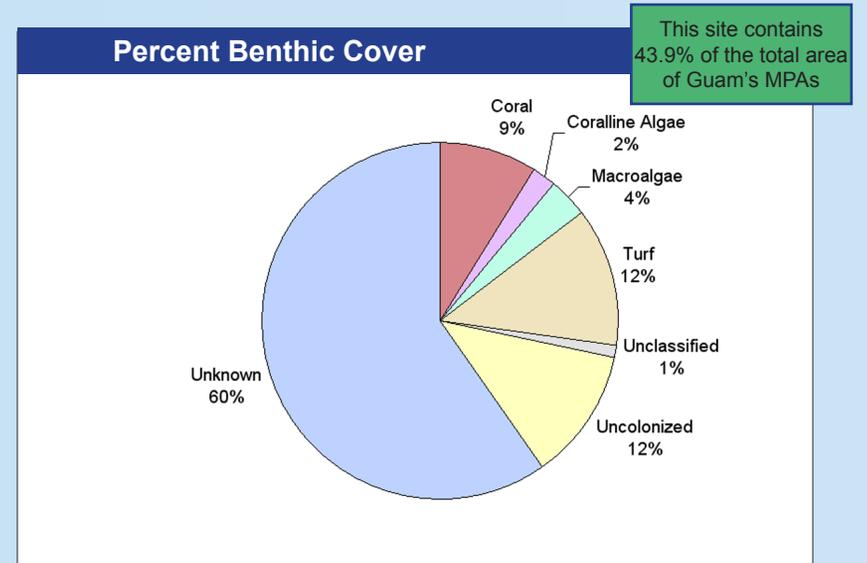
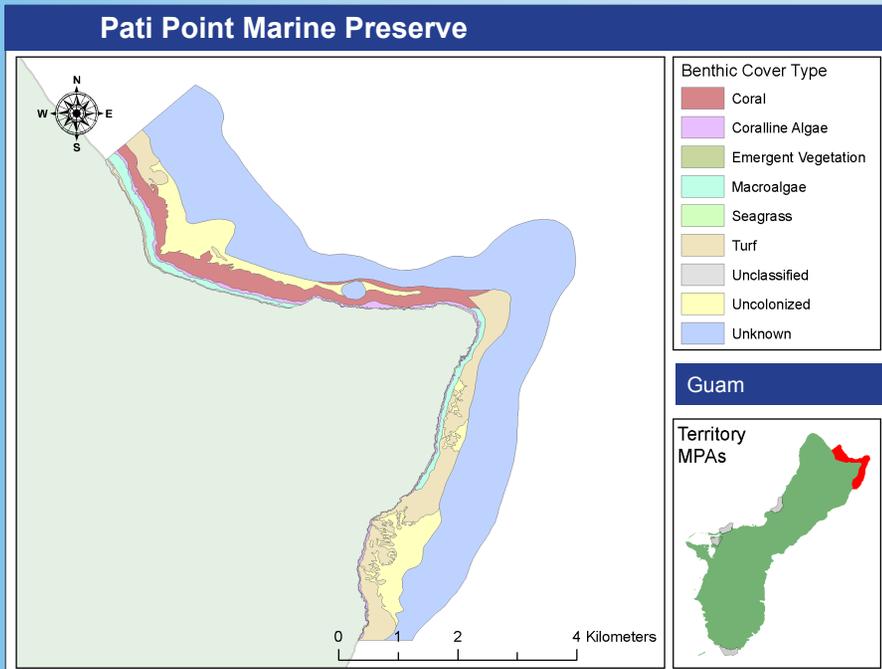
The site contains an impressive number of fish species, many of which are heavily exploited around the island. The outer reef has very diverse coral fauna, with over 45 species encountered within a 200 m transect.

In 1986, the Division of Aquatic and Wildlife Resources determined that fish stocks were beginning to show signs of degradation. Over a 15-year period there had been a 70% decline in harvest and catch per unit effort (CPUE) values. Thus actions were taken to reverse the decline of the coral reef fishery. An evaluation of practical approaches was conducted to identify

suitable sites for the establishment of marine preserves. The study looked at 60 sites with the ultimate goal of protecting 10% of the shoreline and adjacent reef. The results of this study were based on criteria that included habitat diversity, species richness, enforceability, cultural practices, and economic benefit. Five marine preserves were established including Pati Point.



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



# Piti Bomb Holes Marine Preserve

Management Agency: Guam Department of Agriculture

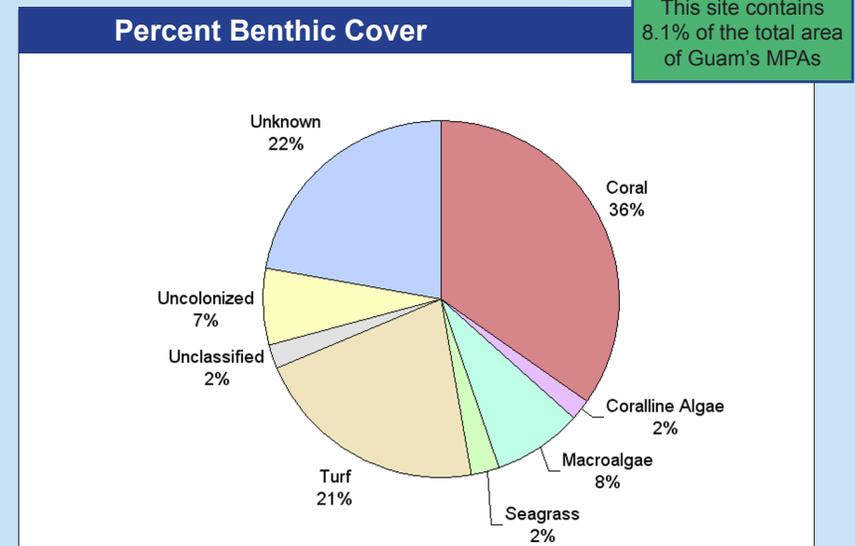
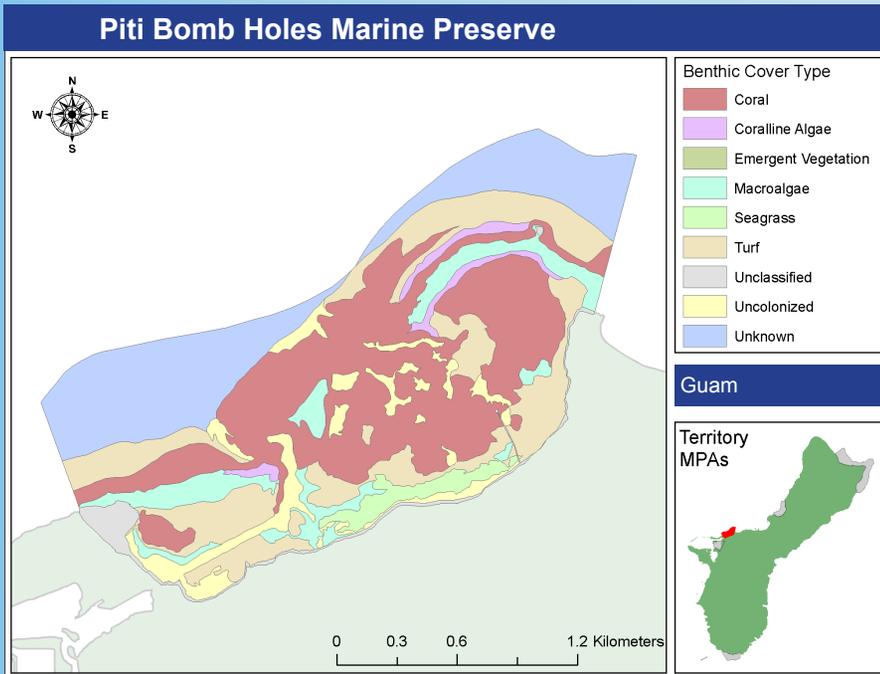
## Overview

Located on the west coast of Guam, Piti Bomb Holes Marine Preserve is a shallow lagoon complex that resembles a barrier reef. Within the preserve are percolation pits at depths of 25–30 ft. where fresh water enters the reef flat. Two species of mollusks and one species of sea urchin are found in these holes that are found nowhere else in the world. Out of all the marine preserves in Guam, Piti Bomb Holes has the most diverse habitat.

In 1986, the Division of Aquatic and Wildlife Resources determined that fish stocks were beginning to show signs of degradation. Over a 15-year period there had been a 70% decline in harvest and catch per unit effort (CPUE) values. Thus actions were taken to reverse the decline of the coral reef fishery. An evaluation of practical approaches was conducted to identify suitable sites for the establishment of marine preserves. The study looked at 60 sites with the ultimate goal of protecting 10% of the shoreline and

adjacent reef. The results of this study were based on criteria that included habitat diversity, species richness, enforceability, cultural practices, and economic benefit. Five marine preserves were established including Piti Bomb Holes.

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



# Sasa Bay Marine Preserve

Management Agency: Guam Department of Agriculture

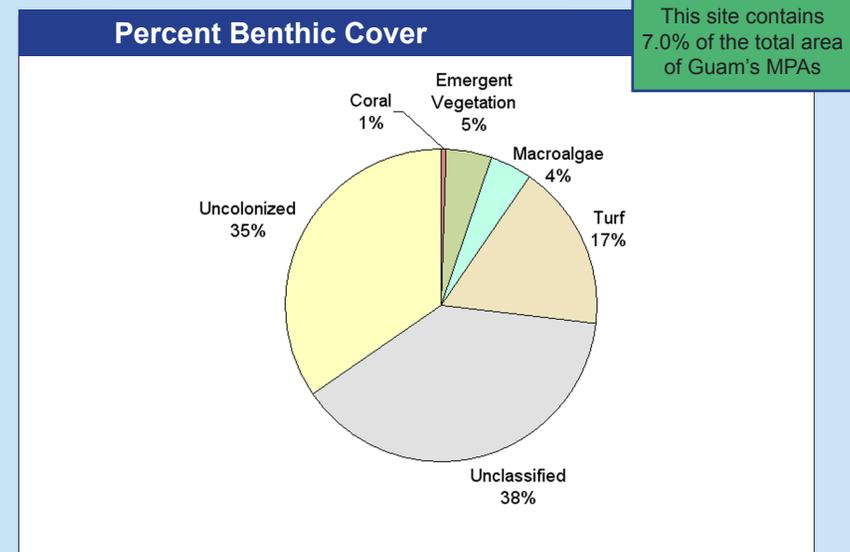
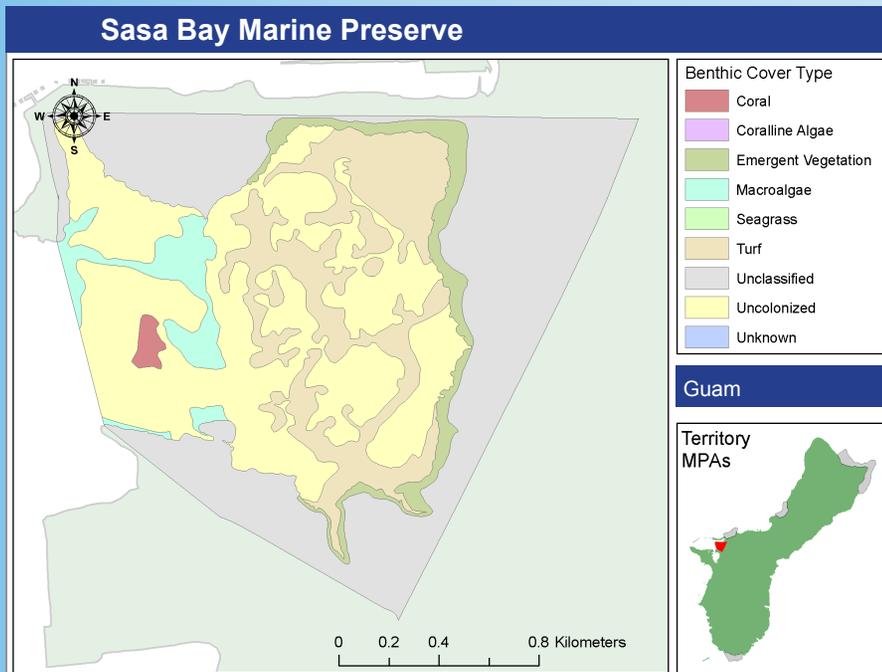
## Overview

Located in Piti, the Sasa Bay Marine Preserve contains a mangrove swamp which skirts the coastline in a narrow band. The bay is a Hawksbill Turtle foraging area and provides habitat for a number of oyster and clam species. Four to five strings of patch reef can also be found within the deeper waters of the embayment.

In 1986, the Division of Aquatic and Wildlife Resources determined that fish stocks were beginning to show signs of degradation. Over a 15-year period there had been a 70% decline in harvest and catch per unit effort (CPUE) values. Thus actions were taken to reverse the decline of the coral reef fishery. An evaluation of practical approaches was conducted to identify suitable sites for the establishment of marine preserves. The study looked at 60 sites with the ultimate goal of protecting 10% of the shoreline and adjacent reef. The results of this study were based on criteria that included

habitat diversity, species richness, enforceability, cultural practices, and economic benefit. Five marine preserves were established including Sasa Bay.

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



# Tumon Bay Marine Preserve

Management Agency: Guam Department of Agriculture

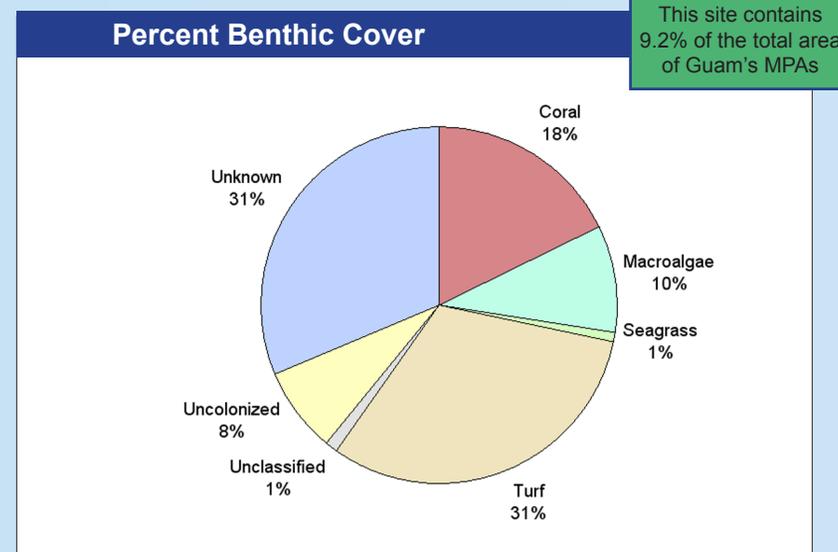
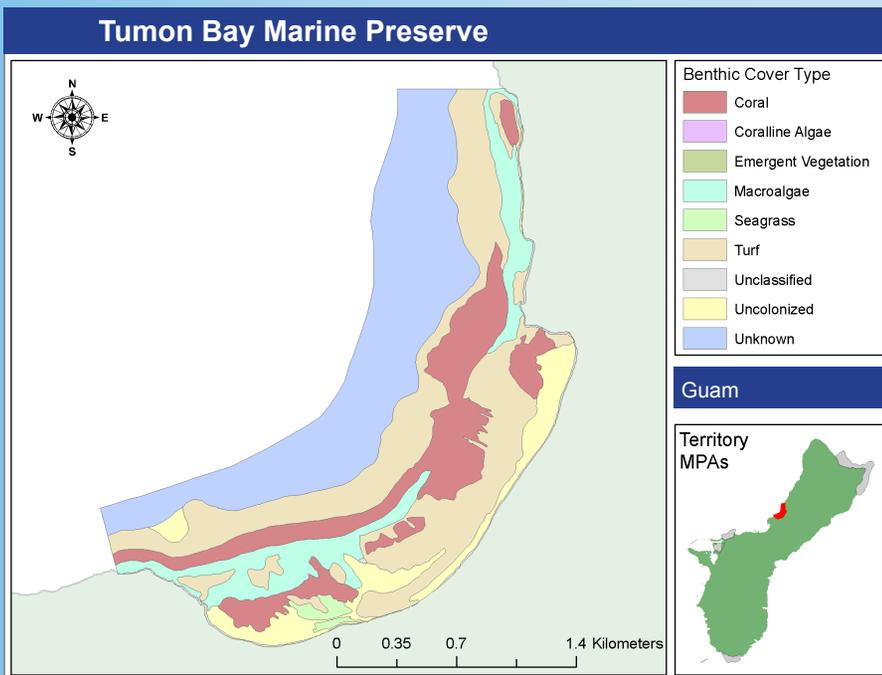
## Overview

Located in Tumon, the preserve is a broad crescent shaped limestone platform stretching from the cliffs of Ypao Point in the southwest to “Gun Point” in the northeast. The bay is 2 miles in length and the reef platform is up to 1,450 feet in width. A major road parallels the beach approximately 1,000 feet from the high water mark making Tumon Bay a center for recreational activity.

In 1986, the Division of Aquatic and Wildlife Resources determined that fish stocks were beginning to show signs of degradation. Over a 15-year period there had been a 70% decline in harvest and catch per unit effort (CPUE) values. Thus actions were taken to reverse the decline of the coral reef fishery. An evaluation of practical approaches was conducted to identify suitable sites for the establishment of marine preserves. The study looked at 60 sites with the ultimate goal of protecting 10% of the shoreline and

adjacent reef. The results of this study were based on criteria that included habitat diversity, species richness, enforceability, cultural practices, and economic benefit. Five marine preserves were established including Tumon Bay.

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



# Guam National Wildlife Refuge: Ritidian Unit

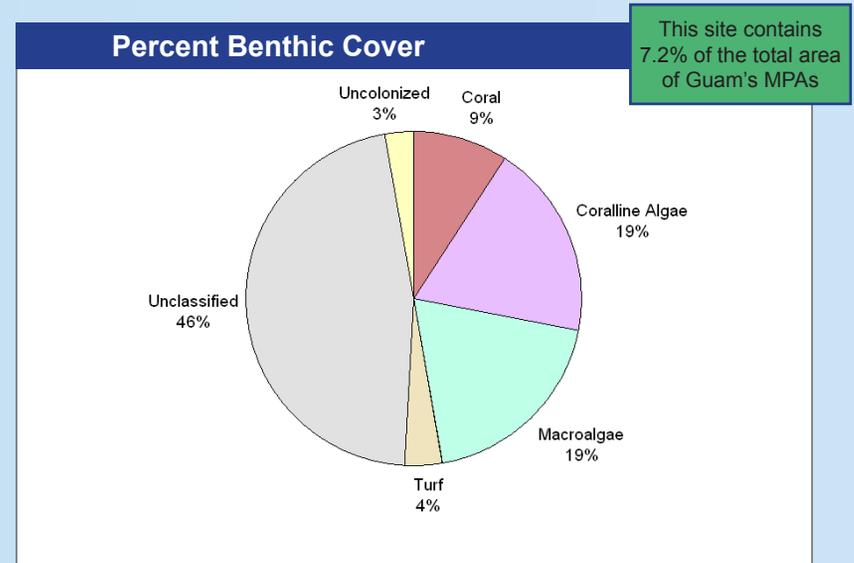
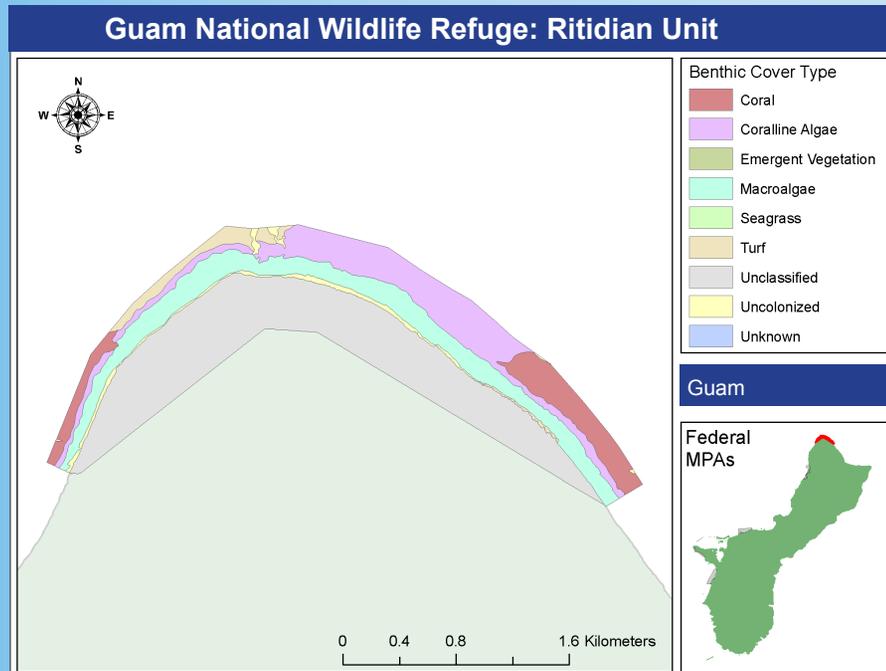
Management Agency: U.S. Fish and Wildlife Service

## Overview

The Guam National Wildlife Refuge: Ritidian Unit is located on the northernmost point of Guam and includes submerged lands out to the 30-m isobath. The Ritidian Unit which is owned by the U.S. Fish and Wildlife Service (USFWS), was created from a small decommissioned, specialized U.S. Naval installation. The transfer of ownership from the U.S. Navy to the USFWS included structures as well as habitat.

The refuge was established in 1993, to protect and recover endangered and threatened species, protect habitat, control non-native species with emphasis on the brown tree snake, protect cultural resources, and provide recreational and educational opportunities to the public where possible.

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



# Haputo Ecological Reserve Area

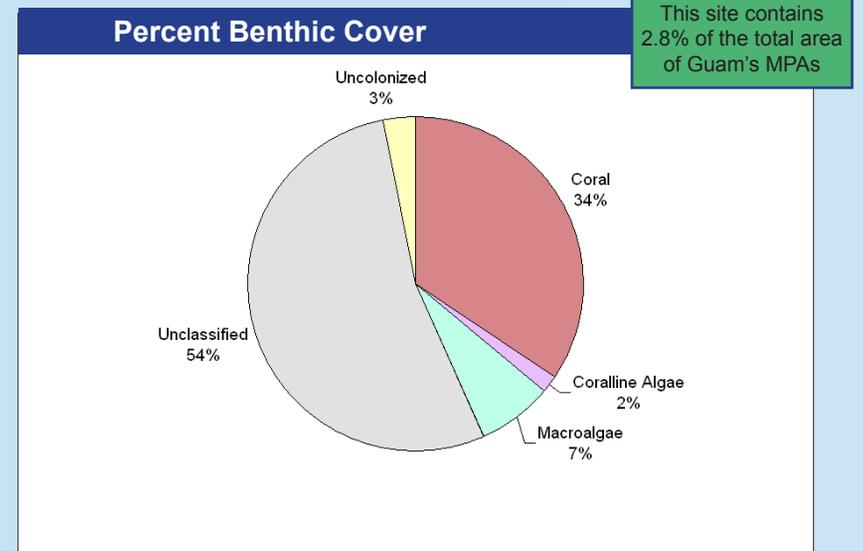
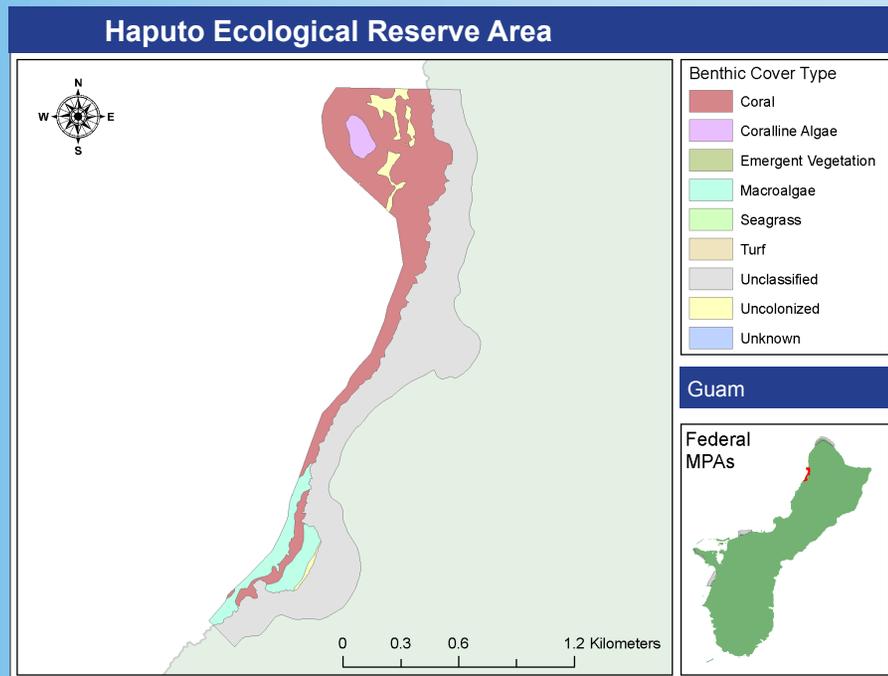
Management Agency: U.S. Navy

## Overview

The Haputo Ecological Reserve Area (ERA) is located on the northwest coast of Guam in the Finegayan area of the Dededo municipality, approximately 5.2 miles north of the town of Dededo. The entire ERA area is under the control of the Commanding Officer, Naval Communications Area Master Station, Western Pacific (NAVCAMS WESTPAC).

Site regulations are governed by a management plan. The purpose of this plan is to provide guidance in the preservation and management of the Haputo ERA and to outline measures to be taken to protect the natural and historical resources located within it. Management actions and use regulations are intended to provide minimum interference by human or human-caused activities with the ecological processes occurring within the ERA.

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



# Orote Peninsula Ecological Reserve Area

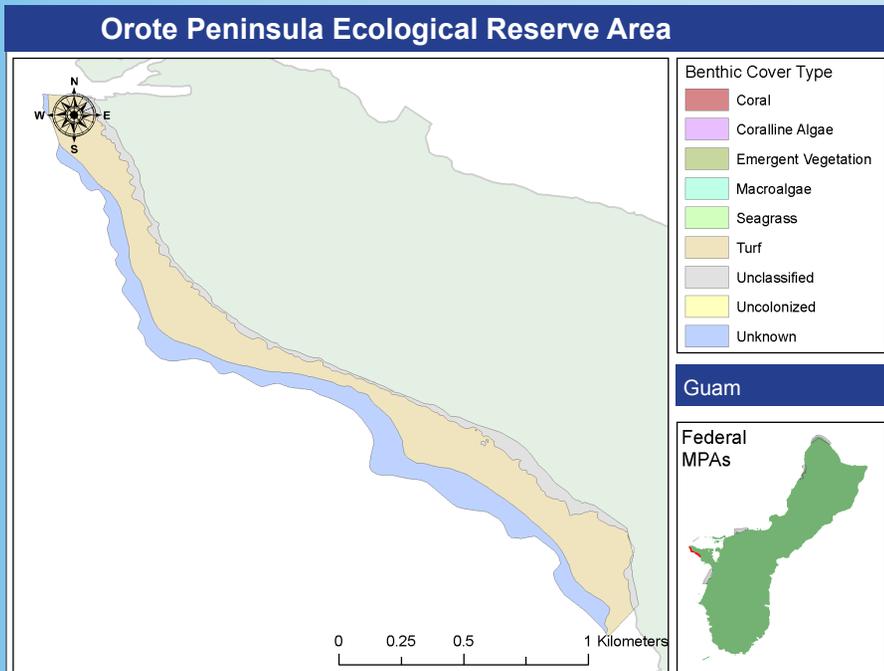
Management Agency: U.S. Navy

## Overview

The Orote Peninsula Ecological Reserve Area (ERA) is located on the southern coast of the Orote Peninsula in the Santa Rita municipality, approximately 0.4 miles north northwest of Apuntua Point. The entire ERA area is under the control of the Commanding Officer, Naval Station, Guam (NAVSTA GUAM).

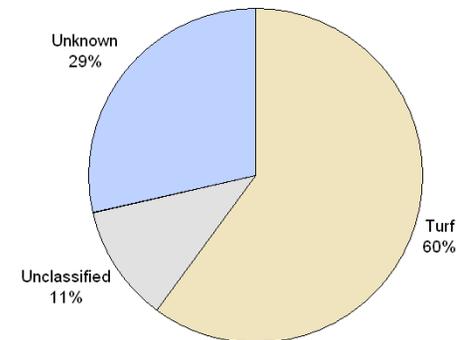
Site regulations are governed by a management plan. The purpose of this plan is to provide guidance in the preservation and management of the Orote Peninsula Ecological Reserve Area (ERA) and to outline measures to be taken to protect the natural and historical resources located within it. Management actions and use regulations are intended to provide minimum interference by human or human-caused activities with the ecological processes occurring within the ERA.

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



## Percent Benthic Cover

This site contains 1.7% of the total area of Guam's MPAs



# War in the Pacific National Historic Park: Agat Unit

Management Agency: National Park Service

## Overview

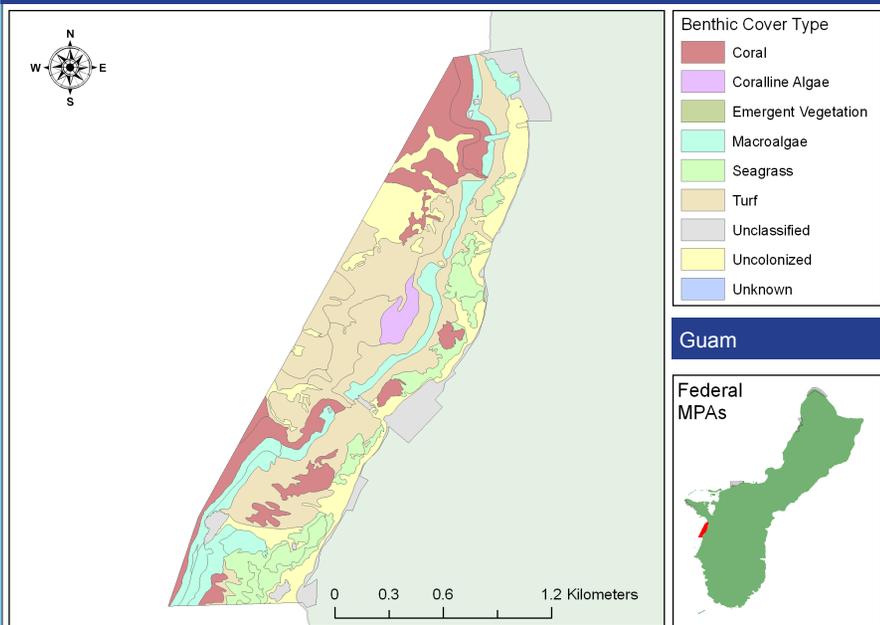
The War in the Pacific National Historic Park: Agat Unit is located on the west coast of Guam bordering the village of Agat. Primarily an offshore area, the land is a series of small parcels between the coastal road and the shoreline. Terrain is generally composed of coral outcroppings interspersed with low-lying areas. A coral reef parallels the shoreline and extends 1,000 to 1,500 feet from the beach. Several small islets and two larger islands, Alutan and Bangi, are also included in the unit. Water inside the reef is one to four feet deep and during low tide some of the reef formation is exposed. A wide variety of plants, coral, and marine life can be seen in park waters.

The park was set aside to commemorate the bravery and sacrifice of those participating in the campaigns of the Pacific theater of World War II and to conserve and interpret outstanding natural, scenic, and historic values and objects on the island of Guam for the benefit and enjoyment of present and future generations.

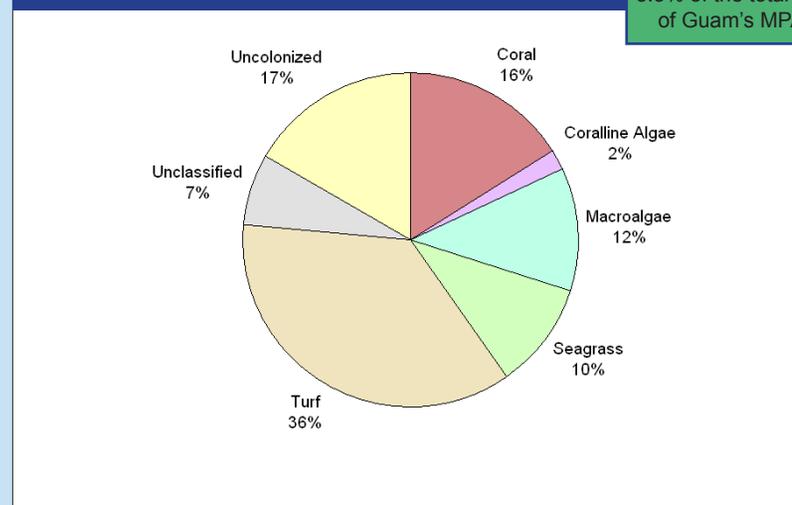
Source of Overview: U.S. Marine Managed Areas Inventory (2006a), NOAA's National Marine Protected Areas Center.



## War in the Pacific National Historic Park: Agat Unit



## Percent Benthic Cover



# War in the Pacific National Historic Park: Asan Beach Unit

Management Agency: National Park Service

## Overview

The War in the Pacific National Historic Park: Asan Unit is located on the west coast of Guam bordering the village of Asan. Occupying mostly offshore area, this unit includes all lands on the ocean side of Marine Drive between Adelup Point and Asan Point. Except for the limestone promontories of these two points, the land is a flat, coastal plain with a sandy beach, 15- to 30-feet wide, fronting the shoreline. The offshore area encompasses extensive reef formations, up to 1,000 feet wide, paralleling the entire shoreline. Water inside the reef varies from one to four feet deep and during low tide many areas of the reef are exposed. There is one small islet, Camel Rock, near Asan Point. A wide variety of plants, coral, and marine life can be seen in park waters.

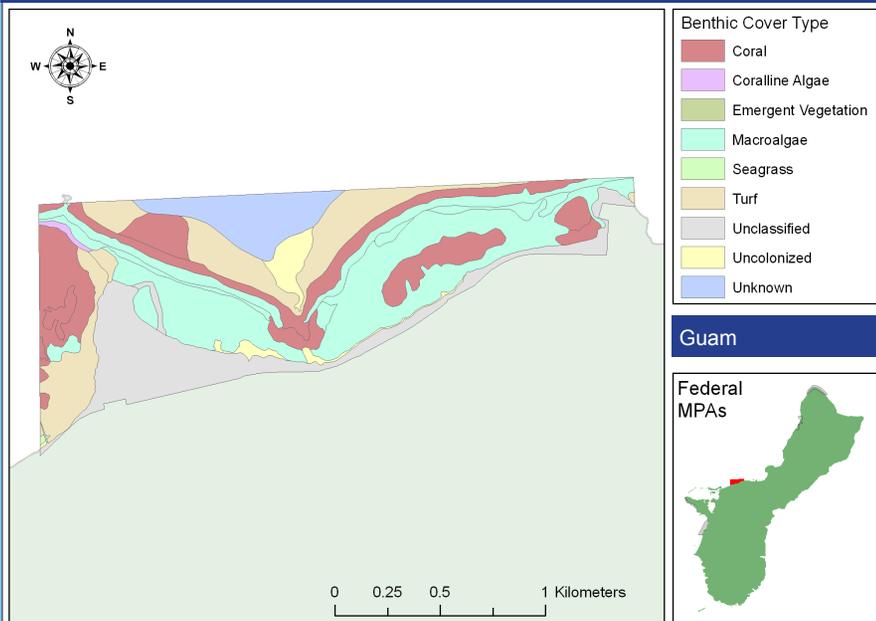
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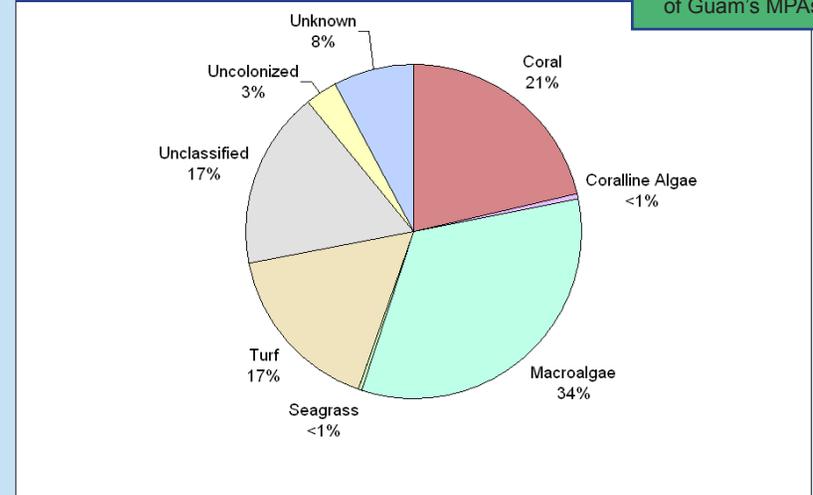
Source of Overview: U.S. Marine Managed Areas Inventory (2006a), NOAA's National Marine Protected Areas Center.



## War in the Pacific National Historic Park: Asan Beach Unit



## Percent Benthic Cover



This site contains 4.5% of the total area of Guam'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](http://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 understand 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: Guam MPA Classification

Site Name	Conservation Goal	Level of Protection	Permanence of Protection	Constancy of Protection	Scale of Protection	Management Plan
<b>1. Achang Reef Flat Marine Preserve</b>	Sustainable Production	Zoned Multiple Use	Permanent	Year Round	Ecosystem	No
<b>2. Pati Point Marine Reserve</b>	Sustainable Production	Zoned Multiple Use	Permanent	Year Round	Ecosystem	No
<b>3. Piti Bomb Holes Marine Preserves</b>	Sustainable Production	Zoned Multiple Use	Permanent	Year Round	Ecosystem	No
<b>4. Sasa Bay Marine Preserve</b>	Sustainable Production	No Take	Permanent	Year Round	Ecosystem	No
<b>5. Tumon Bay Marine Preserve</b>	Sustainable Production	Zoned Multiple Use	Permanent	Year Round	Ecosystem	No
<b>6. Guam National Wildlife Refuge: Ritidian Unit**</b>	Natural Heritage & Sustainable Production	Zoned with No Take Areas	Permanent	Year Round	Ecosystem	Yes
<b>7. Haputo Ecological Reserve Area**</b>	Natural Heritage & Cultural Heritage	Uniform Multiple Use	Permanent	Year Round	Ecosystem	Yes
<b>8. Orote Peninsula Ecological Reserve Area Unit**</b>	Natural Heritage	Uniform Multiple Use	Permanent	Year Round	Ecosystem	Yes
<b>9. War in the Pacific National Historic Park: Agat Unit**</b>	Natural Heritage & Cultural Heritage	Uniform Multiple Use	Permanent	Year Round	Ecosystem	No
<b>10. War in the Pacific National Historic Park: Asan Beach Unit**</b>	Natural Heritage & Cultural Heritage	Uniform Multiple Use	Permanent	Year Round	Ecosystem	No

\* Territory MPA

\*\* Federal MPA

## Appendix C: Benthic Cover (km<sup>2</sup>) by Site

	Coral	Coralline Algae	Emergent Vegetation	Macroalgae	Seagrass	Turf	Unclassified	Uncolonized	Unknown	Total
<b>1. Achang Reef Flat Marine Preserve*</b>	0.441	0.045	0.021	0.721	0.655	0.856	0.111	0.466	1.211	4.527
<b>2. Pati Point Marine Preserve*</b>	1.764	0.441	0.000	0.709	0.000	2.451	0.192	2.333	11.723	19.613
<b>3. Piti Bomb Holes Marine Preserve*</b>	1.250	0.072	0.000	0.288	0.085	0.769	0.085	0.251	0.795	3.594
<b>4. Sasa Bay Marine Preserve*</b>	0.018	0.000	0.148	0.136	0.544	1.205	1.086	0.000	3.137	3.137
<b>5. Tumon Bay Marine Preserve*</b>	0.727	0.000	0.000	0.404	0.038	1.288	0.039	0.319	1.294	4.110
<b>6. Guam National Wildlife Refuge: Ritidian Unit**</b>	0.294	0.607	0.000	0.623	0.000	0.113	1.501	0.087	0.000	3.226
<b>7. Haputo Ecological Reserve Area**</b>	0.428	0.022	0.000	0.088	0.000	0.000	0.667	0.038	0.000	1.243
<b>8. Orote Peninsula Ecological Reserve Area**</b>	0.000	0.000	0.000	0.000	0.000	0.453	0.086	0.000	0.217	0.756
<b>9. War in the Pacific National Historic Park: Agat Unit**</b>	0.397	0.043	0.000	0.296	0.250	0.885	0.174	0.406	0.000	2.452
<b>10. War in the Pacific National Historic Park: Asan Beach Unit**</b>	0.433	0.007	0.000	0.672	0.001	0.340	0.344	0.064	0.157	2.019

\* Territory MPA

\*\* Federal MPA

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

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## References

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Gombos, M., J. Gutierrez, V. Brown. 2007. Guam Coral Reef MPA Summary. pp. 89-96. In Wusinich-Mendez, D. and C. Trappe (ed.), 2007. *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: 2007*. NOAA Technical Memorandum NOS. NOAA Coral Reef Conservation Program. Silver Spring, MD. 153 pp.

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Mapping and Information Synthesis Working Group. 1999. Coral Reef Mapping Implementation Plan (2nd Draft). U.S. Coral Reef Task Force. Washington, DC, NOAA, NASA and USGS (Work Group Co-chairs). 17 pp.

Monaco, M.E., J.D. Christensen, and S.O. Rohmann. 2001. Mapping and Monitoring of U.S. Coral Reef Ecosystems. Earth System Monitor. Vol. 12(1):1-16.

NCRAS (National Coral Reef Action Strategy). 2002. A National Coral Reef Action Strategy: Report to Congress on implementation of the Coral Reef Conservation Act of 2002 and the National Action Plan to Conserve Coral Reefs in 2002-2003. NOAA. Silver Spring, Maryland. 120pp. + appendix.

NOAA National Centers for Coastal Ocean Science (NCCOS). 2005. Shallow-Water Benthic Habitats of American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands (CD-ROM). NOAA Technical Memorandum NOS NCCOS 8, Biogeography Team. Silver Spring, MD.

NOAA National Marine Protected Areas Center. 2006a. U.S. Marine Managed Areas Inventory. [http://www.mpa.gov/helpful\\_resources/inventory.html](http://www.mpa.gov/helpful_resources/inventory.html)

NOAA National Marine Protected Areas Center. 2006b. U.S. MPA Classification System. [http://www.mpa.gov/helpful\\_resources/fact\\_sheets.html](http://www.mpa.gov/helpful_resources/fact_sheets.html)

USCRTF (United States Coral Reef Task Force). 2000. The National Action Plan to Conserve Coral Reefs. USCRTF. Washington, D.C. 33pp. + appendices.

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## For More Information

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NOAA Coral Reef Conservation Program  
1305 East-West Highway, 10th Floor  
Silver Spring, MD 20910-3281  
[coralreef@noaa.gov](mailto:coralreef@noaa.gov)