Office of National Marine Sanctuaries
National Oceanic and Atmospheric Administration

FAGATELE BAY NATIONAL MARINE SANCTUARY

Fagatele Bay
National Marine Sanctuary

Draft Management Plan and Draft Environmental Impact Statement

October 2011

http://fagatelebay.noaa.gov

NATIONAL MARINE SANCTUARIES

FAGATELE BAY

COVER PHOTO

A new endemic species of anemonefish *Amphiprion pacificus* in Fagatele Bay at 40 foot depth (DMWR Photo: By Doug Fenner).

RECOMMENDED CITATION

U.S. Department of Commerce. National Oceanic and Atmospheric Administration. Office of National Marine Sanctuaries. 2011. Fagatele Bay National Marine Sanctuary Draft Management Plan / Draft Environmental Impact Statement. Silver Spring, MD.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
PROGRAM PLANNING AND INTEGRATION
Silver Spring, Maryland 20910

OCT 0 6 2011

Dear Reviewer:

In accordance with provisions of the National Environmental Policy Act of 1969 (NEPA), we enclose for your review the National Oceanic and Atmospheric Administration (NOAA) Office of National Marine Sanctuaries Draft Environmental Impact Statement (DEIS) for the Fagatele Bay National Marine Sanctuary (FBNMS or sanctuary). Fagatele Bay is located along the southwestern coast of Tutuila Island and is the smallest and most remote of the national marine sanctuaries as well as the only one in the Southern Hemisphere. The sanctuary encompasses 0.25 square miles of reef flat, shallow reef, and steep slopes plunging down to 600 feet within a naturally protected bay surrounded by steep cliffs.

This DEIS is prepared pursuant to NEPA to assess the environmental impacts associated with NOAA developing revised regulations for the FBNMS under the National Marine Sanctuaries Act in order to add five new areas to the sanctuary. The preferred alternative also includes changing the name of the FBNMS to the American Samoa National Marine Sanctuary, and promulgating regulations that would apply to these new areas and in some instances would prohibit fishing and restrict certain uses of these areas. To allow the addition of new areas and the regulation of certain activities not currently identified as subject to regulation, these proposed changes will require the FBNMS to change its existing terms of designation. The proposed rule publishes the proposed new regulations, the text of the proposed revised terms of designation for the FBNMS, and announces the availability of the DEIS.

Public hearings will be held as follows:

(1) November 17, 4:30 pm - AS Community College Lecture Hall

(2) November 18, 9:00 am – Auasi Village, High Chief Fonoti's Guest Fale

(3) November 21, 9:00 am - Fitiuta Village, Ta'u island, Mayor's Meeting Fale

(4) November 21, 2:00 pm, Ofu island, Mayor's Guest Fale

Written comments will be accepted until January 6, 2012, and should be directed to the Sanctuary official identified below.

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Sanctuary Official:
Gene Brighouse
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Sincerely,

Paul N. Doremus, Ph.D.
NOAA NEPA Coordinator

ABOUT THIS DOCUMENT

This document is a combined draft management plan (DMP) and draft environmental impact statement (DEIS). Proposed revisions to sanctuary regulations are published concurrently in the Federal Register (FR) as a proposed rule. The National Oceanic and Atmospheric Administration (NOAA) is the lead agency for this proposed action. The American Samoa Department of Commerce (AS DOC) is a cooperating agency.

Management plans are sanctuary-specific planning and management documents used by all national marine sanctuaries. Management plans fulfill many functions, including describing regulations and boundaries; outlining staffing and budget needs; setting priorities and performance measures for resource protection, research and education programs; and guiding development of future budgets and management activities. When final, this plan will chart the course for the sanctuary over the next 5 to 10 years.

The DEIS evaluates the potential environmental, cultural, and socio-economic impacts of the proposed American Samoa National Marine Sanctuary actions, including changing the name from Fagatele Bay National Marine Sanctuary to American Samoa National Marine Sanctuary; designating additional units to be included in the sanctuary; revising sanctuary regulations; and implementing new sanctuary action plans. The DEIS has been prepared in accordance with the National Environmental Policy Act of 1969, as amended (NEPA), 42 United States Code (U.S.C.) 4321 et seq., its implementing regulations (40 Code of Federal Regulations [CFR] parts 1500–1508), and NOAA's implementing procedures for NEPA (NOAA's Administrative Order 216-6). The Notice of Intent to prepare this EIS was published on January 30, 2009 (74 FR 5641). To help readers locate topics required by NEPA, Table 1 (below) lists them with the corresponding section of this document and the relevant page numbers. An index of important terms is also provided at the end of the document.

This document relies on expertise and information, comments, and recommendations from the AS DOC, the Sanctuary Advisory Council, the NOAA National Centers for Coastal Ocean Science (NCCOS), NOAA Fisheries, scoping participants on the management plan, and communities on Tutuila, Aunu'u, Ta'u, and the Manu'a islands who participated in management plan meetings.

Comments or questions on this document should be directed to:
Kevin Grant, Deputy Sanctuary Superintendent
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Table 1: Legal requirements for the DMP/DEIS.

NEPA REQUIREMENT	DOCUMENT SECTION	PAGE
Purpose and Need for Action	Section 1.4	20
Alternatives	Section 2.2	47
Preferred Alternative	Section 2.2.3	50
Other Alternatives	Sections 2.2.1, 2.2.2, and 2.2.4	47, 53
Affected Environment	Chapter 3	75
Environmental/Socioeconomic Consequences	Chapter 5	289
Cumulative Impacts	Chapter 6	357
List of Preparers	Below Table 1	
List of Agencies, Organizations, and Persons Receiving Copies of the DEIS	Appendix B	B-1
Executive Summary		ES-1
Table of Contents		i
Index		421

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EXECUTIVE SUMMARY

This document describes the federally-mandated review and update of the Fagatele Bay National Marine Sanctuary Management Plan, which includes a proposed expansion of the sanctuary to as many as five additional locations, as well as a suite of sanctuary-wide and location-specific regulations designed to enhance protection of sanctuary resources while limiting adverse impacts to the public. The proposed expansion would increase the size of the sanctuary from 0.25 square miles up to 14,378 square miles, with approximately 94 percent of this increase consisting of the inclusion of the marine areas of the Rose Atoll Marine National Monument. A series of community meetings with each of the villages associated with the proposed new sanctuary units, led by the sanctuary's territorial partner, has generated strong and broad public support for this action.

In response to a proposal from the American Samoa Government to the National Oceanic and Atmospheric Administration (NOAA), Congress designated the Fagatele Bay National Marine Sanctuary (sanctuary) in 1986, among other reasons, "to protect and preserve an example of a pristine tropical marine habitat and coral reef terrace ecosystem of exceptional biological productivity," (49 FR 47415). The sanctuary is located in the South Pacific Ocean in American Samoa, the only U.S. territory south of the equator. The territory is comprised of five volcanic islands (Tutuila, Aunu'u, Ofu, Olosega, and Ta'u) and two small remote coral atolls (Rose Atoll and Swains Island). Fagatele Bay is located along the southwest coast of Tutuila Island and with an area of .25 square miles is the smallest and most remote of the 13 sanctuaries managed by NOAA's Office of National Marine Sanctuaries (ONMS). Fagatele Bay's coral reefs provide habitat for at least 271 species of fishes, 168 species of coral and at least 1,400 species of algae and invertebrates (other than coral). Marine mammals and sea turtles may also be found in or near the sanctuary and surrounding environs. In addition, Fagatele Bay's shoreline bears witness to the rich Samoan maritime culture as the site of a pre-historic village in addition to grinding holes or bait cups that Ancient Samoans carved along the reef edge.

Sanctuary regulations clarify that NOAA has primary responsibility for sanctuary management, and that the American Samoa Economic and Development Planning Office (now known as the American Samoa Department of Commerce or AS DOC) will assist NOAA in the administration of the sanctuary (15 CFR 922.103). As a territorial partner and co-manager, AS DOC provides a local alliance and support services to address territorial processes and coordination. AS DOC greatly assists sanctuary staff with joint efforts in outreach, constituency building and cooperation in the territory. Through its partnership with AS DOC, sanctuary staff are also able to coordinate efforts to reach out to local communities through the American Samoa Government's Office of Samoan Affairs, whose staff serve as liaisons between the territorial government and local residents.

The local alliance with AS DOC is critical since the ONMS places a high value on partnerships with sanctuary communities and maintain great respect for *fa'a-Samoa*. *Fa'a-Samoa*, the traditional Samoan way of life, provides the cultural context for all sanctuary activities and functions. The foundation of Polynesia's oldest culture, which dates back some 3,000 years,

fa'a-Samoa places great importance on the dignity and achievements of the group rather than on individual achievements. Sanctuary staff must work in a culturally appropriate manner with local communities, who may serve as sanctuary stewards and whose communally-owned lands adjacent to the sanctuary are managed by local *matais* (chiefs).

The sanctuary's current management plan was written during the sanctuary designation process in 1984. A sanctuary management plan is a site-specific planning and management tool that describes the sanctuary's goals, objectives, regulations and boundaries, guides future activities, outlines staffing and budget needs, and sets priorities and performance measures for resource protection, research and education programs. The NMSA requires the ONMS to periodically review and evaluate the progress in implementing the management plan and goals for each sanctuary, with special focus on the effectiveness of site-specific techniques and strategies. ONMS must revise management plans and regulations as necessary to fulfill the purposes and policies of the NMSA (16 U.S.C. 1434(e)) to ensure that sanctuary sites continue to best conserve, protect, and enhance their nationally significant living and cultural resources. The 1984 management plan was written to give broad, general direction for the formation of sanctuary program areas. In the ensuing 25 years, the ONMS has achieved an extensive and diverse variety of accomplishments in support of the original sanctuary goals. In addition, sanctuary managers recognize significant advances in science and technology, innovations in marine resource management techniques, challenging new resource management issues and new local community concerns have emerged and, as such, have rendered the original 1984 management plan obsolete. The ONMS also recognizes that the sanctuary's focus on a single isolated bay limits its ability to foster awareness and stewardship throughout villages across the territory, and that other areas in the territory also warrant the additional federal protections and programs provided by the NMSA and ONMS. Finally, Presidential Proclamation 8337 issued by President George Bush in 2009 states that, "[t]he Secretary of Commerce shall initiate the process to add the marine areas of the [Rose Atoll Marine National M]onument to the Fagatele Bay National Marine Sanctuary in accordance with the National Marine Sanctuaries Act (16 U.S.C. 1431 et seq.)." This updated management plan and proposed sanctuary expansion is designed to address all of these factors and through the management plan review process to inform (and be informed by) sanctuary constituents regarding the sanctuary, its accomplishments to date, its revised goals objectives and planned management actions.

The ONMS and sanctuary managers have developed this new management plan through a public process. Public involvement began in 2007-2008 with outreach about the management plan review process through distribution of informational fact sheets and reports, newspaper articles, radio spots, and interviews on radio and TV talk shows. From February through March, 2009, sanctuary staff conducted a public scoping period during which they solicited public comments on the status of sanctuary management and possible inclusion of additional sanctuary units. The scoping period included three public scoping meetings on the island of Tutuila covering central areas, eastern villages, and western villages. Public scoping together with numerous community meetings, sanctuary advisory council meetings, advisory council working group meetings, communications with the Governor of American Samoa and the results of the NOAA National Centers for Coastal Ocean Science (NCCOS) biogeographic assessment of archipelago-wide

coral reef habitat have provided input on and helped form the proposed sanctuary actions and alternatives analyzed herein.

This document includes both the draft management plan (DMP) and a draft environmental impact statement (DEIS). The DEIS evaluates the potential environmental, cultural and socio-economic impacts of the proposed sanctuary actions, including: changing the name from Fagatele Bay National Marine Sanctuary to American Samoa National Marine Sanctuary, including additional units in the sanctuary, revising sanctuary regulations, and implementing new sanctuary action plans. The DEIS has been prepared in accordance with the National Environmental Policy Act of 1969, as amended (NEPA), 42 U.S.C. 4321 et seq., its implementing regulations (40 CFR parts 1500–1508), and NOAA's implementing procedures for NEPA (NAO 216-6). Below is a summary of each of the major sections of this combined DMP/DEIS.

Chapter 1 (Introduction) of the document introduces the concept of *fa'a-Samoa*, NOAA, the NMSA, the National Marine Sanctuary System and how the ONMS employs comprehensive, ecosystem based management, the Fagatele Bay sanctuary, its management plan review process and sanctuary advisory council. This section also reviews the sanctuary's original goals, accomplishments since designation and current status of resources. Next, it presents the purpose and need for this action, along with the revised sanctuary goals, considerations in developing the proposed action and alternatives, and finally it briefly describes the proposed action.

Chapter 2 (Alternatives Including the Proposed Action) focuses on describing a suite of alternatives, each of which describes a differing set of potential sanctuary units (see Table ES-1), accompanying regulations and non-regulatory actions. It also explains how the ONMS and sanctuary managers developed these alternatives. In addition, the section describes alternatives considered, but eliminated, and explains the reasons for such eliminations. Alternatives analyzed herein include the following (summarized in brief):

- **No Action**
  - Sanctuary unit at: Fagatele Bay
  - No new sanctuary regulations
  - Review and maintain 1984 management plan
- **Alternative 1 – Update Management Plan**
  - Sanctuary unit at: Fagatele Bay
  - Implement management permit
  - No additional sanctuary regulations
  - Updated management plan
- **Alternative 2 – Incorporation of Muliāva (Rose Atoll Marine National Monument)**
  - Sanctuary units at: Fagatele Bay, Muliāva (Rose Atoll)
  - Implement management permit; new non-fishing sanctuary regulations; maintain existing prohibition of commercial fishing at Muliāva per Proclamation 8337
  - Updated management plan

- **Alternative 3 (A and B) – Multi-village Sanctuary Unit Expansion**
  - Sanctuary units at: Fagatele Bay, Muliāva, Larsen Bay, Aunu'u Island, Swains Island, and Ta'u Island (Alternative 3B only)
  - Implement management permit; same non-fishing regulations of Alternative 2; new location-specific fishing regulations; no new fishery regulations for Muliāva unit
  - Updated management plan
- **Alternative 4 – Multi-village Sanctuary Unit Expansion with Buffer Zones and Additional Regulations**
  - Sanctuary units at: Fagatele Bay, Muliāva, Larsen Bay, Aunu'u Island, Ta'u Island, Swains Island; boundary expansion at Muliāva, Aunu'u Island, Ta'u Island, and Swains Island sanctuary units
  - Implement management permit; same fishing and non-fishing regulations of Alternative 3; new fishing regulations including prohibition on take of certain large fish species sanctuary-wide and complete no-take at Muliāva
  - Updated management plan

Table ES-1: Summary of Sanctuary Units and Size for Each Alternative

Sanctuary Unit	Area (square miles [mi²])	Change in unit from previous alternative
No Action/Alternative 1		
Fagatele Bay	0.25 mi²	N/A
Alternative 2		
Fagatele Bay	0.25 mi²	None
Muliāva	13,448 mi²	N/A
Alternative 3A and 3B		
Fagatele Bay	0.25 mi²	None
Muliāva	13,508 mi²	Expands unit to include Vailulu'u Seamount
Larsen Bay	0.46 mi²	N/A
Aunu'u Island (total) Multi-use Zone Research Zone	5.8 mi² 1.9 mi² 3.9 mi²	N/A
Swains Island	54 mi²	N/A
Ta'u Island	14.6 mi² (3B only)	Ta'u is not proposed for Alternative 3A
Alternative 4A and 4B		
Fagatele Bay	0.25 mi²	None
Muliāva (4A)	13,508 mi²	None
Muliāva (4B)	13,510 mi²	Expands unit to include NWR overlay
Larsen Bay	0.46 mi²	None
Aunu'u Island (total) Multi-use Zone Research Zone	6.2 mi² 1.9 mi² 4.3 mi²	Expands research zone to include mesophotic reefs in federal waters
Ta'u Island	16 mi²	Expands unit to include NPAS overlay
Swains Island	844 mi²	Expands unit to include 12 nm buffer zone

Each subsequent alternative increases the total size of the sanctuary and builds on the number of proposed regulations. As such, Alternative 1 proposes the lowest level of protection for marine resources, while Alternative 4 proposes the highest level of protection. Maps of the proposed sanctuary units are found at the end of this summary (Figure ES-1 – ES-7).

Chapter 3 (Affected Environment) provides both a background of the history and current status of marine resource use and management as subtext to the management plan, as well as the environmental context necessary for understanding how each of the alternatives may affect that environment. It describes the physical, biological, human and institutional setting across the territory of American Samoa, as well as at specific locations (Fagatele Bay, Larsen Bay, Aunu'u Island, Ta'u Island, Rose Atoll and Swains Island) encompassing or containing sanctuary units proposed for inclusion across the alternatives.

Chapter 4 (Management Plan) presents eight action plans designed to help achieve specific sanctuary goals, directly address current priority resource management issues and guide sanctuary management over the next five to ten years. This section also explains how action plans were developed, presents a framework for developing new action plans (as necessary), explains costs associated with action plan implementation, and the role of adaptive management in implementation and the concept of performance evaluation. The action plans explain the issues their activities aim to address, and the need for such actions. Each action plan's objective provides the unifying theme for the collection of strategies housed within it. Strategies begin with a brief background articulating why the activities they contain are important and how they help meet the given action plan's objective.

- **Cultural Heritage & Community Engagement Action Plan**
  - To promote stewardship through active engagement of sanctuary communities while incorporating Samoan culture and protecting cultural heritage and maritime heritage resources.
- **Marine Conservation Science Action Plan**
  - To improve ecosystem-based management by providing a strong foundation of science and increasing knowledge of sanctuary marine ecosystems.
- **Climate Change Action Plan**
  - To minimize and mitigate the impact from climate change events on coastal and marine ecosystems in sanctuary units.
- **Operations and Administration Action Plan**
  - To outline the means and level of support necessary to successfully achieve sanctuary goals and implement the strategies and activities detailed in the other action plans.
- **Ocean Literacy Action Plan**
  - To cultivate an informed public and enhance ocean stewardship by increasing public awareness, understanding, and appreciation of sanctuary resources in American Samoa.
- **Resource Protection & Enforcement Action Plan**
  - To reduce existing and potential resource threats, and to prevent adverse impacts to the ecosystem.

- **Partnerships & Interagency Cooperation Action Plan**
  - To foster and facilitate cooperation and coordination of planning and management actions.
- **Program Evaluation Action Plan**
  - To effectively and efficiently incorporate performance measurement into sanctuary operations in order to determine the degree to which management actions are achieving sanctuary goals.

Chapter 5 (Environmental Consequences) provides a summary of potential impacts of the proposed sanctuary expansion alternatives on the natural and human environment in comparison to the baseline of No Action. The impact analysis for each of the alternatives occurs on three levels: 1) the set of actions proposed for each of the alternatives that impact the resources, 2) the physical, biological, and cultural resources and human uses impacted, and 3) the specific locations where these impacts occur. A discussion of the factors used to determine the significance of direct and indirect impacts (pursuant to 40 CFR 1508.8 section 5.1.2) is included.

Alternative 1 updates the 1984 management plan. This is primarily an administrative action, and the strategies and activities could be implemented without updating the management plan. As such there are only minor beneficial impacts associated with Alternative 1 compared to No Action (see Table ES-2 below for a comparison summary of potential resource impacts). The proposed expansion of Fagatele Bay sanctuary to two sanctuary units (Alternative 2) or a network of five sanctuary units (Alternative 3A) or six sanctuary units (Alternatives 3B, 4A and 4B) with a suite of habitat protection, fishery, and other regulations, would result in beneficial impacts on the physical and biological resources compared to No Action or Alternative 1. Each subsequent alternative provides more protection for marine resources through both increasing the total size of the sanctuary and proposing additional regulations. As such, Alternative 4 provides the greatest benefit to physical and biological resources.

Most of the impacts to the human environment are beneficial, including additional protection for cultural resources, new opportunities for research, and improving health and safety within the sanctuary units. Some adverse impacts to fisheries will result from use restrictions within the sanctuary units. These impacts are considered less than significant or mitigated to less than significant through cooperative management with the associated villages. Land-based operations that occur adjacent to sanctuary waters may experience less than significant or significant impacts if they cause pollutants to enter sanctuary waters that violate the discharge prohibition. This could include agricultural activities, piggery operations, utility discharge, and construction. Most of the proposed sites are adjacent to unpopulated or sparsely populated villages where land-based activities are limited. Nevertheless, sanctuary regulations may impact the type or level of activities that occur on adjacent lands. Adverse economic impacts, specifically the loss of revenue due to fishery restrictions, are expected to be small due to the diminishing level of nearshore fisheries and the small size of reef area that is closed to all fishing. Impacts to the entire economy are expected to be beneficial due to the increase in management activity across the territory, including additional employment opportunities through the sanctuary program.

Table ES-2: Summary of Potential Resource Impacts

Resource	No Action	Alternative 1	Alternative 2	Alternative 3A and 3B	Alternative 4	
					A	B
Physical and Biological Environment						
Water Quality and Habitats	○ Status quo maintained; water quality and habitats of bay in good condition; landfill leaching concern	○ Same as No Action	+ Benthic habitat and discharge protections provide comprehensive protection at Muliāva	+ Improved mechanisms to address land-based pollution; benthic habitat protections extended to 6 units	+ Additional protection for mesophotic reefs	+ Same protections as Alternative 4A
Biological Resources (Fish, Invertebrates, and Special Status Species)	○ Status quo maintained; reduction of large fish species remains	+ Ocean Literacy and Resource Protection and Enforcement Action Plans may improve compliance for Sanctuary users	+ Secondary benefit to biological resources from habitat protection; increased resources from joint management	+ Increased protection for vulnerable species (giant clams, corals) and a greater diversity of habitats	+ Protection for vulnerable fish species; increased protection at Muliāva	+ No-take zone provides highest protection for Muliāva
Human Environment						
Fisheries	○ Status quo maintained; fishing remains allowed	○ Same as No Action	⊙ No restriction of fishing opportunities; anchoring and discharge prohibitions imparts minimal inconvenience to vessels within Muliāva	⊙ No-take zones restricts 3.7% of coral habitat; gear and species harvest restrictions limit some activities	⊙ 12 nm no-take zone at Muliāva and large reef fish prohibition limits some fishing, e.g., recreational fishing for giant trevally	⊙ Similar to Alternative 4A, with a greater lost fishing opportunity at Muliāva (50nm no-take zone)
Maritime Heritage and Cultural Resources	○ Status quo maintained; minimal threats to few resources in Bay	+ Cultural Heritage and Community Engagement Action Plan provides minor benefits.	+ Same as Alternative 1	+ Benthic habitat and cultural resource regulations extended to 5 or 6 units; cultural fishing activities preserved	+ Ta'u unit expansion provides full protection for *Taisamasama*	+ Same as Alternative 4A

Resource	No Action	Alternative 1	Alternative 2	Alternative 3A and 3B	Alternative 4	
					A	B
Tourism and Recreation	○ Status quo maintained; public access difficulties remain	○ Same as No Action	○ No additional opportunities or restrictions	+ Resource protection of added units improves ecosystem for non-consumptive activities	+ Same as Alternative 3	+ Same as Alternative 3
Research	○ Status quo maintained; focus remains only on Bay	○ Marine Science Conservation Action Plan would provide minimal differences from status quo under Alternative 1	+ Increased opportunities through Marine Conservation Science Action Plan	+ Increased opportunities through Aunu'u Research Zone	+ Addition of mesophotic reefs to research zone	+ Same as Alternative 4A
Human Health and Safety	○ Status quo maintained; current boating regulations protect users	○ Same as No Action	○ New regulations have minimal impact on health and safety	+ Safe boating regulations extended to 5 or 6 units	+ Same protections as Alternative 3	+ Same as Alternative 4A
Socioeconomic Environment						
Economics and Revenue	○ Status quo maintained	+ New Management Plan would likely increase sanctuary budget and economic opportunities	+ Increase non-use value of Rose Atoll reefs; additional funds for management	+ Increased funding and employment opportunities offset small losses in fisheries revenue. Potential significant impact to land-based operations that create polluted runoff.	+ Increased funding offset lost fishing opportunities at Muliāva	+ Same as Alternative 4A

LEGEND:

○ = No impact

⊙ = Less than significant

\+ = Beneficial impact

Chapter 6 (Cumulative Projects and Impacts) evaluates the compounded effects of past, present, and reasonably foreseeable future actions, known as cumulative impacts. Cumulative impacts can result from individually minor but collectively significant actions taking place over time (40 CFR 1508.7). There are 22 existing marine protected areas (MPAs), 3 newly proposed MPAs, and a number of infrastructure projects considered in this section. The MPAs discussed include community based fisheries reserves, special management areas, national park units, a no-take MPA, a territorial marine park, a marine national monument, a national wildlife refuge, a national marine sanctuary, and a private marine reserve. The infrastructure projects include road improvements, shoreline protection, waste water systems, clean water, and energy efficiency projects, and the Samoa Port Master Plan.

This document includes two appendices; Appendix A is a glossary of Samoan terms used in the document with their English translation; Appendix B is a list of agencies that have received copies of this document for their review during the public comment period.

It should be noted that a separate rulemaking will be proposed in the Federal Register to request public comment on the proposed changes to the sanctuary's regulations under the proposed action. Descriptions of these potential regulatory changes appear in chapter two; and the environmental consequences of these regulatory changes are analyzed in chapter five.

A notice will be published in the Federal Register to alert the public of both the availability of the joint DMP/DEIS as well as the opening of a public comment period. Written public comments can be submitted via e-mail, fax, phone or letter. Oral public comments can be submitted at any of the several public hearings that ONMS will hold in the region. For more information on these public hearings or on how to submit public comments, in addition to all the documents developed for the management plan review, please visit the sanctuary's management plan website at: http://fagatelebay.noaa.gov/html/management_plan.html.

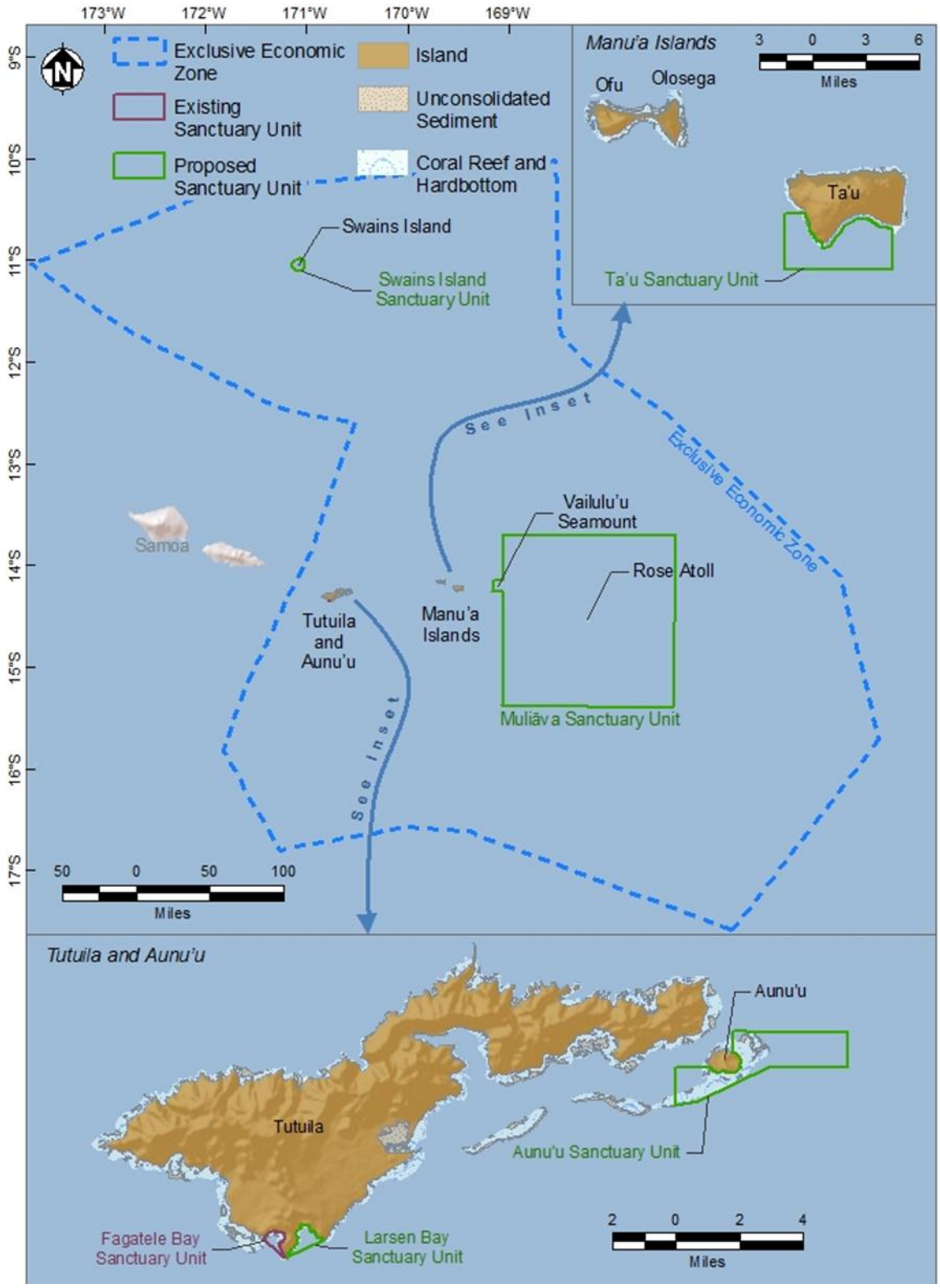

Figure ES-1: Map of the Samoan Archipelago with Proposed Sanctuary Units for the preferred alternative.

Fagatele Bay

Under the preferred alternative, the unit would retain the same boundaries as that under No Action, although Zone A (most fishing prohibited) and Zone B (commercial fishing allowed) would be removed as the entire unit would be designated no-take (Figure ES-2).

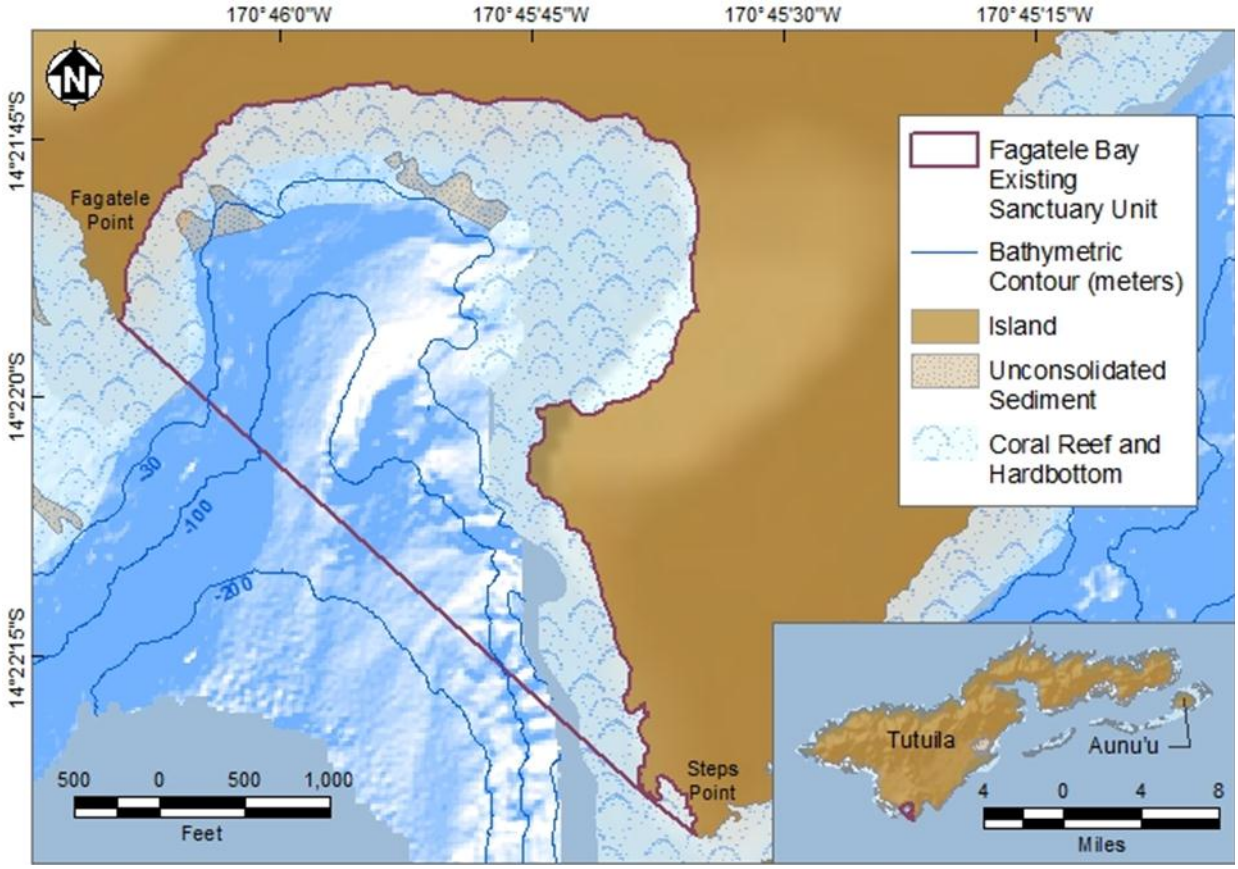

Figure ES-2: Alternative 3 Boundaries of the Fagatele Bay Unit.

Muliāva

Under the preferred alternative, the unit would encompass the marine portions of the Rose Atoll Marine National Monument, with an extension of the northwestern boundary to include 59.8 square miles (154.9 square km) of waters surrounding the Vailulu'u Seamount. The unit would not overlay the Rose Atoll National Wildlife Refuge (Figure ES-3).

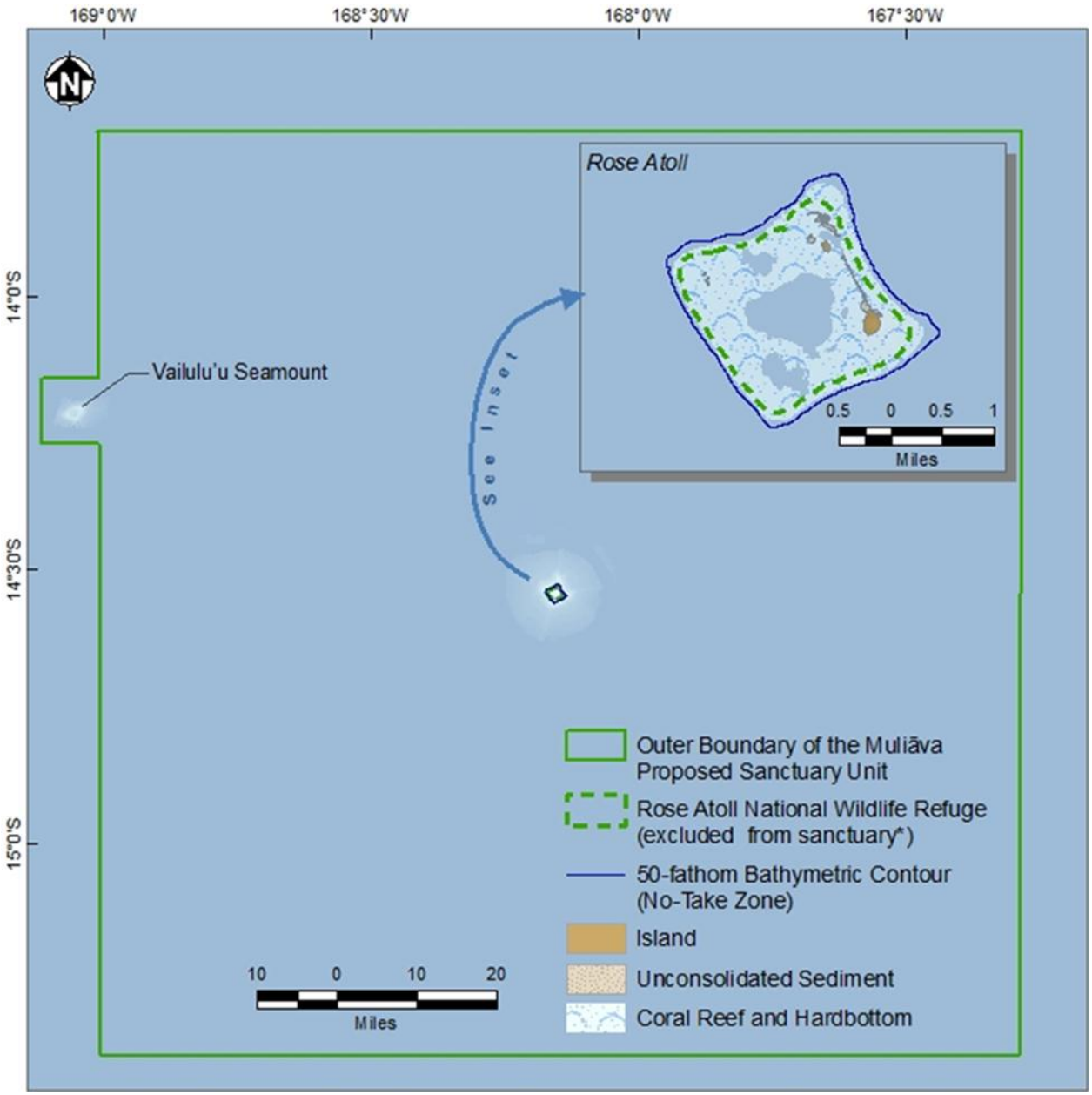

Figure ES-3: Alternative 3 Boundaries of the Muliāva Unit Including the Vailulu'u Seamount.
*this line represents both the seaward boundary of the NWR and the landward boundary of the proposed Muliāva Unit

Larsen Bay

Under the preferred alternative, the unit would encompass both Fagalua and Fogama'a Bays adjacent to Fagatele Bay (Figure ES-4).

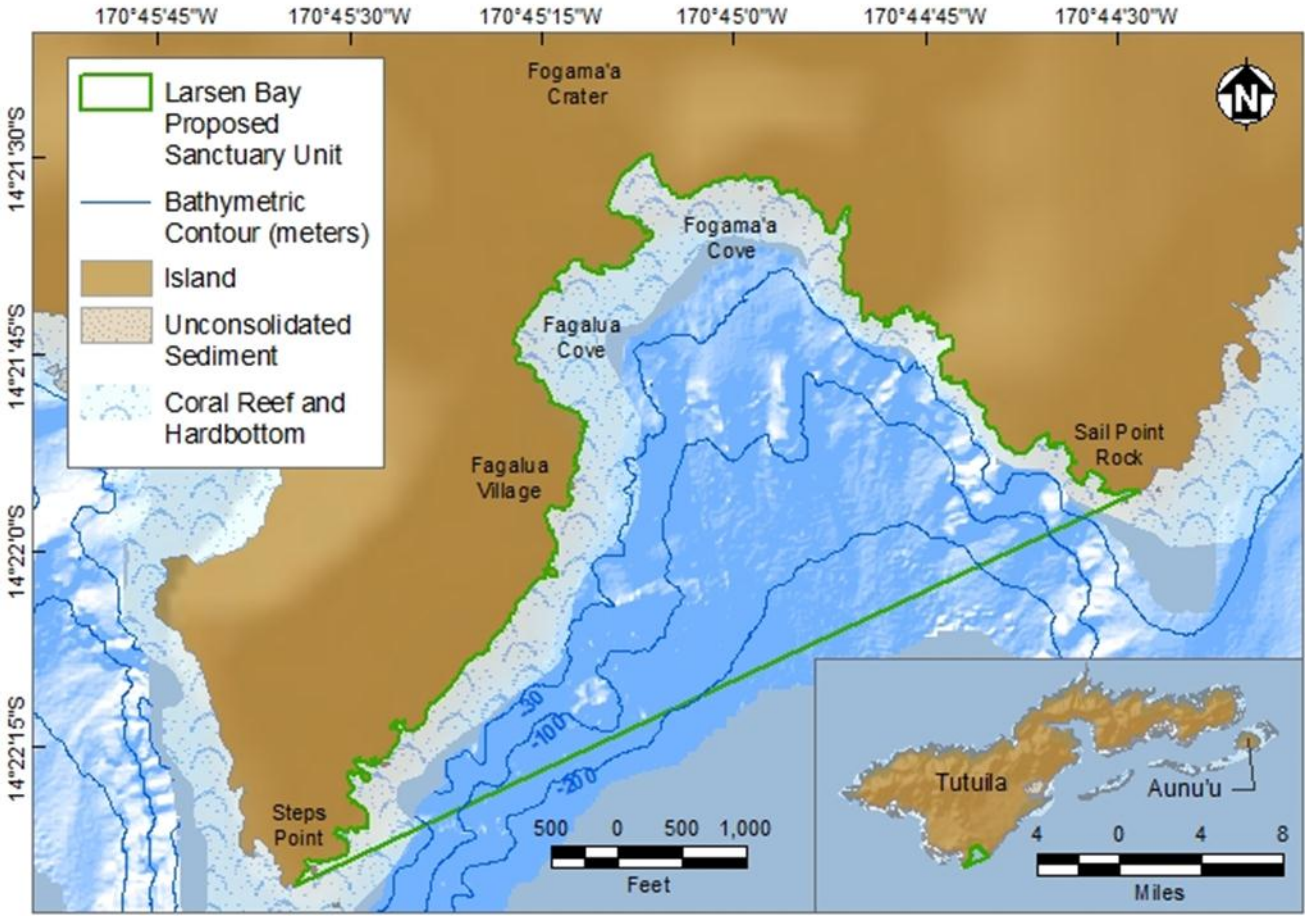

Figure ES-4: Alternative 3 Boundaries of the Larsen Bay Unit.

Aunu'u Island

Under the preferred alternative, the unit would border the island on three sides, with the southern border approximating the 30-meter isobath, while extending almost to the boundary of federal waters 3 nm to the east of Aunu'u (Figure ES-5). The eastern area of the proposed unit was identified as a suitable potential research zone, and would be no-take for all resources.

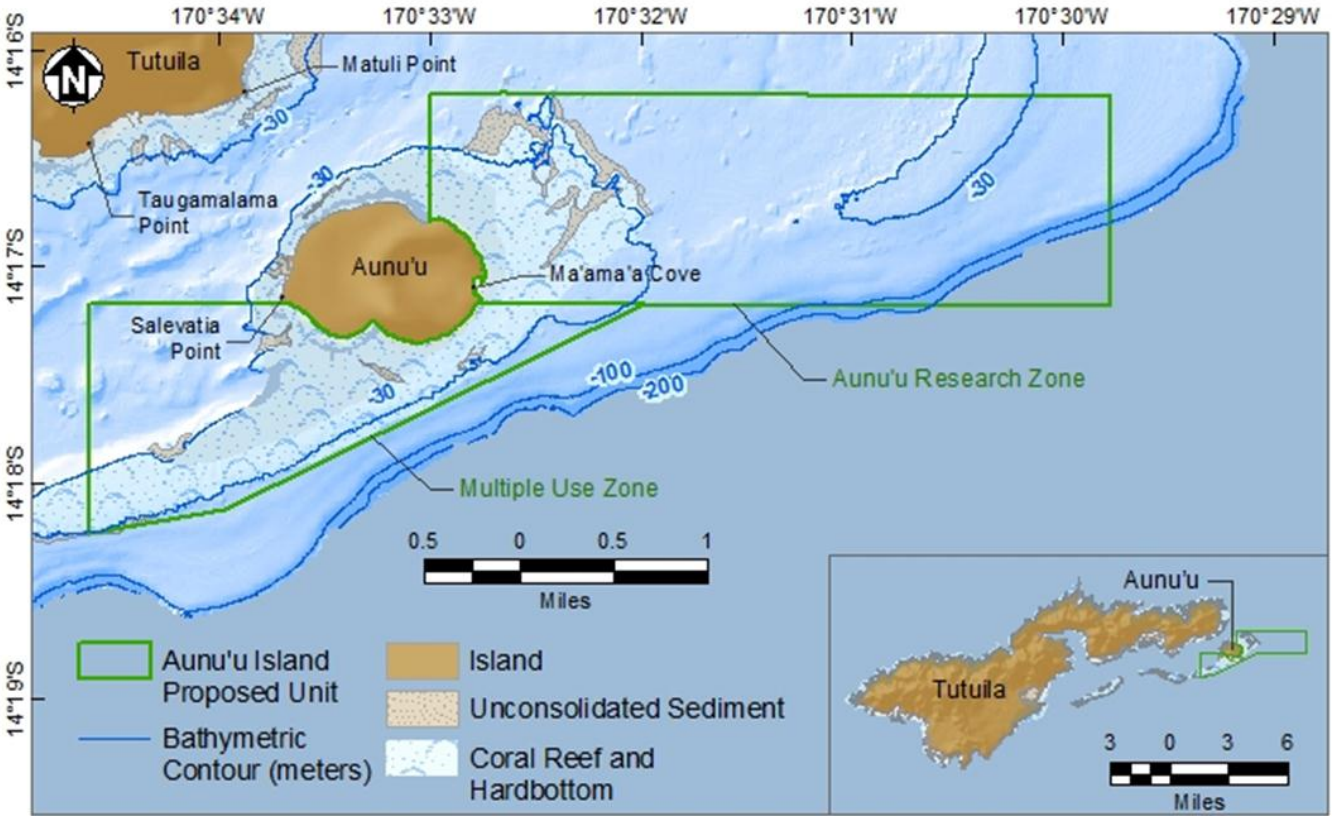

Figure ES-5: Alternative 3 Boundaries of the Aunu'u Island Unit.

Ta'u Island

Under the preferred alternative, the Ta'u unit would include nearshore waters along the western coast, extending approximately one nm seaward from Vaita Point. Along the southern coast, the sanctuary would extend 1 nm from the seaward boundary of the NPAS at Si'ufa'alele Point, extending along that parallel until reaching due south of Si'u Point. The inner boundary along the southern coast between Si'ufa'alele Point and Si'u Point would be adjacent to the nearshore waters of the NPAS, which extends 0.25 nautical miles from shore (Figure ES-6).

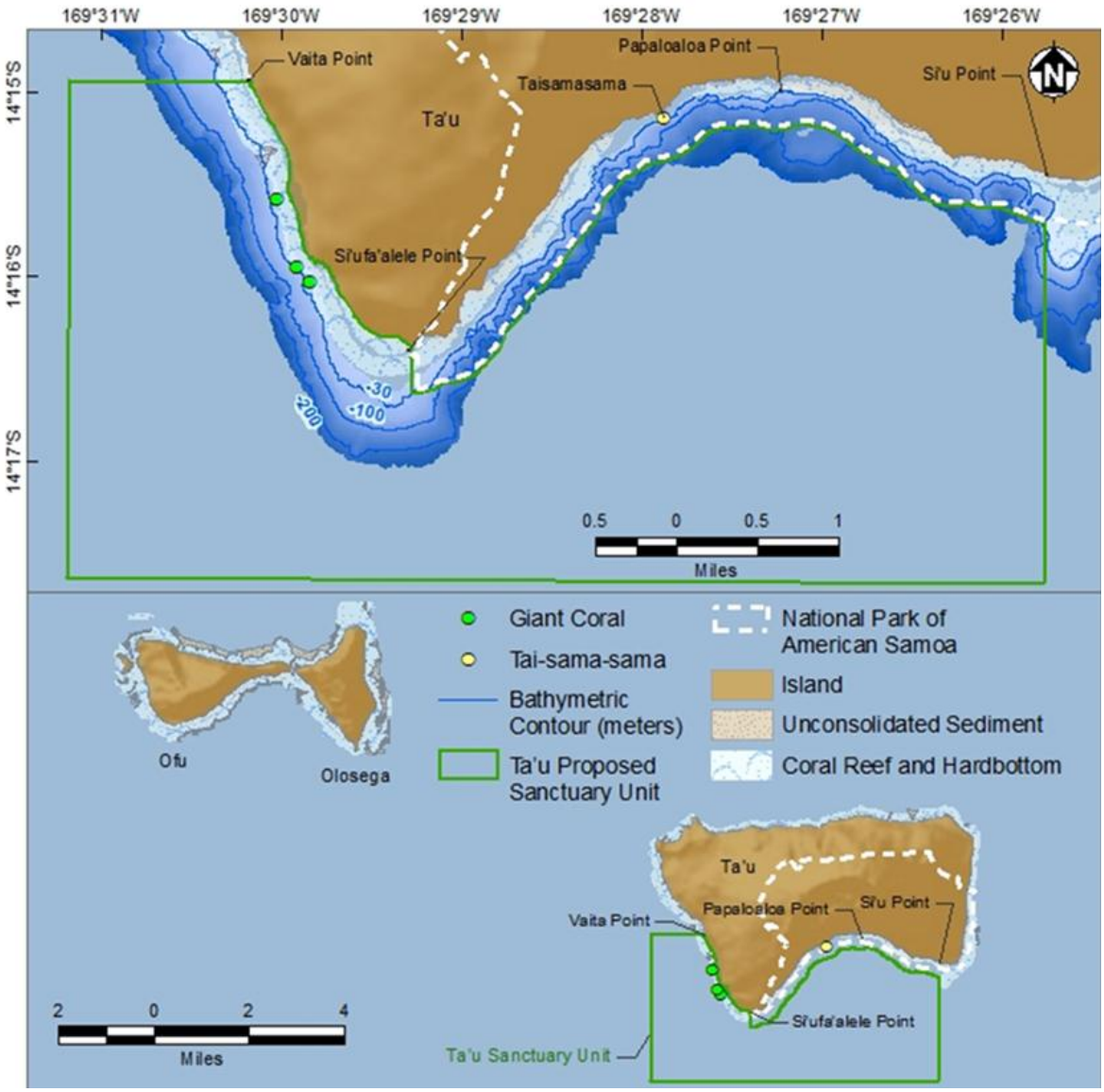

Figure ES-6: Alternative 3 Boundaries of the Ta'u Island Unit.

Swains Island

Under the preferred alternative, the unit would include territorial waters within a 3 nm circle of the island (Figure ES-7). The boundary overlays the territorial waters boundary for the island.

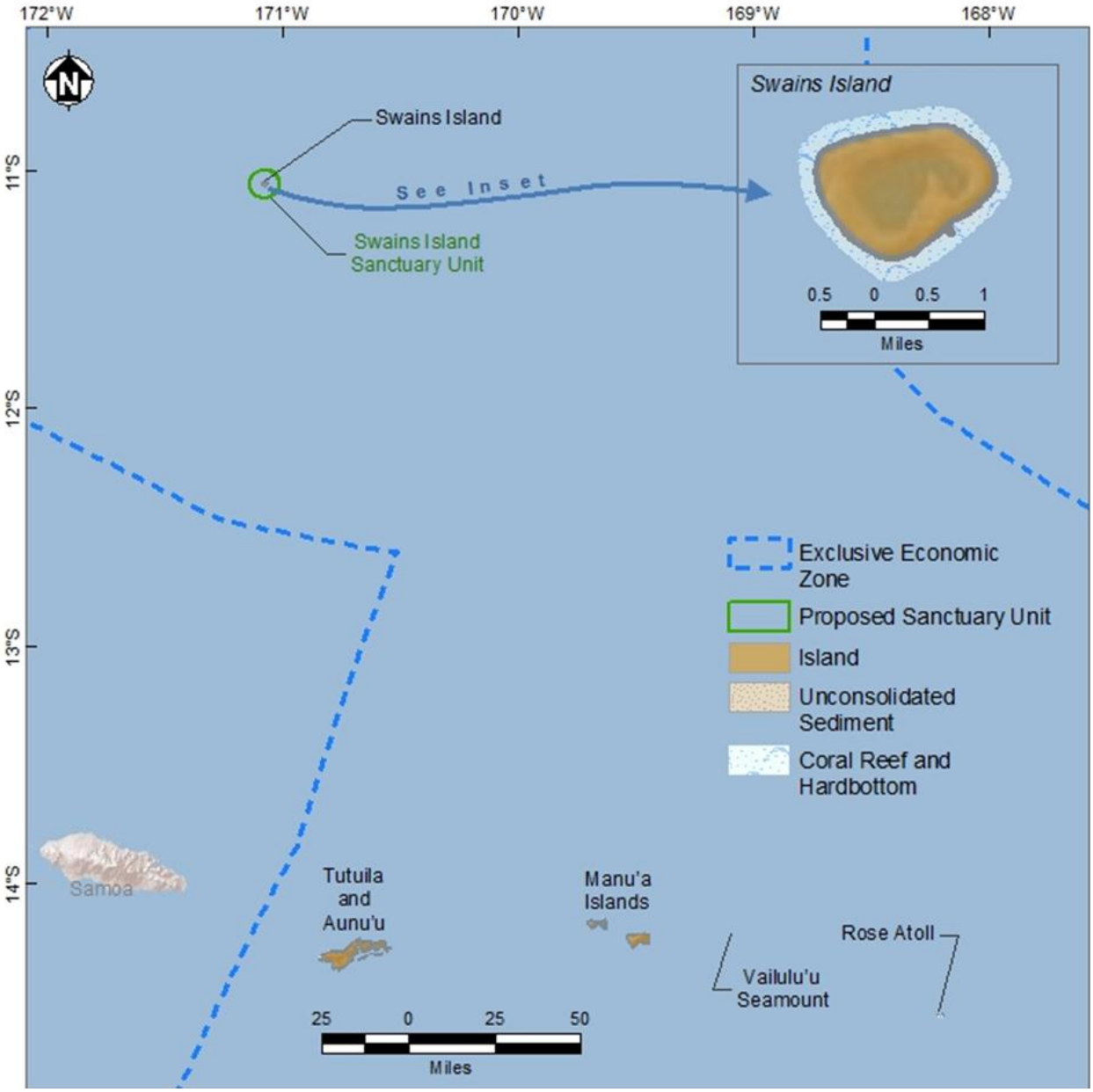

Figure ES-7: Alternative 3 Boundaries of the Swains Island Unit.

TABLE OF CONTENTS

EXECUTIVE SUMMARY....ES-1
Acronyms....xi
1.0 INTRODUCTION AND OVERVIEW....1
1.1 Fagatele Bay National Marine Sanctuary....4
1.2 Sanctuary Management Plan Review....6
1.2.1 The Sanctuary Advisory Council....8
1.2.2 Review of Sanctuary Goals....10
1.2.3 Sanctuary Accomplishments....11
1.2.4 Condition of Sanctuary Resources....18
1.3 The Environmental Impact Statement and Management Plan....20
1.4 Purpose and Need....20
1.4.1 Need for Action....20
1.4.2 Purpose of Action....23
1.5 Considerations in Developing the Proposed Action and Alternatives....24
1.6 Proposed Action....30
1.6.1 New Sanctuary Name....31
1.6.2 Addition of Sanctuary Units....31
1.6.3 Revision of Sanctuary Regulations....34
2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION....37
2.1 Alternative Development Process....37
2.1.1 Alternatives Considered but Eliminated....38
2.1.2 Selection of Alternatives....40
2.2 Description of Alternatives....47
2.2.1 No Action....47
2.2.2 Alternative 1 – Update Sanctuary Management Plan....47
2.2.3 Alternative 2 – Designation of Muliāva (Rose Atoll Marine National Monument)....50
2.2.4 Alternative 3 (A and B) – Multi-village Sanctuary Unit Expansion....53
2.2.5 Alternative 4 – Multi-village Sanctuary Unit Expansion with Buffer Zones and Additional Regulations....62
2.3 Comparison of Alternatives....69
3.0 AFFECTED ENVIRONMENT....75
3.1 American Samoa....75
3.1.1 Physical Setting....75
3.1.2 Biological Setting....90
3.1.3 Human Setting....101
3.1.4 Socioeconomic, Demographic, and Environmental Justice Resources....135
3.1.5 Institutional Setting....142

3.1.6 Operational Setting 149
3.2 Site-Specific Affected Environment 151
3.2.1 Fagatele Bay 151
3.2.2 Larsen Bay 157
3.2.3 Aunu'u Island 161
3.2.4 Ta'u Island 165
3.2.5 Muliāva (Rose Atoll) 172
3.2.6 Swains Island 177
4.0 ACTION PLANS 183
4.1 Cultural Heritage and Community Engagement Action Plan 189
4.1.1 Overview 189
4.1.2 Issues and Need for Action 190
4.1.3 Addressing the Issues – Strategies for this Action Plan 194
4.1.4 Addressing the Issues – Strategies from other Action Plans 203
4.1.5 Addressing the Issues – Regulations 204
4.2 Marine Conservation Science Action Plan 205
4.2.1 Overview 205
4.2.2 Issues and Need for Action 205
4.2.3 Addressing the Issues – Strategies for this Action Plan 208
4.2.4 Addressing the Issues – Strategies from other Action Plans 213
4.2.5 Addressing the Issues – Regulations 214
4.3 Climate Change Action Plan 216
4.3.1 Overview 216
4.3.2 Issues and Need for Action 216
4.3.3 Addressing the Issues – Strategies for this Action Plan 217
4.3.4 Addressing the Issues – Strategies from other Action Plans 224
4.3.5 Addressing the Issues – Regulations 224
4.4 Operations and Administration Action Plan 225
4.4.1 Overview 225
4.4.2 Issues and Need for Action 225
4.4.3 Addressing the Issue – Strategies for this Action Plan 228
4.4.4 Addressing the Issues – Strategies from other Action Plans 232
4.4.5 Addressing the Issues – Regulations 233
4.5 Ocean Literacy Action Plan 234
4.5.1 Overview 234
4.5.2 Issues and Need for Action 236
4.5.3 Addressing the Issues – Strategies for this Action Plan 238
4.5.4 Addressing the Issues – Strategies from other Action Plans 247
4.5.5 Addressing the Issues – Regulations 248
4.6 Resource Protection and Enforcement Action Plan 249

4.6.1 Overview 249
4.6.2 Issues and Need for Action 249
4.6.3 Addressing the Issues – Strategies for this Action Plan 255
4.6.4 Addressing the Issues – Strategies from other Action Plans 264
4.6.5 Addressing the Issues – Regulations 265
4.7 Partnerships and Interagency Cooperation Action Plan 266
4.7.1 Overview 266
4.7.2 Issues and Need for Action 270
4.7.3 Addressing the Issues – Strategies for this Action Plan 271
4.7.4 Addressing the Issues – Strategies from other Action Plans 276
4.7.5 Addressing the Issues – Regulations 276
4.8 Program Evaluation Action Plan 277
4.8.1 Overview 277
4.8.2 Issues and Need for Action 279
4.8.3 Addressing the Issues – Strategies for this Action Plan 279
4.8.4 Performance Measures 280
4.8.5 Addressing the Issues – Strategies from other Action Plans 287
4.8.6 Addressing the Issues – Regulations 287
5.0 ENVIRONMENTAL CONSEQUENCES 289
5.1 Introduction 289
5.1.1 Impact Methodology 290
5.1.2 Factors Considered in Determining Significance of Impacts 294
5.1.3 Resources not Analyzed 298
5.1.4 Organization of Alternative Analysis 299
5.1.5 Summary of Impacts 300
5.2 No Action 305
5.2.1 Physical and Biological Environment 305
5.2.2 Human Environment 307
5.2.3 Socioeconomic Environment 307
5.3 Alternative 1: Update Sanctuary Management Plan 308
5.3.1 Cultural Heritage and Community Engagement Action Plan 309
5.3.2 Marine Conservation Science Action Plan 310
5.3.3 Climate Change Action Plan 310
5.3.4 Operations and Administration Action Plan 311
5.3.5 Ocean Literacy Action Plan 311
5.3.6 Resource Protection and Enforcement Action Plan 312
5.3.7 Partnerships and Interagency Cooperation Action Plan 313
5.3.8 Program Evaluation Action Plan 313
5.4 Alternative 2: Designation of Muliāva (Rose Atoll Marine National Monument) 313
5.4.1 Action: Inclusion of Additional Unit (Muliāva) into Sanctuary Network 314

5.4.2 Action: Discharge Prohibition 316
5.4.3 Action: Anchoring Prohibition and Other Benthic Habitat Protection 318
5.4.4 Other Actions 322
5.5 Alternative 3: Multi-village Sanctuary Unit Expansion 323
5.5.1 Action: Inclusion of Additional Units into Sanctuary Network 323
5.5.2 Action: Discharge Prohibition 327
5.5.3 Actions: Anchoring Prohibition and Other Benthic Habitat Protection 330
5.5.4 Actions: Fishing Restrictions 334
5.5.5 Action: Other Regulations 344
5.6 Alternative 4: Multi-village Sanctuary Unit Expansion with Buffer Zones and Additional Regulations 345
5.6.1 Action: Extended Boundaries for the Aunu'u Island, Swains Island, Ta'u Island, and Muliāva Units, Including Overlays of Other Federal MPAs 345
5.6.2 Action: Additional Fishing Regulations 349
6.0 CUMULATIVE PROJECTS AND IMPACTS 357
6.1 Cumulative Methodology 357
6.2 Past, Present, and Reasonably Foreseeable Future Projects 358
6.3 Summary of cumulative effects 370
7.0 REFERENCES AND SOURCES CONSULTED 371
INDEX 421

LIST OF FIGURES

Figure 1-1: The National Marine Sanctuary System. 1
Figure 1-2: Summary of Conditions in the Fagatele Bay Unit from the 2007 FBNMS Condition Report ... 19
Figure 1-3: Proposed American Samoa National Marine Sanctuary Network..... 33
Figure 2-1: Map of the Samoan Archipelago with Proposed Sanctuary Units Identified. 42
Figure 2-2: Alternative 1 Boundaries of the Fagatele Bay Unit. 48
Figure 2-3: Alternative 2 Boundaries of the Muliāva Unit. 51
Figure 2-4: Alternative 3 Boundaries of the Fagatele Bay Unit. 54
Figure 2-5: Alternative 3 Boundaries of the Muliāva Unit Including the Vailulu'u Seamount. 55
Figure 2-6: Alternative 3 Boundaries of the Larsen Bay Unit. 56
Figure 2-7: Alternative 3 Boundaries of the Aunu'u Island Unit. 57
Figure 2-8: Alternative 3 Boundaries of the Ta'u Island Unit. 58
Figure 2-9: Alternative 3 Boundaries of the Swains Island Unit. 59
Figure 2-10: Alternative 4 Boundaries of the Aunu'u Island Unit Including Federal Waters. 63
Figure 2-10: Alternative 4 Boundaries of the Aunu'u Island Unit Including Federal Waters. 63
Figure 2-11: Alternative 4 Boundaries of the Ta'u Island Unit including NPAS overlay. 64
Figure 2-11: Alternative 4 Boundaries of the Ta'u Island Unit including NPAS overlay. 64
Figure 2-12: Alternative 4 Boundaries of the Swains Island Unit Including Federal Waters. 65
Figure 2-13: Alternative 4A Boundaries of the Muliāva Unit Including 12 nm No-Take Zone. 67
Figure 2-14: Alternative 4B Boundaries of the Muliāva Unit Overlapping the NWR. 69
Figure 3-1: Samoan Archipelago, with Rose Atoll and Swains Island. 75
Figure 3-2: Schematic of Atoll Formation. 77
Figure 3-3: Map of American Samoan Archipelago Identifying the 41 Watersheds of the Island 80
Figure 3-4: Schematic Diagram of Reef and Slope Features. 87
Figure 3-5: Sanctuary Staff Organization Chart. 150
Figure 3-6: Fagatele Bay. 152
Figure 3-7: Fagatele Bay Benthic Habitats. 153
Figure 3-8: Fagatele Bay Benthic Zones. 154
Figure 3-9: Larsen Bay Benthic Habitats. 158
Figure 3-10: Larsen Bay Benthic Zones. 159
Figure 3-11: Aunu'u Benthic Habitats. 162
Figure 3-12: Aunu'u Benthic Zones. 163
Figure 3-13: Ta'u Benthic Zones. 167
Figure 3-14: Ta'u Benthic Habitats. 168
Figure 3-15: Rose Atoll Benthic Habitats. 173
Figure 3-16: Rose Atoll Benthic Zones. 174
Figure 3-17: Swains Island Habitat Zones. 178
Figure 3-18: Swains Island Benthic Zones. 179

Figure 4-1: Relationship between Action Plan Components and the Overarching Management Framework 183
Figure 4-2: Adaptive Management Cycle to Inform Management Decision Making. 185
Figure 4-3: ONMS Performance Measure Logic Model. 278
Figure 6-1: American Samoa Marine Protected Network. 367

LIST OF TABLES

Table 1: Legal requirements for the DMP/DEIS. ii
Table 1-1: Sanctuary Advisory Council Membership. 9
Table 1-2: Comparison of 1984 and New Management Plans 28
Table 1-3: Summary of Sanctuary Unit Key Attributes. 32
Table 2-1: Proposed Alternative 2 Regulations. 52
Table 2-2: Proposed Alternative 3 Regulations. 60
Table 2-3: Regulatory Differences between Alternatives 71
Table 2-4: Physical and Administrative Differences between Alternatives. 73
Table 3-1: Coral Reef Fish Stock Size. 96
Table 3-2: American Samoa Final 2011 List of Fisheries Categorizations. 115
Table 3-3: 2000 Population Estimates. 137
Table 3-4: Employment Status and Occupation by Industry. 138
Table 3-5: Coral Reef Annual Values ($ per year). 141
Table 3-6: Ethnic Origin. 143
Table 4-1: Total Estimated Costs to Fully Implement Action Plans by Year (excluding new vessel). 187
Table 4-2: Total Estimated Costs of New Vessel Procurement, Operations and Maintenance by Year. 188
Table 4-3: Summary of Strategies and Activities for the Cultural Heritage and Community Engagement Action Plan. 202
Table 4-4: Summary of Strategies and Activities for the Marine Conservation Science Action Plan. 213
Table 4-5: Summary of Strategies and Activities for the Climate Change Action Plan. 223
Table 4-6: Summary of Strategies and Activities for the Operations and Administration Action Plan. 232
Table 4-7: Summary of Strategies and Activities for the Ocean Literacy Action Plan. 246
Table 4-8: Summary of Strategies and Activities for the Resource Protection and Enforcement Action Plan. 263
Table 4-9: Summary of Strategies and Activities for the Partnerships and Interagency Cooperation Action Plan. 276
Table 4-10: Performance Measures for the Cultural Heritage and Community Engagement Action Plan. 281
Table 4-11: Performance Measures for the Marine Conservation Science Action Plan. 282
Table 4-12: Performance Measures for the Climate Change Action Plan. 283
Table 4-13: Performance Measures for the Operations and Administration Action Plan. 284
Table 4-14: Performance Measures for the Ocean Literacy Action Plan. 285
Table 4-15: Performance Measures for the Resource Protection and Enforcement Action Plan. 286
Table 4-16: Summary of Strategies and Activities for the Program Evaluation Action Plan. 287
Table 5-1: Resources not Analyzed. 298
Table 5-2: Summary of Potential Resource Impacts. 303
Table 5-3: Reef Habitat and Associated Near Shore Commercial Fishery Economic Value. 343
Table 5-4: Alternative 4 Boundary Expansion Qualities. 346

Table 6-1: Cumulative Projects – Marine Protected Areas. 359
Table 6-2: Cumulative Projects – Infrastructure. 370

APPENDICES

Appendix A Glossary
Appendix B List of Agencies

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Acronyms

AI	Aunu'u Island
AOP	Annual Operating Plan
AS DMWR	American Samoa Department of Marine and Wildlife Resources
AS DOC	American Samoa Department of Commerce
ASCA	American Samoa Code Annotated
ASCC	American Samoa Community College
ASCMP	American Samoa Coastal Management Program
ASDOE	American Samoa Department of Education
AS-EPA	American Samoa Environmental Protection Agency
ASG	American Samoa Government
ASHPO	American Samoa Historic Preservation Office
ASPA	American Samoa Power Authority
ASRAMP	American Samoa Reef Assessment and Monitoring Program
ASVB	American Samoa Visitor's Bureau *used as citation only
AUVs	autonomous underwater vehicles
CALM	Consolidated Assessment and Listing Methodology
CFMP	Community-based Fisheries Management Program
CFR	Code of Federal Regulations
CH&CE	Cultural Heritage & Community Engagement
CLIP	Climate Leadership In Parks
cm	centimeters
CMT	Customary Marine Tenure
CO_2	Carbon dioxide
COPPS	Community-Oriented Policing and Problem Solving
CoRTAD	Coral Reef Temperature Anomaly Database
CRAG	Coral Reef Advisory Group
CRCP	Coral Reef Conservation Program
CRED	NOAA Coral Reef Ecosystem Division
CRTF	U.S. Coral Reef Task Force
CWA	Clean Water Act
DEIS	draft environmental impact statement
DMP	draft management plan
DMWR	Department of Marine and Wildlife Resources
DOPAA	description of the proposed action and alternatives
EEZ	exclusive economic zone
EIS	environmental impact statement
ENSO	El Niño and Southern Oscillation
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act

FB	Fagatele Bay
FBNMS	Fagatele Bay National Marine Sanctuary
FEP	fishery ecosystem plan
FMP	Fishery Management Plan
FOIA	Freedom of Information Act
FR	Federal Register
FTE	full time equivalent
GIS	geographic information systems
GPS	Global positioning system
HPO	Historic Preservation Office
ICS	Incident Command System
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature *used as citation only
JEA	Joint Enforcement Agreement
km	Kilometer
LAS	local action strategies
LB	Larsen Bay
LME	Large Marine Ecosystem
m	meters
M/V	Merchant vessel
MCS	Marine Conservation Science
MMPA	Marine Mammal Protection Act
MNM	Marine National Monument
MNRE	Ministry of Natural Resources & Environment
MOA	memorandum of agreement
MOP	Marine Options Program
MPA	marine protected area
MPR	management plan review
MSD	Marine Sanitation Device
NCCOS	National Centers for Coastal Ocean Science
NEPA	National Environmental Policy Act
NGO	Non-governmental organization
nm	nautical mile
NMS	National Marine Sanctuary
NMSA	National Marine Sanctuaries Act
NMSP	National Marine Sanctuaries Program *used as citation only
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPAS	National Park of American Samoa
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NWR	National Wildlife Refuge

O&A	Operations and Administration
OCRM	Office of Ocean and Coastal Resource Management *used as citation only
OL	Ocean Literacy
OLE	Office for Law Enforcement
ONMS	Office of National Marine Sanctuaries
OSA	Office of Samoan Affairs
OSPREY	Online Sanctuary Permitting, Reporting, and Evaluation System
P&IC	Partnerships & Interagency Cooperation
PacIOOS	Pacific Islands Ocean Observing System
PBR	Potential Biological Removals
PE	Program Evaluation
PIFSC	Pacific Island Fisheries Science Center
PIR	Pacific Islands Region
PIRO	NOAA Pacific Islands Regional Office
R/V	research vessel
RA	Rose Atoll
REEF	Reef Environmental Education Foundation
ROI	region of influence
ROVs	remotely operated vehicles
RP&E	Resource Protection & Enforcement
RUST	Resources and UnderSea Threats
S.M.A.R.T.	Specific, Measurable, Achievable, Realistic and Time-bounded
SCUBA	self contained underwater breathing apparatus
SEA	Sea Education Association
SHIELDS	Sanctuaries Hazardous Incident Emergency Logistics Database System
SI	Swains Island
SOC	Student Ocean Council
SOPs	standard operating procedures
SOS®	Science On a Sphere
SPICE	Sustainability in Polynesian Island Cultures and Environments
SPREP	South Pacific Region Environment Program
SST	Sea Surface Temperature
TI	Ta'u Island
U.S.C.	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
US DOC	U.S. Department of Commerce
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey **used as citation only
WPacFin	Western Pacific Fishery Information Network * used as a citation only
WPFMC	Western Pacific Fishery Management Council

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Fa'a-Samoa – The Samoan Way

While American Samoa is the place where the sanctuary is physically located, *fa'a-Samoa* is the cultural context for all sanctuary activities and functions. *Fa'a-Samoa* is the traditional Samoan lifestyle, or way of life. It is the foundation of Polynesia's oldest culture – dating back some 3,000 years. It places great importance on the dignity and achievements of the group rather than on individual achievements. The traditional communal lifestyle revolves around the *aiga*, or family. *Aiga* are headed by leading *matai* (chief) or *Sa'o*, who manage the communal economy, protect and distribute family lands, are responsible for the welfare of all in their *aiga*, and represent the family in councils (U.S. Department of Commerce 1984).

The ONMS and Fagatele Bay National Marine Sanctuary place a high value on partnerships with sanctuary communities and maintain great respect for *fa'a-Samoa*. In American Samoa, the sanctuary-*matai* relationship is critical to the success of this partnership. The American Samoa Department of Commerce and Office of Samoan Affairs help facilitate the sanctuary's community consultations in a manner that is culturally appropriate and respectful of *fa'a-Samoa*. This work includes consultations with *saofa'iga ale nuu* (village council meeting) and individual *matai*.

1.0 INTRODUCTION AND OVERVIEW

This chapter introduces the management plan and environmental impact statement (EIS). It provides overviews of the National Marine Sanctuary System, Fagatele Bay National Marine Sanctuary, and proposed revisions to this sanctuary as the American Samoa National Marine Sanctuary. It addresses Office of National Marine Sanctuaries (ONMS) authorization and sanctuary designation. It also describes the management plan review process and the role of the sanctuary advisory council.

The National Marine Sanctuary System

The National Marine Sanctuary System includes 13 national marine sanctuaries and one marine national monument, encompassing more than 290,000 square miles of ocean and Great Lakes waters from Washington State to the Florida Keys, and from New England to American Samoa (see Figure 1-1). They range in size from 0.25 square miles for the Fagatele Bay National Marine Sanctuary (NMS), to more than 134,000 square miles at the Papahānaumokuākea Marine National

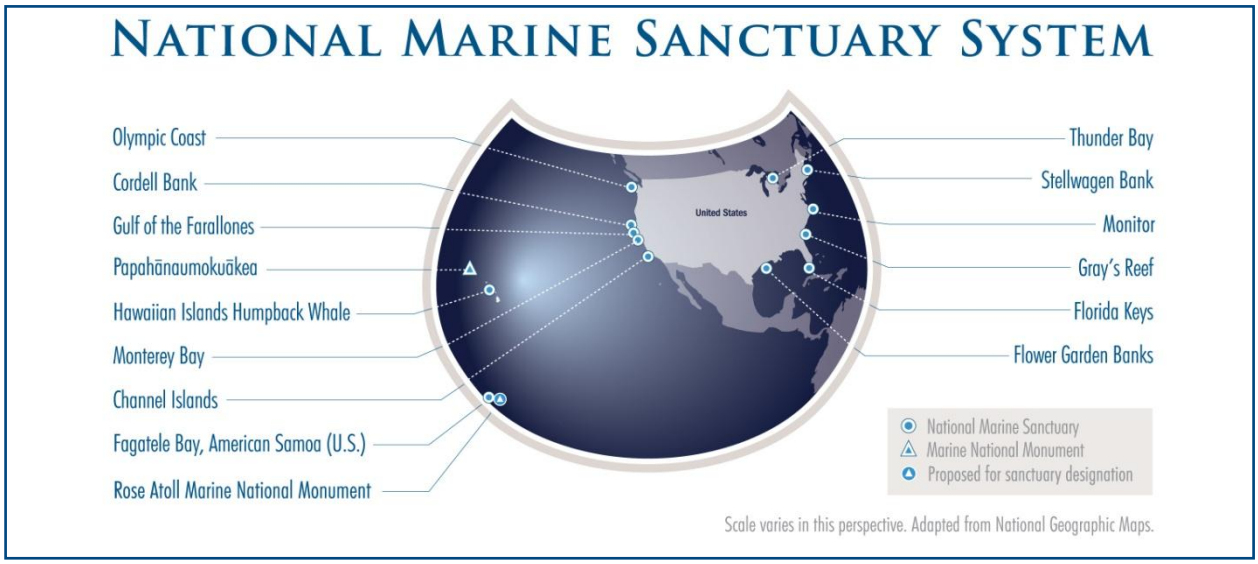

Figure 1-1: The National Marine Sanctuary System.

National Oceanic and Atmospheric Administration (NOAA)

Mission: Science, Service and Stewardship:

- *To understand and predict changes in climate, weather, oceans and coasts*
- *To share that knowledge and information with others, and*
- *To conserve and manage coastal and marine ecosystems and resources*

Vision: healthy ecosystems, communities and economies that are resilient in the face of change (NOAA 2010b).

The ONMS is part of NOAA, which conducts research and gathers data about the global oceans, atmosphere, space and sun, and applies this knowledge to science and service that touch the lives of all Americans (www.noaa.gov). In doing so, NOAA warns of dangerous weather, charts the nation's seas and skies, guides the use and protection of ocean and coastal resources, and conducts research to improve the collective understanding and stewardship of the environment that sustains the nation.

Monument (MNM), located in the northwest Hawaiian Archipelago.

National marine sanctuaries are special areas set aside for long-term protection and conservation and are part of our nation's legacy to future generations. Effectively the marine equivalents to our national parks, sanctuaries are an essential part of this country's collective environmental riches. They contain deep ocean habitats of resplendent marine life, kelp forests, coral reefs, whale migration corridors, deep-sea canyons, historically significant shipwrecks, and other underwater archaeological sites. Each sanctuary is a unique place worthy of special protection. Because they serve as natural classrooms, cherished recreational spots and places for valuable commercial activities, national marine sanctuaries represent many things to many people.

Office of National Marine Sanctuaries

ONMS, formerly the National Marine Sanctuary Program, serves as the trustee for the National Marine Sanctuary System and is an office within the National Ocean Service (NOS) of NOAA (see sidebar). The mission of ONMS is to identify, protect, conserve, and enhance the natural and maritime heritage resources, values, and qualities of the National Marine Sanctuary System for this and future generations throughout the nation.

The National Marine Sanctuaries Act

The National Marine Sanctuaries Act (NMSA) (16 U.S.C. 1431 et seq.) is the organic legislation governing ONMS.[1] The NMSA authorizes the Secretary of Commerce to designate as national marine sanctuaries, areas of the marine environment or Great Lakes with special national significance based on their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational or esthetic qualities. The primary objective of the NMSA is to protect sanctuary resources. The NMSA also focuses on education, public outreach and research.

Photo 1: Coral reef ecosystem at Swains Island, American Samoa. NOAA CRED Photo.

Comprehensive, Ecosystem Based Management of National Marine Sanctuaries

The NMSA states that the National Marine Sanctuary Program (now ONMS) shall "maintain for future generations the habitat and ecological services of the natural assemblage of living resources that inhabit [sanctuaries]" (16 U.S. Code [U.S.C.] 1431 et seq., 301(a)(4)(A),(C)). The NMSA further recognizes that "while the need to control the effects of particular activities has led to enactment of resource-specific legislation, these laws cannot in all cases provide a coordinated and comprehensive approach to the conservation and management of the marine environment" (16 U.S.C. 1431 et seq., 301(a) (3)). Accordingly, ONMS subscribes to a broad and comprehensive ecosystem based management approach to meet the NMSA's primary objective of resource protection.

The NMSA was the first legislation to focus on comprehensive and area-specific protection of the marine environment, and national marine sanctuaries use an ecosystem based management approach that focuses on the maintenance of high levels of biodiversity to meet the NMSA's primary objective of resource protection.

The NMSA is unique in that it allows management actions focused on the protection and conservation of the full spectrum of biological diversity at a unique and significant site (*e.g.*, the

[1] See www.sanctuaries.noaa.gov/about/legislation/.

sanctuary in American Samoa) and can serve as an important complement to other laws and regulations. Sanctuaries can consider an array of management measures (*e.g.*, zoned use within designated areas) to maintain "natural biological communities." By including the broad mandate "to protect, and where appropriate, restore and enhance natural habitats, populations, and ecological processes," the NMSA highlights its purpose to provide protection of overall biodiversity in these special areas. In specifying the management of "natural biological communities," "natural assemblages of living resources," and "natural habitats" rather than focusing on a particular specie or issue *per se*, national marine sanctuaries can be managed to broadly protect and conserve biodiversity. This comprehensive management approach differs from many other laws and regulations, which tend to address specific problems or resource issues such as water quality, endangered species, or particular fishery stocks, but are not really geared to consider management of human uses as they affect the whole ecosystem. Given the unique roles that sanctuaries can play in overall resource conservation and management, it is reasonable to anticipate that the management plan would advocate for a higher level of conservation in these "special places" than would be found elsewhere in American Samoa.

1.1 FAGATELE BAY NATIONAL MARINE SANCTUARY

Photo 2: Fagatele Bay is located on the southwestern shore of Tutuila Island and is surrounded by steep, volcanic ridges.

The text below briefly introduces Fagatele Bay National Marine Sanctuary, while subsequent sections of this document describe the existing and proposed sanctuary and surrounding region in detail. Any introduction to the sanctuary would be incomplete without also introducing Samoan culture. ONMS co-manages the sanctuary with the American Samoa Government and works closely with communities adjacent to the sanctuary (see the Cultural Heritage & Community Engagement Action Plan), all within the context of Samoan cultural traditions and practices. *Fa'a-Samoa*, the Samoan way of life, is highlighted in the sidebar on the first page of this chapter, and a detailed cultural description is in Chapter 3. When past sanctuary activities are discussed, the sanctuary is referred to by its original title, Fagatele Bay National Marine Sanctuary, while planned sanctuary activities refer to the sanctuary by its proposed new name, the American Samoa National Marine Sanctuary.

Photo 3: Fagatele Bay National Marine Sanctuary's extensive reefs include over 160 species of coral. NOAA CRED Photo.

In response to a proposal from the American Samoa Government, NOAA designated the sanctuary in 1986, among other reasons, "to protect and preserve an example of a pristine tropical marine habitat and coral reef terrace ecosystem of exceptional biological productivity" (49 Federal Regulations [FR] 47415). The sanctuary is located in the South Pacific Ocean in American Samoa, the only U.S. territory south of the equator. The territory is composed of five volcanic islands (Tutuila, Aunu'u, Ofu, Olosega, and Ta'u) and two small remote coral atolls (Rose Atoll and Swains Island). American Samoa has 393 square miles (1,018 square kilometers [km]) of territorial waters[2] and 155,900 square miles (403,780 square km) of Exclusive Economic Zone (EEZ)[3]. Fagatele Bay is located along the southwestern coast of Tutuila Island and is the smallest and most remote of the national marine sanctuaries as well as the only one in the Southern Hemisphere. The sanctuary encompasses 0.25 square miles (0.65 square km) of reef flat, shallow reef, and steep slopes plunging down to 600 feet (183 meters [m]) within a naturally protected bay surrounded by steep cliffs. The sanctuary is co-administered by NOAA and the American Samoa Department of Commerce (AS DOC) toward the purpose of achieving the set of four goals, discussed below under "Review of Sanctuary Goals."

The sanctuary's most prevalent feature is its extensive coral reef ecosystem. This ecosystem consists of a nearshore inner reef flat that slopes to a deeper water reef (reef slope) farther offshore. The reef crest, between the inner reef flat and outer reef slope, lies in extremely shallow water and is exposed during the lowest tides. Fagatele Bay's coral reefs provide habitat for at least 271 species of fishes (including damselfish, surgeonfish, wrasse, butterflyfish, and parrotfish), 168 species of coral, at least 1,400 species of algae and invertebrates (other than

[2] There are no territorial waters around Rose Atoll. Territorial waters by island are; Tutuila and Aunu'u - 192 square miles, Ofu and Olosega - 74 square miles, Ta'u - 86 square miles, Swains Island 41 square miles.

[3]The EEZ is a limit established in 1982 by the United Nations Convention on the Law of the Sea whereby a nation controls marine resources for a distance of 200 nautical miles from its shores.

coral). Marine mammals and sea turtles may also be found in or near the sanctuary and surrounding environs, including several dolphin species, humpback whales, and hawksbill and green sea turtles. Birds use the shore, rocky cliffs, and the heavily forested ridges that surround Fagatele Bay for nesting and feeding. In addition to birds, large colonies of fruit bats, also known as flying foxes, reside in the forest surrounding Fagatele Bay but are infrequently encountered in such numbers in other locations on Tutuila. (NMSP 2007)

Although remote sensing imagery and documentation of Fagatele Bay indicate that the sanctuary contains no large submerged archaeological artifacts, the sanctuary bears cultural significance. The site of at least one pre-historic village has been identified and mapped along the bay's shore (Gould *et al.* 1985). The shoreline also contains grinding holes or bait cups that ancient Samoans carved along the reef edge (VanTilburg 2007).

A full description of Fagatele Bay is provided in the individual site profiles for sanctuary units in Chapter 3.

1.2 SANCTUARY MANAGEMENT PLAN REVIEW

New challenges and opportunities emerge with time. For this reason, the NMSA requires periodic updating of sanctuary management plans to reevaluate site-specific goals and objectives and to develop management strategies and activities to ensure that each sanctuary properly conserves and protects its nationally significant living and cultural resources. Management plans are sanctuary-specific planning and management documents used by all national marine sanctuaries. Management plans fulfill many functions, including describing regulations and boundaries; outlining staffing and budget needs; setting priorities and performance measures for resource protection, research and education programs; and, guiding development of future budgets and management activities.

The sanctuary management plan review (MPR) process is based on three fundamental steps: (1) public scoping, which includes a formal comment period and public meetings to identify a broad range of issues and concerns related to management of the sanctuary; (2) analysis and prioritization of the issues raised during scoping, followed by development of action plans; and (3) preparation of the draft and final management plans and relevant National Environmental Policy Act (NEPA) documentation, such as an EIS or Environmental Assessment. Public review of the draft management plan (DMP) provides guidance for staff to revise the document and prepare the final management plan. Once approved by NOAA, the final management plan will outline the sanctuary's priorities for the next 5 to 10 years.

The original Fagatele Bay National Marine Sanctuary Management Plan was written as part of the sanctuary designation process and published in 1984 with the final EIS.[4] Many of the activities in the original management plan have been accomplished and help demonstrate the value the sanctuary provides to the community. This document is the sanctuary's new DMP and

[4]The original management plan can be obtained at http://fagatelebay.noaa.gov/html/docs/fbeis_84ab.pdf.

Draft Environmental Impact Statement (DEIS), constituting the first MPR since the sanctuary was designated in 1986.

In preparation for the MPR, in 2007 the sanctuary released a condition report (described below), and in 2008 released an updated State of the Sanctuary report. These documents were made available on the sanctuary's website and provide information about significant sanctuary accomplishments to date, a summary of sanctuary resources, pressures on those resources, and current and emerging sanctuary resource management issues. These reports helped raise public awareness about the sanctuary before public scoping meetings were held. In addition, in December 2008, sanctuary staff developed informational fact sheets, in both English and Samoan, to inform people about the sanctuary, the MPR process, and how they could become involved. Sanctuary staff also conducted MPR outreach through newspaper articles, radio spots, and interviews on radio and TV talk shows.

Sanctuary management formally initiated the MPR process in January 2009, with the publication of a notice of intent to begin the MPR in the Federal Register (74 FR 5641). From February 9 to March 27, 2009, sanctuary staff initiated formal public review of the 1984 management plan by asking the public for comments on the status of site management and possible designation of additional sanctuary units during a public scoping period. Members of the public provided comments at three public scoping meetings, as well as written comments submitted via letter, fax, and e-mail. During the week of February 9, 2009, ONMS held three public scoping meetings on the island of Tutuila covering central areas (at the Convention Center in Utulei), eastern villages (at Fagaitua High School), and western villages (at the American Samoa Community College). These forums allowed the public to comment on the sanctuary's management strategies implemented to date and to actively participate by providing input on specific issues they see as management priorities for the next 5 to 10 years. The scoping meetings and written comments are tools used to obtain input from resource users, interest groups, government agencies, and other members of the public on resource management issues. After the scoping period ended, sanctuary staff compiled all comments and posted them on the sanctuary website.

During the scoping process, the public identified a range of important considerations for sanctuary management. Twelve issue areas were synthesized by sanctuary staff from the hundreds of individual comments provided by participants who attended the scoping meetings or submitted written comments received during the public comment period:

- Overarching
- Administration
- Ecosystem Characterization, Research & Monitoring
- Ecotourism
- Education
- Emergency Response
- Enforcement & Regulations
- Expansion & Possible Additional Site Designations
- Fishing
- Outreach
- Partnerships
- Resource Management

Photo 4: Sanctuary staff discussed the management plan review with community members during public scoping. Photo: NOAA National Marine Sanctuaries.

Public scoping, together with numerous community meetings, sanctuary advisory council meetings, communications with the Governor of American Samoa, and the results of the NOAA's National Centers for Coastal and Ocean Science (NCCOS) biogeographic assessment of archipelago-wide coral reef habitat, have provided input on the proposed sanctuary actions and alternatives analyzed in this document. A number of comments focused on who should manage the marine resources, support of *fa'a Samoa*, the Community Fisheries Management Plan (CFMP) process[5], and concern over the federal government's regulation of marine resources, as the territorial government is active in marine resource protection. It was implied that local communities are familiar with the territorial agency (Department of Marine and Wildlife Resources [DMWR]) methods and policies and some were wary of federal action. Direct village involvement in management, including utilizing *aumaga* (the group of untitled and young men in a village) for enforcement, was often mentioned. These types of comments made it apparent that ONMS needed to conduct extensive consultations with candidate sanctuary unit communities to ensure local buy-in, and influenced the Cultural Heritage & Community Engagement Action Plan. In addition, transparency in sanctuary unit selection and sanctuary expansion was critical to achieve community support. Land-sea interactions, including concern for land-based pollution, were common themes for research needs. Comments related to tourism, education, and emergency response have been integrated into various strategies in each of the action plans. The 12 issue areas and associated public comments regarding them are available on the sanctuary's website[6] and are addressed in this DMP/DEIS.

1.2.1 The Sanctuary Advisory Council

The sanctuary advisory council was established in 2005 to provide advice and recommendations to the sanctuary superintendent on protection and management of the sanctuary. The advisory council plays a critical role in management plan review and was instrumental in providing guidance on the future direction of the sanctuary. Section 315 of the NMSA authorizes the

[5] The Community Fisheries Management Plan is an effort of the DMWR to allow for greater community control of a village's nearshore marine resources.

[6] http://fagatelebay.noaa.gov/html/management_plan.html

Secretary of Commerce to establish sanctuary advisory councils. This authority has been delegated to the Director of ONMS, who appoints advisory council members in consultation with the AS DOC Director. The advisory council is composed of 13 voting members and seven non-voting members (Table 1-1). Voting members consist of nine non-government and four government members.

Table 1-1: Sanctuary Advisory Council Membership.

SANCTUARY ADVISORY COUNCIL MEMBERS	
Voting	**Non-Voting**
Non-Government Members	
Research	Youth Member (age 14-25)
Education	
Fishing	
Ocean Recreation	
Tourism	
Business/Industry	
Community-at-large (3 seats)	
Government Members	
American Samoa Department of Commerce – Resource Division	NOAA Fisheries Pacific Islands Regional Office (PIRO)
American Samoa Department of Marine and Wildlife Resources	NOAA Office for Law Enforcement (OLE)
American Samoa Community College/Sea Grant	National Park Service of American Samoa
American Samoa-Environmental Protection Agency	Sanctuary Superintendent
	ONMS Pacific Regional Director
	U.S. Coast Guard

The advisory council is an effective body for drawing in public participation and building a shared understanding of sanctuary management through open discussion and collaborative efforts. The advisory council participates in every step of the management plan review process, beginning with public scoping. Council members assisted in organizing public scoping meetings designed to help inform the management plan and identify potential areas for inclusion in the sanctuary.

To date, the advisory council has established three working groups: 1) the Site Selection Working Group, 2) the Education Working Group and 3) the Research and Monitoring Working Group. Working groups consist of members of the advisory council and members of the public, assisted by sanctuary staff. The Site Selection Working Group utilized NMSA criteria to evaluate the ecological, cultural, and economic value of nine marine areas that the public had proposed as potential new sanctuary units and made recommendations about which areas should be considered for sanctuary designation. Descriptions of those areas not selected, their associated issues, and rationale for not selecting them are provided in Chapter 2.

The Education Working Group developed education and outreach programs to teach relevant stakeholders about the value of marine conservation in American Samoa. This working group also helped to develop education programs for the villages adjacent to potential new sanctuary units and coordinated presentations for the Office of Samoan Affairs (OSA) about the value of a larger national marine sanctuary presence in American Samoa.

The Research and Monitoring Working Group developed a detailed sanctuary science needs assessment. Local scientists from numerous agencies, as well as a number of off-island researchers who conduct work in the territory, made individual recommendations regarding the types of research and monitoring that are needed for the sanctuary and could supplement other efforts in the territory. The results were compiled, and all participants then met as a group to refine the final list. This information helped guide the development of the Marine Conservation Science Action Plan and will be crucial in the development of the Sanctuary Science Plan (Activity MCS 1.2).

1.2.2 Review of Sanctuary Goals

The original Fagatele Bay National Marine Sanctuary management plan contained a series of goals and related objectives. At the start of the current management plan review, sanctuary staff and the advisory council reviewed the sanctuary's original goals and program activities to see how well the sanctuary has been able to achieve these goals.

Original Sanctuary Goals (1984)

Goal 1 Protect and preserve Fagatele Bay's natural resources and pristine character.

Goal 2 Expand public awareness and understanding of marine environments found in the warm waters of the Pacific Ocean, and thereby foster a marine conservation ethic.

Goal 3 Expand scientific understanding of marine ecosystems found in the warm waters of the Pacific Ocean, especially coral reefs that have been infested by the crown-of-thorns starfish, and apply scientific knowledge to the development of improved resource management techniques.

Goal 4 Allow uses of the sanctuary that are compatible with Goals 1-3 above; give highest priority to subsistence and public recreational uses.

In general, the sanctuary has made progress toward accomplishing these broad goals. Toward goal 1, sanctuary staff developed partnerships with NOAA OLE and DMWR to help achieve enforcement of and education about sanctuary regulations. Through collaboration with these and other agencies and constituents, the sanctuary has enhanced protection of sanctuary resources. Toward goal 2, sanctuary staff and partners from the American Samoa Government (ASG) environmental educators group, *Le Tausagi* (a consortium of environmental education staff from various territorial and federal agencies that provides environmental education and outreach programs throughout American Samoa) and the American Samoa Community College (ASCC)

have developed educational programs that enhance public awareness and understanding of the significance of the sanctuary and the need to protect its resources. Toward goal 3, sanctuary staff conducted, participated in, and facilitated research projects focused on resolving management concerns and increasing understanding of the sanctuary environment and resources. Research partners include the Hawaiian Islands Humpback Whale National Marine Sanctuary, NOAA Coral Reef Ecosystem Division (CRED) and NCCOS, DMWR, the National Park of American Samoa (NPAS), the University of Hawai‘i, The Nature Conservancy, and American Samoa-Environmental Protection Agency (AS-EPA), among others. Over the years, sanctuary management has allowed use of the sanctuary that is compatible with goals 1 to 3, giving highest priority to subsistence use and public recreation as described in goal 4. As part of this management plan review, a new set of sanctuary goals have been proposed (Section 1.4.2) that maintain the intent of these goals while incorporating new ideas for a changing environment.

1.2.3 Sanctuary Accomplishments

Sanctuary staff have achieved a number of major accomplishments relative to sanctuary goals and the original sanctuary management plan since the sanctuary was designated in 1986. These accomplishments help demonstrate the value added by the sanctuary to the local community. The following bullets highlight some of these achievements by thematic area. As noted in the bullets below, many of these activities result from sanctuary partnerships with other agencies and organizations. The activities described in the action plans (see Chapter 4) will continue the tradition of sanctuary accomplishments that contribute to the community.

Management, Administration & Operations

- In 2004, sanctuary staff completed the first State of the Sanctuary report. An important precursor to the 2007 condition report, it evaluated the sanctuary’s status and information needs, highlighted significant accomplishments, and included recommendations for increasing understanding of environmental processes in Fagatele Bay.

- In 2005, the sanctuary advisory council was formed to promote community involvement in sanctuary management.

- Since 2005, sanctuary staff have hosted or helped support an annual boating safety refresher course. Participants include local-based agency staff with an on-water presence such as the sanctuary, NOAA Fisheries, DMWR, and the NPAS. The course includes classroom and field instruction in boating safety basics such as safety checks, man-overboard drills, towing a disabled vessel, pre-departure safety briefings, trip planning, and other professional marine operations procedures. Ensuring that sanctuary staff and partners practice boating safety skills and procedures is an important part of on-water sanctuary operations.

- In 2007, ONMS and sanctuary staff completed the first condition report, providing standardized information on the status and trends of sanctuary water quality, habitat, living resources, maritime archaeological resources, and human activities affecting them.

- In 2008, sanctuary management secured additional support staff positions: Deputy Superintendent, Education and Outreach Coordinator, and Program Analyst. These additional staff positions are instrumental to developing and implementing the new action plans, significantly increasing sanctuary staff capacity to conduct and support resource protection, education and outreach, and research.

- In 2008, Fagatele Bay and Thunder Bay national marine sanctuaries partnered to initiate the Joining Hands Hyperbaric Wound Care Project to establish a hyperbaric and wound care center in American Samoa modeled after that developed by Thunder Bay in Alpena, Michigan. This project, estimated to be completed in mid-2012, will meet dual needs in American Samoa and the Pacific Region to treat injuries related to diving and to combat non-healing wounds resulting from diabetes. The hyperbaric treatment facility nearest to American Samoa is in Fiji.

Education / Outreach

- In 1996, sanctuary staff helped co-found *Le Tausagi*. *Le Tausagi* supports annual events such as Earth Day, Arbor Week, and Coastweeks activities, as well as EnviroDiscoveries summer camps that encourage students to learn about the marine environment through interactive games and activities. Through *Le Tausagi*, sanctuary staff promote the importance of marine conservation to audiences throughout American Samoa.

- In 2002, sanctuary staff supported an ONMS and NOAA Dive Center training in Utulei for dive medical technicians. Participants included professionals from the Emergency Medical Service, the NPAS, and the private sector. As part of the training, the NOAA Dive Center in Seattle certified two Emergency Medical Service personnel as dive medical technicians and decompression chamber operators. The training helped augment crucial medical support for dive operations in the territory.

- In 2002, sanctuary staff sponsored a Sustainable Seas Expedition to American Samoa. The week-long expedition included teacher workshops, dive trips, and presentations, and highlighted the national significance of the sanctuary and its resources.

- In 2007, sanctuary staff collaborated with numerous partners to develop the Fagatele Bay hiking trail. This trail runs 5 km from the village of Taputimu to Fagatele Bay through some of America's rare paleo-tropical rainforest and provides perimeter views of the sanctuary. Signs indicating the trail occur at the entrance and along the trail above Fagatele Bay, but not at the entrances to the trail leading from Vaitogi or Taputimu. The trail offers recreational and health benefits to all, while providing excellent outreach opportunities. Using the new trail, sanctuary staff conduct guided hikes for a variety of local and off-island groups, including elementary through college students, federal staff, and visiting delegations.

- In 2008, an education cruise targeting high schools in American Samoa, including Manu`a schools, allowed more than 90 teachers and students to spend a day aboard the

NOAA ship Hi'ialakai, learning about ship operations and science activities. Each student completed five education modules: live rock studies, water quality, geographic information systems (GIS), benthic sampling, and habitat identification. This cruise provided a wonderful hands-on opportunity for students in American Samoa to discover career options in marine conservation. In 2010, the sanctuary hosted an Education and Learning Cruise on board the NOAA ship "Hi'ialakai" with 20 students and 8 chaperone teachers representing all public and private high schools in American Samoa.

Photo 5: Sanctuary and NOAA Ship Hi'ialakai *staff coordinate educational cruises to teach local high school students about ship operations and marine science. Photo: NOAA National Marine Sanctuaries.*

- In 2009, sanctuary staff presented an overview of the sanctuary and its programs to a dozen Southeast Asian participants in the Department of State's International Leadership Program, "The Coral Triangle: Protecting Coastal and Marine Environments - A Regional Project for South-East Asia." Management plan review and potential new sanctuary unit designation presentations provided the visiting marine scientists, resource managers, journalists, and local community leaders involved in coastal zone management an opportunity to learn about these processes as undertaken by ONMS.

- In 2010, sanctuary staff hosted a "Dive into Education" ocean science literacy workshop in American Samoa. This marine science education program is aimed at providing teachers with resources and training to support ocean literacy in America's classrooms. More than 140 teachers from grades kindergarten through 12 participated in the 2-day event.

- In 2010, sanctuary staff hosted a Cultural and Traditional Indigenous Resource Protection Workshop to discuss the integration of cultural knowledge and practices in resource management throughout the Pacific and Western United States. The workshop brought together a range of speakers representing government agencies, First Nations of the Pacific Northwest, Native Hawaiians, nongovernment organizations (NGOs), and local villages, who shared knowledge and practical experience.

- In 2010, sanctuary staff assisted with and supported the process that led to American Samoa's designation as a Preserve America site. Preserve America is a federal initiative that recognizes communities that use their historic assets for economic development and community revitalization and encourages people to experience and appreciate local historic resources through education and heritage tourism programs. The territory was designated for its robust history and living culture, as well as its commitment to "American" heritage.

- Annual teacher trainings and workshops sponsored by the sanctuary cover topics from marine science to teaching the scientific method. These trainings help augment local marine science education capacity.

- Since 2003, sanctuary staff have helped support Ocean Fest, an annual event filled with hands-on ocean related activities and demonstrations by various agencies, entertainment by youth groups, and ocean-themed student presentations. The event reaches hundreds of community members with important messages about environmental stewardship and ocean conservation.

- Since 2003, sanctuary education staff have sponsored ReefWeeks, an annual, month-long, coral reef education program for Tutuila and Manua fourth graders. The students participate in environmental presentations, reef walks, wetland tours, and contests in poetry, artwork, and essay writing. The program reaches hundreds of students each year.

- Since 2003, sanctuary education staff have sponsored the Save-A-Beach program, which engages participating schools whose students clean adjacent beaches at least monthly, and participate in regular poetry, art, and essay contests. The students record data on marine debris and water quality, directly engaging them in environmental stewardship.

- Sanctuary management and the AS DOC established and support a variety of educational scholarship opportunities. Since 2003, AS DOC has collectively offered undergraduate scholarships in marine science to students from American Samoa, helping build local capacity in environmental science. Sanctuary staff also support the NOAA Hollings Scholarship Program, in which undergraduate students develop an internship project that benefits the local sanctuary and community during the summer break between their junior and senior years.

Research

- Since 1985, sanctuary staff has helped support the Fagatele Bay Biological Resource Survey. One of the longest running coral reef monitoring programs in the world, the survey is conducted every few years and has produced insightful results on coral recovery from perturbation as well as indications of overfishing in the bay.

- Since 2003, sanctuary staff, along with David Mattila of the Hawaiian Islands Humpback Whale National Marine Sanctuary, Dr. Jooke Robbins of the Provincetown Center for Coastal Studies, DMWR, the National Park Service (NPS), and other partners, have collaborated on multiple surveys of Southern Pacific humpback whales that come to American Samoan waters to breed and calve in the austral winter. The goal of the research is to define the local population, to clarify its relationship to other parts of Oceania, and to identify its Antarctic migratory destinations. In addition, the work has contributed to the management of this population providing the basis for the first NOAA Stock Assessment Report, and a South Pacific Region Environment Programme (SPREP) Convention for Migratory Species Recovery Plan. In addition, the study provided information for the marine mammal section of the third edition of the Natural History Guide to American Samoa (Craig 2009), and a DVD is being developed to further share the results of this work with the public.

- In 2006, sanctuary staff supported a coral disease survey of Tutuila by Dr. Greta Aeby and Dr. Theirry Work. Coral diseases are poorly understood, and this survey increased understanding of the extent and diversity of coral diseases in American Samoa.

- In 2006, sanctuary staff established water quality monitoring protocols for Fagatele Bay in collaboration with the AS-EPA to expand its island-wide beach water quality monitoring to include the bay. The inclusion of this remote location in the monitoring program provides AS-EPA with a baseline for *enterococci* levels in coastal waters, as well as a water quality baseline specific to Fagatele Bay.

- In 2007, ONMS released the American Samoa Marine Heritage Inventory. The result of efforts initiated in 2003 by Erica Raddewagen and Dr. Hans Van Tilburg and supported by sanctuary staff, this initial report inventories cultural, archaeological, and historical properties associated with coastal and marine areas and seafaring activities and traditions throughout American Samoa. The inventory is also a key supporting document to the sanctuary's management plan review.

- In 2008, the sanctuary and NOAA's Coral Reef Conservation Program funded NCCOS' Biogeography Branch to initiate a biogeographic assessment of marine waters within American Samoa, as well as links to the independent nation of Samoa. The purpose of this project was to conduct geospatial analyses of ocean climate, larval connectivity patterns among islands, biogeographic patterns in reef fish and coral communities, and to

inventory existing marine protected areas (MPAs)[7] in the region to support multiple marine managed area initiatives in the Samoan archipelago including this MPR. The project also characterized candidate sanctuary units based primarily on ecological information and will serve as a prototype for assessments in other areas of the Pacific.

Photo 6: NCCOS scientists concluded biogeographic assessment field surveys of Fagatele Bay (pictured here) and other sites in 2010. Photo: NOAA NCCOS.

- In 2008, sanctuary management launched a socioeconomic survey of villages adjacent to Fagatele Bay. This survey provides socioeconomic baseline information that can be used to assess the sanctuary's impact on the local community.

- In 2008, ONMS and AS DOC released a report titled, "Long term monitoring of Fagatele Bay National Marine Sanctuary, Tutuila Island, American Samoa: results of surveys conducted in 2007/8, including a re-survey of the historic Aua Transect" (Fenner *et al.* 2008). This report represents the latest results in a monitoring program stretching back almost 30 years. Results indicate that corals in Fagatele Bay are resilient and doing quite well. In addition, four species of coral not previously recorded in the bay were discovered. The report also indicates that reef fish communities in Fagatele Bay and elsewhere around Tutuila are still showing signs of overfishing.

[7] Ex. Ord. No. 13158, May 26, 2000, 65 F.R. 34909 sec. 2. (a) defines a "marine protected area" as, "any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein."

- In 2009 the sanctuary procured the 10-meter research vessel (R/V) *Manumā*. As the only platform dedicated to marine research in the territory, the R/V *Manumā* is a critical asset that supports not only sanctuary and NOAA research, but also researchers from the NPS, DMWR and other partners. It also served an important role during territorial tsunami damage and recovery assessments in 2009.

- Over the years, sanctuary staff have also offered support for a variety of benthic habitat mapping projects in the sanctuary and broader territory. Knowledge about the extent, diversity, and location of habitat types is critical to ecosystem-based management.

Climate Change

- In 2010, sanctuary staff hosted a climate workshop in American Samoa to encourage sharing of climate change planning experiences, knowledge, and skills among participating managers and community members. Participants shared case studies and lessons learned, gave presentations, and worked together on both group and individual projects and problem-solving exercises. Coastal managers and community leaders worked together to develop an adaptation planning framework as a model for addressing areas in American Samoa that are vulnerable to the effects of climate change.

- In 2010, sanctuary staff launched the Climate Smart Sanctuary Initiative to promote community resiliency and protect coastal resources from the potential impacts of climate change in the territory. ONMS developed the Climate Smart Sanctuary process to guide climate change planning at national marine sanctuaries across the United States.

- In 2010, sanctuary staff developed a Climate Change Story as part of the Climate Smart Sanctuary Initiative. The story synthesizes existing information on the main climate change impact drivers and the potential impacts to ecosystems, heritage and cultural resources, and communities relevant to the sanctuary, and is a companion to the Climate Change Action Plan contained in this document.

Emergency Response

- On September 29, 2009, a magnitude-8.3 earthquake struck 190 km southwest of American Samoa and generated a tsunami that devastated shorelines throughout the territory. After these events, sanctuary staff conducted rapid coastal resource assessments and engaged with territorial partners to assist with the recovery efforts. Sanctuary staff worked to remove marine debris, including scrap metal, house frames, and beds buried under the sand. Sanctuary staff also collaborated with local agencies to prepare a Post-Tsunami Coastal Impact and Damage Assessment Report to identify the areas that incurred the most damage, and assisted with preparing the NOAA American Samoa Tsunami-generated Marine Debris and Coral Damage Response Report. Sanctuary staff continue to help identify local needs and work with other parts of NOAA to identify what capabilities and capacities within the agency may be of assistance to recovery efforts.

1.2.4 Condition of Sanctuary Resources

In addition to reviewing sanctuary goals and accomplishments, another important part of management plan review is developing a sanctuary condition report to help sanctuary staff identify monitoring, characterization, and research priorities to address gaps, day-to-day information needs, and new threats. In 2007, ONMS and sanctuary staff developed the sanctuary condition report[8]. This report provides a summary of resources in Fagatele Bay, pressures on these resources, the current condition and trends, and management responses to the pressures that threaten the integrity of the marine environment. The condition report includes information on the status and trends of water quality, habitat, living resources, and maritime archaeological resources and the human activities that affect them, summarized from responses to a set of 17 standard condition report questions (see Figure 1-2 and Appendix A of the condition report for an explanation of the questions). The report rates resource status on a scale from good to poor, and with trends generally based on observed changes over the past 5 years. Status and trends were evaluated by sanctuary staff, based on interpretation of quantitative and, when necessary, non-quantitative assessments and observations of scientists, managers, and users. In many cases, sanctuary staff consulted outside experts familiar with the resources and with knowledge of previous and current scientific investigations. The ratings reflect the collective interpretation of the status of local issues of concern among sanctuary staff and outside experts based on their knowledge and perceptions of local problems.

Photo 7: The Fagatele Bay Biological Resource Survey includes transect surveys (shown here) and is one of the longest running coral reef monitoring programs in the world. Photo: Doug Fenner.

[8] http://fagatelebay.noaa.gov/html/docs/fb_condition.pdf

CONDITION REPORT 2007 | Fagatele Bay

Fagatele Bay National Marine Sanctuary Condition Summary Table

Condition Summary: The results in the following table are a compilation of findings from the "State of Sanctuary Resources" section of this report. (For further clarification of the questions posed in the table, see Appendix A.)

Good	Good/Fair	Fair	Fair/Poor	Poor	Undet.

Trends:
- ▲ Conditions appear to be improving.
- — Conditions do not appear to be changing.
- ▼ Conditions appear to be declining.
- ? Undetermined trend.
- N/A Question not applicable.

#	Questions/Resources	Rating	Basis for Judgment	Description of Findings	Sanctuary Response
WATER					
1	Are specific or multiple stressors, including changing oceanographic and atmospheric conditions, affecting water quality and how are they changing?	▼	Increasing number of warm-water events causing coral bleaching	Selected conditions may inhibit the development of assemblages, and may cause measurable but not severe declines in living resources and habitats.	American Samoa and sanctuary regulations have been designed to prevent any reduction in water quality. *Enterococcus* bacterial concentrations are measured to assess how land development affects water quality. Staff are also proposing to assess the groundwater beneath the island landfill to determine if contaminants are being transported into the marine environment (page 20).
2	What is the eutrophic condition of sanctuary waters and how is it changing?	—	Low nutrient levels, good water clarity; lack of fleshy algae	Conditions do not appear to have the potential to negatively affect living resources or habitat quality.	
3	Do sanctuary waters pose risks to human health and how are they changing?	?	No known risks	Conditions do not appear to have the potential to negatively affect human health.	
4	What are the levels of human activities that may influence water quality and how are they changing?	▼	Land clearing for agriculture, proximity of island landfill	Some potentially harmful activities exist, but they do not appear to have had a negative effect on water quality.	
HABITAT					
5	What are the abundance and distribution of major habitat types and how are they changing?	?	Resilient coral populations; destructive fishing activities, diseases present	Selected habitat loss or alteration has taken place, precluding full development of living resource assemblages, but it is unlikely to cause substantial or persistent degradation in living resources or water quality.	Regulations prohibit destructive activities, such as fishing and anchoring, that disturb or damage natural features. Mooring buoys were installed in 2006 to eliminate the need for anchoring (page 20).
6	What is the condition of biologically structured habitats and how is it changing?	—	Destructive events have not reduced biodiversity	Selected habitat loss or alteration has taken place, precluding full development of living resources, but it is unlikely to cause substantial or persistent degradation in living resources or water quality.	
7	What are the contaminant concentrations in sanctuary habitats and how are they changing?	—	None identified	Contaminants do not appear to have the potential to negatively affect living resources or water quality.	
8	What are the levels of human activities that may influence habitat quality and how are they changing?	—	Low visitation, but fishing impacts occur	Some potentially harmful activities exist, but they do not appear to have had a negative effect on habitat quality.	
LIVING RESOURCES					
9	What is the status of biodiversity and how is it changing?	—	All species present, but some in low numbers	Biodiversity appears to reflect pristine or near-pristine conditions and promotes ecosystem integrity (full community development and function).	Regulations prohibit removing or disturbing marine invertebrates or plants. Most fishing gears are excluded from the sanctuary. Regulations by federal and state partners protect marine mammals, birds, and sea turtles from "take," disturbance and harm. Field assessments of coral and fish populations, coral diseases and other indicators of coral reef health are conducted (pages 20 - 21).
10	What is the status of environmentally sustainable fishing and how is it changing?	—	Fishing has removed large fish	Extraction has caused or is likely to cause severe declines in some but not all ecosystem components and reduce ecosystem integrity.	
11	What is the status of non-indigenous species and how is it changing?	—	Some non-indigenous algae and invertebrates may be present	Non-indigenous species are not suspected or do not appear to affect ecosystem integrity (full community development and function).	
12	What is the status of key species and how is it changing?	—	Reduced numbers and size of certain predatory fish species	The reduced abundance of selected keystone species has caused or is likely to cause severe declines in some but not all ecosystem components, and reduce ecosystem integrity; or selected key species are at substantially reduced levels, and prospects for recovery are uncertain.	
13	What is the condition or health of key species and how is it changing?	▼	Coral and coralline algae diseases	The condition of selected key resources is not optimal, perhaps precluding full ecological function, but substantial or persistent declines are not expected.	
14	What are the levels of human activities that may influence living resource quality and how are they changing?	?	Illegal and legal fishing continues to remove large fish	Selected activities have caused or are likely to cause severe impacts, and cases to date suggest a pervasive problem.	
MARITIME ARCHAEOLOGICAL RESOURCES					
15	What is the integrity of known maritime archaeological resources and how is it changing?	N/A	No documented underwater archeological sites	N/A	Although no maritime archaeological artifacts have been identified in the sanctuary, regulations prohibit the removal, damage or disturbance of any historical or cultural resource within the sanctuary (page 21).
16	Do known maritime archaeological resources pose an environmental hazard and is this threat changing?	N/A	No documented underwater archeological sites	N/A	
17	What are the levels of human activities that may influence maritime archaeological resource quality and how are they changing?	N/A	No documented underwater archeological sites	N/A	

Figure 1-2: Summary of Conditions in the Fagatele Bay Unit from the 2007 FBNMS Condition Report (NMSP 2007)

1.3 THE ENVIRONMENTAL IMPACT STATEMENT AND MANAGEMENT PLAN

After public scoping, issue analysis, prioritization and review of sanctuary goals and accomplishments and the condition of sanctuary resources, the next steps in the MPR process required development of action plans and preparation of the draft and final management plans as well as relevant NEPA documentation. The following paragraphs describe these next steps.

The basic elements of an EIS include: the purpose and need for the proposed action (below), a description of the proposed action and alternatives (DOPAA, Chapter 2), the affected environment (Chapter 3), and the environmental consequences of the alternatives (or the alternatives impact analysis, Chapter 5). The DOPAA includes a description of a no-action alternative, the proposed action, and other alternatives. The affected environment describes the biological, cultural, and socioeconomic value of the marine habitats of the Samoan Archipelago and more specifically details these values for the proposed additional sanctuary units. The DOPAA (along with the action plans in Chapter 4) and description of the affected environment present decision makers and the public with the information necessary to understand the analysis of potential environmental, cultural, and socioeconomic consequences or impacts of the alternatives. The requirement to prepare an EIS for this project was triggered by the proposed revisions to the sanctuary's terms of designation, including the proposal for including additional sanctuary units within American Samoa. The EIS focuses on presenting and analyzing proposed changes to the sanctuary regulations, boundary, and non-regulatory actions. The study area for this EIS is the territory of American Samoa.

Sanctuary management plans generally include an introduction to the given sanctuary (provided here in Chapter 1), sanctuary regulations and boundaries (both current and proposed regulations and boundaries are in Chapter 2), a description of the sanctuary environment (Chapter 3), and a series of action plans (briefly described below and presented in Chapter 4). The management plan also serves to outline staffing and budget needs; identify priorities and performance measures for resource protection, research, and education programs; and guide development of future budgets and management activities. As such, the plan serves as a blueprint for sanctuary management and as a tool for sanctuary partners and the public to understand the sanctuary's planned management framework over the next 5 to 10 years.

1.4 PURPOSE AND NEED

1.4.1 Need for Action

The NMSA requires ONMS to periodically review and evaluate the progress in implementing the management plan and goals for each sanctuary, with special focus on the effectiveness of site-specific techniques and strategies. ONMS must revise management plans and regulations as necessary to fulfill the purposes and policies of the NMSA (16 U.S.C. 1434(e)) to ensure that each sanctuary continues to best conserve, protect, and enhance their nationally significant living and cultural resources. The Fagatele Bay National Marine Sanctuary management plan dates back to 1984 and has not yet been updated.

This review provided ONMS an opportunity to consider the value of coral reef ecosystems across the territory, assess existing threats and protection to these valuable resources, and determine where the NMSA can enhance protection over and above that provided by the Territory and other federal agencies, including NPS and the U.S. Fish and Wildlife Service (USFWS).

In the 25 years since the sanctuary was designated, an extensive and diverse variety of accomplishments have been achieved in support of the original sanctuary goals (see *Sanctuary Accomplishments* in this chapter). On a global scale, this has been a period of tremendous advancement in marine discovery and exploration, marine conservation science, and ecosystem-based management. The availability and practical use of real-time remote sensing and *in situ* data, together with a greater understanding of marine ecosystems and how human activities alter them, have led to wide-ranging and far-reaching domestic and global programs, policies, and innovative techniques aimed at improving the health and resilience of marine ecosystems (Ecosystem Principles Advisory Panel 1996; PEW 2003; Commission on Ocean Policy 2004; National MPA Center 2008, Ocean Policy Task Force 2010). Amendments to the NMSA in 1988, 1992, 1996, and 2000 have strengthened and clarified the conservation principles for the program, including increased enforcement authority and emphasis on the protection of cultural resources. Incorporating these new tools and techniques into the current management plan will allow for improved management and conservation, which are needed to slow the long-term decline of coral reefs throughout the world (Pandolfi *et al.* 2003).

There has been a trend in recent years for resource management agencies to build capacity and break down institutional barriers to foster community partnerships and use traditional ecological knowledge for a wide variety of resource conservation and management efforts, including outreach, enforcement, monitoring, and restoration (Friedlander *et al.* 2000; Pomeroy, Parks, and Watson 2004; Hawaii Coastal Zone Management Program 2006). A recent survey of 121 Samoan residents from 10 villages on Tutuila indicates a relatively narrow understanding of the value, threats to, and management of coral reef resources (Turner 2005). Most people “felt they knew very little about coral reefs,” with a particular lack of understanding of the threats to American Samoa’s marine environment. The sanctuary’s focus on a single isolated bay limits the ability of ONMS to foster awareness and stewardship throughout villages across the territory. Through collaboration between the sanctuary and local populations across the archipelago, however, resource users can better understand the goals of the management regime and are more likely to comply with regulations and take responsibility for the long-term health of the resource (Christie and White 2007; Pomeroy and Douvere 2008).

Photo 8: Coral bleaching, seen here in the tips of an Acropora coral, is a current resource management concern for American Samoa's coral reefs. Photo: Doug Fenner.

Within American Samoa, the landscape over the past 25 years has also changed. The sudden growth of the commercial longline fishery in 2001 (Western Pacific Fishery Management Council [WPFMC] 2009a), mass coral bleaching in 1994, 2002 and 2003 (Fenner *et al.* 2008), and nonpoint source pollution from poor land-use practices (AS-EPA 2010a) are recent management concerns that may affect the health and resilience of American Samoa's marine ecosystems. Public scoping also provided an opportunity to hear community concerns about the sanctuary system, the health and protection of marine resources, and other emerging concerns.

Recent archipelago-wide marine research efforts (Brainard *et al.* 2008; Kendall and Poti in prep.) have led to comprehensive integrated ecosystem assessments of American Samoa's coral reefs. These assessments have provided a baseline understanding of the status and health of the marine resources, an improved understanding of how natural and man-made stressors affect coral reefs, and an improved understanding of the forces that promote and impede ecosystem recovery to a healthy state (Brainard *et al.* 2008). These studies have also provided information on the relative biological value of different reefs across the territory, a critical step in determining where to focus marine resource protection efforts.

A new management plan is needed to provide effective conservation and management of sanctuary resources. The revised management plan will reflect new scientific information and understanding, advancements and collaboration in managing marine resources, and new resource management issues. This revised management plan addresses each of these issues.

In addition, developing a science- and culturally-based network of sanctuary units addresses a number of needs important to ONMS, including linking protected areas together to improve overall ecosystem health and resiliency, protecting valuable natural and cultural resources within the territory, improving local stewardship and reaching a wider general audience through an increased presence across the territory, incorporating a foundation of community involvement at all of the units, and providing natural laboratories that can be used to continue to improve the understanding of threats to the ecosystem and the factors managers can influence to limit the impacts of these threats. In summary, the marine ecosystems surrounding American Samoa are a valuable resource, and the NMSA can provide unique protection of this environment, enhancing the existing protection already provided by the territory and other federal agencies.

1.4.2 Purpose of Action

The purpose of this action is to best fulfill the overarching goal of the sanctuary: to protect sanctuary resources. The management plan review process assesses the need, and subsequently determines how best to revise sanctuary goals and regulations and develop new action plans and activities. This review also provides an opportunity to review sanctuary accomplishments achieved to date based on the sanctuary missions, goals, and objectives formulated in 1984.

Although the original sanctuary goals are still in line with the direction provided by the NMSA, they do not address contemporary community and management concerns with regard to both living and nonliving marine resources in Fagatele Bay and other proposed sanctuary units. Sanctuary staff worked with the sanctuary advisory council to develop guiding principles and corresponding revised sanctuary goals shown below to develop a contemporary set of goals. The guiding principles provide direction for making informed decisions on the overarching policy and guidance for sanctuary management. The sanctuary goals are the unifying elements of successful sanctuary management. They identify and focus management priorities, resolve issues, and link to the public interest in preserving and caring for sanctuary resources.

Guiding Principles

- All management actions and principles should be consistent with *fa'a-Samoa*.
- When there is uncertainty in available information, use the precautionary principle to act in favor of resource protection to avoid potential serious or irreversible harm.
- Weigh the socioeconomic impacts on current users with the need to provide the highest level of possible protection to inform all management actions.
- Cooperate, collaborate and partner with local and regional resource agencies to leverage resources and reduce duplication of effort.

Revised Sanctuary Goals

Goal 1 Protect, preserve, and where appropriate enhance the marine environment and the associated biological communities, biodiversity, and ecological integrity.

Goal 2 Interpret, protect, and preserve historic and cultural resources.

Goal 3 Incorporate traditional knowledge and stewardship into management consistent with long-term conservation and protection.

Goal 4 Provide for cooperative conservation and community involvement with villages, agencies, and other partners to achieve effective operations and ecosystem-based management.

Goal 5 Support, promote, and coordinate research, monitoring, ecosystem characterization, and traditional knowledge that increases understanding and improves management decision making throughout the Samoan archipelago.

Goal 6 Enhance public understanding, appreciation, and the need for protection and wise use of the natural, cultural, and historic resources through outreach and education.

Goal 7 Cooperate with local, regional and global programs regarding conservation of marine resources – including partnerships related to mitigating land-based sources of pollution.

Goal 8 Facilitate, to the extent compatible with the primary objective of resource protection, public and private recreational uses of the sanctuary not prohibited pursuant to other authorities.

Goal 9 Provide for the highest level of protection available under Proclamation 8337 for the coral reef ecosystem at Rose Atoll Marine National Monument.

1.5 CONSIDERATIONS IN DEVELOPING THE PROPOSED ACTION AND ALTERNATIVES

This revised management plan incorporates six new mechanisms to complement and fulfill these nine goals. These are discussed below and supported throughout this document to address current sanctuary resource conditions and uses and to continue uses that are consistent with the primary objective of resource protection.

Proposed Additional Sanctuary Units

As described above, Fagatele Bay fulfills the NMSA standard of special national significance for its pristine coral terrace ecosystem, with a diversity of corals, fish and other marine life (US Department of Commerce [US DOC] 1984). Since this time, the value of MPAs to enhance the health and productivity of the ecosystem both within and outside their borders has become well established (Bohnsack 1993; Halpern, Lester, and McLeod 2010; Rosenberg and McLeod 2005). In addition, the idea of developing a network of MPAs within a given region has become a key strategy in marine resource protection, as exemplified by the European model *Natura 2000*[9] (Cabeza 2003; Mora *et al.* 2006; Greenstreet, Fraser, and Piet 2009). Rather than protecting a single location of high value, a network has the ability to perform multiple functions, including: (1) limiting overall displacement of resource users by decreasing the size of individual sites while leaving adjacent open areas (Charles and Wilson 2009), (2) ensuring that protected areas are comprehensive and representative for species, habitats and ecological processes found within a given region, (3) safeguarding ecosystems for sustainable use by providing refuge for commercially valuable species, (4) safeguarding highly mobile threatened and endangered species and the range of habitats they rely on, (5) sustaining resident populations within and outside of MPA sites by self-seeding as well as through larval dispersal from other sites (Planes

[9] http://www.natura.org

et al. 2009), and (6) protecting ecosystem diversity against unforeseen natural or man-made catastrophes at a single site (Green *et al.* 2007).

To this end, the U.S. Coral Reef Task Force has established the conservation objective to protect "a minimum of 20% of each coral reef and associated habitat type" as no-take areas (US Coral Reef Task Force 2000b; NOAA 2002a). In 2000, the ASG initiated a commitment to protect coral reef habitat within the Territory when the late Governor Tauese Sunia requested a plan be developed for protecting 20 percent of territorial coral reefs as "no-take" MPAs. Former Governor Sunia directed the Coral Reef Advisory Group to develop the plan (Sunia 2000), which was completed in 2008 (Oram 2008).

Photo 9: NOAA is considering adding portions of the waters surrounding Aunu'u Island (foreground) to the sanctuary network. Photo: Claire Fackler, NOAA ONMS.

For these and other related reasons described below, ONMS decided early in the management plan review process to pursue the idea of establishing a network of sanctuary units across the archipelago. These potential additions have been guided by both scientific and socio-economic information. Scientific rationale includes an assessment of natural resource qualities for a variety of locations across the archipelago, as well as a detailed study of connectivity between locations. Resource assessment studies (Brainard *et al.* 2008; Kendall and Poti in prep.) aid in determining which areas have the highest ecological value (based on species and habitat diversity, species abundance and total coral cover, and rare and special status species). Connectivity studies (Kendall and Poti in prep.) provide larval transport models that inform resource managers (1) of areas that should be considered for protection because they serve as sources of recruitment to other locations, or (2) of areas of relative isolation that are vulnerable to human or natural perturbations. Understanding of currents, larval transport, and species biology has helped resource managers understand where to locate these protected areas for maximum resource conservation. Socio-economic information includes assessments of management concerns, human uses, and cultural and historical value (Spurgeon *et al.* 2004). Management concerns have been identified through public scoping comments (ONMS 2009), the sanctuary condition report (NMSP 2007), and the review of sanctuary accomplishments in this document. Many of the concerns identified are discussed in the appropriate action plans. Management concerns, human uses, and cultural and historical values have been essential in ranking potential locations for sanctuary designation. The incorporation of socio-economic considerations is critical to successful designation and management of MPA networks (Charles and Wilson 2009).

Increase Community Participation

Because it is an oceanic archipelago, American Samoa has no continental shelf. Consequently, most of the coral reef habitat occurs in the nearshore area. The cultural structure of the *matai* (chief) system of land tenureship extends into the nearshore habitat, where Customary Marine Tenure (CMT; see section 3.1.3) provides the framework for marine resources usage rights. With the exception of Rose Atoll, all of the proposed sanctuary units occur entirely or primarily in territorial, nearshore waters adjacent to associated villages. ONMS understands the value of community support during both sanctuary designation and ongoing management, which is particularly important given the cultural setting of American Samoa. As such, ONMS places primary emphasis on cultural recognition, community involvement, and cooperative conservation throughout this management plan.

Photo 10: Sanctuary staff work with the territory's Office of Samoan Affairs to arrange meetings with local matai *and their villages, which are typically held in village* fales*. Photo: NOAA ONMS.*

Development of sanctuary management options adhered to culturally appropriate protocols regarding community involvement and the village meeting process. OSA strongly encourages that all government meetings with villages go through the culturally correct process of seeking the advice of OSA and using the office as a conduit to the villages. Sanctuary staff consulted with OSA before all village meetings. Meeting details (participants, time, date, and location) were confirmed through OSA before sanctuary and AS DOC staff met with the villages, and OSA identified initial meeting representatives. County Chiefs, after consultation with the village mayors, then determined if other village personnel should be involved and ensured community participation at scheduled meetings. Following this familiar and culturally appropriate process minimized contradictions and confusion of the villagers and served to promote the goals of

increasing awareness and stewardship, improving voluntary compliance, inspiring new methods of conservation and obtaining feedback from those most intimate with the resource.

The value of expanding the sanctuary to multiple units and the involvement of villages adjacent to these units fits well with the goal of incorporating traditional knowledge and stewardship into management. This management plan embraces and recognizes existing traditional and cultural processes in American Samoa and includes community engagement and involvement as a key cornerstone to effective implementation. Traditional ecological knowledge is also gaining acceptance throughout the sanctuary system (*e.g.*, Papahanaumokuakea MNM 2008). This emphasis on community participation is also reflected throughout most of the new action plans, as is described below, with specific emphasis on enhancing public understanding, appreciation, and stewardship of these shared resources.

Develop New Action Plans

Action plans are the means ONMS uses to identify and organize the wide variety of management tools it employs to manage and protect its marine resources. Action plans allow ONMS to articulate the programs, projects, and regulations it uses to address the resource issues identified for this management plan, to fulfill the purposes and policies of the NMSA, and to achieve sanctuary goals. In general, action plans are designed to address:

- The management issues identified during the management plan review process.
- The goals and objectives of the NMSA and the sanctuary.
- Extensive comments, input and ideas from the sanctuary advisory council.
- The scientific, socioeconomic, and local knowledge gathered about the status of sanctuary resources and resource management issues.
- The unique, non-duplicative, and beneficial services the sanctuary can offer to improve resource management.
- The need for evaluating the effectiveness of the sanctuary over time.

The 1984 management plan includes four components that parallel five of the action plans of this document. This updated management plan includes three additional action plans based on emerging needs. All eight action plans provide strategies and actions that address new needs and issues intended to fulfill the revised sanctuary goals. Specifically, the impacts of climate change, introduced species, and land-based activities on coral reefs are discussed, and strategies and actions to address these threats are presented in multiple action plans. In light of the increased geographic scope of this action, research and resource protection strategies and actions from the 1984 management plan are inadequate. For instance, a primary concern of the 1984 management plan was to understand and mitigate the destructive impacts of crown-of-thorns starfish outbreaks. Based on monitoring both in Fagatele Bay and other locations within the archipelago, this threat remains valid, but at a lower priority.

Table 1-2 presents how the new management plan updates and expands on these critical sanctuary functions.

Table 1-2: Comparison of 1984 and New Management Plans

1984 PLAN	NEW PLAN	COMMENTS
Sanctuary Administration and Operations: describes the roles of agencies, coordination and evaluation of the plan.	**Program Evaluation Action Plan**: describes the process of evaluating the effectiveness of how the strategies and actions fulfill the goals of the sanctuary	Updates and expands on the evaluation process from the Sanctuary Administration and Operations section of the 1984 plan
	Operations and Administration Action Plan: describes day-to-day activities, including new facilities, vessel operations, and permitting	Update includes revised operating budget and priorities given the expanded responsibility of the sanctuary
Surveillance and Enforcement: describes regulations and enforcement responsibility	**Resource Protection and Enforcement Action Plan**: describes threats to the ecosystem, regulations, enforcement and emergency response	Update addresses a much broader set of threats to sanctuary resources. In addition, each strategy identifies partners, management actions and outreach strategies
Interpretive Program: describes the public education program, including recreation within sanctuary	**Ocean Literacy Action Plan**: describes sanctuary visitor center, direct community interaction, volunteer programs, and school curriculum	Update includes the use of new technologies while integrating culturally sensitive communications to promote ocean literacy within and outside American Samoa
Resource Studies Plan: describes value of bay as a natural laboratory, emphasizing research, resource assessment and monitoring	**Marine Conservation Science Action Plan**: describes monitoring, habitat characterization, and resource surveys. Details are left for the proposed Sanctuary Science Plan	Update emphasizes ecosystem approach to management, expands effort to all sanctuary units, incorporates socio-economic and cultural studies, while integrating partnerships and ocean literacy goals
	Cultural Heritage & Community Engagement Action Plan: describes how both the living culture and the cultural and historic resources are critical to the focus of this plan	This new action plan corresponds to NMSA emphasis on interpreting, protecting, and preserving historic and cultural resources and highlights the importance of actively engaging the community in sanctuary efforts
	Climate Change Action Plan: describes the process ONMS and partners will use to address climate change. Specific actions will be proposed in a completed Climate Change Action Plan	This new action plan corresponds to how this global threat specifically affects coral reefs and proposes actions to minimize potential impacts
	Partnership & Interagency Cooperation Action Plan: describes critical partnerships for core operations as well as regional and international associations to improve management and limit duplicated efforts	This action plan is new, although some of the key aspects were described in the 1984 plan's Sanctuary Administration and Operations

Increase Capacity for Research Opportunities

While the 1984 management plan also included research as a sanctuary goal[10], this goal was somewhat limiting, emphasizing a single threat out of many to the coral reef ecosystem. Given the range of serious issues facing coral reefs today, it is appropriate for this updated management plan to increase emphasis on scientific study that can improve management decision making throughout the Samoan Archipelago. Part of the biogeographic characterization conducted by NCCOS included identification of potential research sites for proposed sanctuary designation. Marine scientists and managers developed a list of critical attributes for a successful research site, including a variety of habitat types that extend from shoreline to mesophotic reefs and beyond, relatively intact ecosystems with minimal anthropogenic disturbance, ease of access from Pago Pago Harbor and generally favorable sea surface conditions for most of the year. Research sites (or zones) should be no-take zones, allowing for a natural assemblage of species and undisturbed habitat for long-term ecological and climate change studies. The ideal site for studies on anthropogenic impacts would have similar geological, oceanographic, and biological characteristics to an open-access site. These issues, as well as the socio-economic impacts, were taken into account during site alternative development.

In addition to identifying potential research sites, a revised science action plan and development of scientific partnerships as described above are critical to fostering increased emphasis on scientific research and management-driven assessment and monitoring activities.

Incorporate Territorial, Regional and International Efforts into Management Goals

There has been a greater sharing of knowledge, increased regional coordination, and other efforts and mechanisms that complement ONMS efforts in the region. Currently, the sanctuary is working on a strategic plan with the two other Pacific national marine sanctuaries as well as climate change adaptation programs with Samoa and other regional partners. This mechanism recognizes a broader range of stakeholders and the land-sea connection in resource protection, and is emphasized through revised Goal 7, “Cooperate with local, regional and global programs regarding conservation of marine resources – including partnerships related to mitigating land-based sources of pollution.”

The Partnership and Interagency Cooperation Action Plan details the multi-tiered approach to carry out this management mechanism. This plan includes cultivating partnerships, particularly promoting the efforts of the sanctuary co-manager, the AS DOC. Further cooperation includes the American Samoa DMWR and the NPAS, which have management responsibility for nearshore waters across the archipelago. In addition, partnerships will be cultivated with NOAA (PIRO and Pacific Islands Fishery Science Center (PIFSC), as well as the USFWS, all of which have management responsibilities within the Rose Atoll Marine National Monument. Other

[10] Goal 3: Expand scientific understanding of marine ecosystems found in the warm waters of the Pacific Ocean, especially coral reefs that have been infested by the crown-of-thorns starfish, and apply scientific knowledge to the development of improved resource management techniques (US DOC 1984).

important collaborations include working with Samoa on the Two Samoas Initiative and collaborating with the United Nations Educational, Scientific and Cultural Organization to obtain World Heritage Site status for Fagatele Bay, and possibly other areas worthy of this designation. These and other efforts are critical to fulfill sanctuary goals given limited resources.

Fulfill the Mandate of Presidential Proclamation 8337

*Photo 11: Duerden's coral (*Pavona duerdeni*) at Rose Atoll. NOAA Photo: By J. Kenyon.*

On January 6, 2009, President George Bush used the Antiquities Act to establish a Marine National Monument for 13,451 square miles of "emergent and submerged lands and waters of and around Rose Atoll" (74 FR 1577). The proclamation specifically states that "[t]he Secretary of Commerce shall initiate the process to add the marine areas of the monument to the Fagatele Bay National Marine Sanctuary in accordance with the National Marine Sanctuaries Act (16 U.S.C. 1431 et seq.)." The proclamation also describes management responsibility, provisions for research, emergencies, national security, and law enforcement activities, as well as the prohibition of commercial fishing. This revised management plan complies with the proclamation's mandate, including the marine areas of the Rose Atoll Marine National Monument in three of the alternatives and highlighting its incorporation into the sanctuary through one of its revised goals.[11]

1.6 PROPOSED ACTION

The following is a summary of the proposed action. Full descriptions of the no action alternative and four action alternatives are presented in Section 2. No Action would maintain the existing management plan, without updating the guiding principles or sanctuary goals. Alternative 1 includes the development of new sanctuary goals (discussed above) and the management plan revision, discussed in Chapter 2 and presented as Action Plans in Chapter 4. The new sanctuary goals and management plan revision are considered non-regulatory actions, and are included as part of all of the alternatives, although a few aspects of the management plan would be not be

[11] Goal 9: Provide for the highest level of protection available under Proclamation 8337 for the coral reef ecosystem at Rose Atoll Marine National Monument.

relevant under Alternatives 1 or 2. In addition, all of the alternatives would include the addition of a management permit, in addition to the existing research, education and salvage permits. This new permit would give the authority for the sanctuary to issue a superintendent's permit as well as permits to third parties for activities that assist in managing the sanctuary. These permits could be issues annually or for individual discrete projects to facilitate management of the sanctuary. All permits are subject to NEPA review prior to issuance. The following description of the proposed action is a summary of the regulatory components of the Preferred Action (Alternative 3B), consisting of (1) changing the name from the Fagatele Bay National Marine Sanctuary to the American Samoa National Marine Sanctuary, (2) adding five units to the existing sanctuary, and (3) revising the language of existing regulations and developing new regulations for greater resource protection.

1.6.1 New Sanctuary Name

As a result of the proposed incorporation of five additional units across the archipelago, the current sanctuary name — Fagatele Bay National Marine Sanctuary — would no longer be appropriate since it would refer only to a small part of the newly expanded sanctuary. Throughout this document, in referring to the aspects of the proposed action, the sanctuary will be called the American Samoa National Marine Sanctuary.

1.6.2 Addition of Sanctuary Units

As a result of the MPR process, the sanctuary is proposing to incorporate five additional units, expanding the current sanctuary at Fagatele Bay to a network of sanctuary units across the archipelago (Figure 1-3). NOAA chose these units for inclusion in the preferred alternative based on the quality and diversity of their biological resources, their scientific and cultural value, and the specific desire of the communities intimate with these marine habitats. The Fagatele Bay and Larsen Bay units are located along the southern coast of Tutuila. Aunu'u Island is located just off the southeastern shore of Tutuila. The remaining three units are at Ta'u Island, Rose Atoll, and Swains Island. The Samoan name for Rose Atoll is Muliāva (which translates into English as "end of the current" and is the proposed name for this unit). This could refer to its position at one end of the Samoan Archipelago at the upstream end of the South Equatorial Current (Kendall and Poti in prep.). The Muliāva unit consists solely of federal waters, but would not include the land or the 1,600 acres of reef habitat of the Rose Atoll National Wildlife Refuge. All of the other units would occur completely within territorial waters, encompassing both shallow reef and deep waters, and extend to the mean high water line of the coast. This proposed action would increase the overall size of the sanctuary from 0.25 square miles (0.65 square km) to 13,568.5 square miles (35,142.2 square km), with the majority of this expansion (99 percent) from the designation of the marine areas of the Rose Atoll Marine National Monument.[12] Alternative 4 adds additional federal waters around Rose Atoll, Swains Island and Aunu'u Island.

[12]The Monument designation would remain, with the added management regime associated with this proposed sanctuary unit, necessary to implement the provision of Proclamation 8337.

All six units have intrinsic value that merits their inclusion in the National Marine Sanctuary System (see attributes summarized in Table 1-3). The Fagatele Bay and Larsen Bay units are the only bays in the territory formed by collapsed craters – a unique geologic and habitat feature. In addition, similarities in the fish and coral population between these two bays make them useful replicates for research. The prehistoric village site at the Fagatele Bay unit may offer important archeological insights into interactions between humans and the marine environment (Gould *et al.* 1985). The Aunu'u unit bears cultural resource significance because of a 19th century whaling vessel lost there, has a vibrant patch reef system, and a coral shelf that provides a continuous habitat that extends down to mesophotic reefs (Kendall and Poti in prep.). The Ta'u unit includes a unique fish community, as well as some extraordinarily large *Porites* species coral colonies (Brainard *et al.* 2008). The Swains Island unit is the northern most emergent reef in the territory, is isolated from the rest of the archipelago, and is composed of unique fish and coral communities. The Muliāva unit is the easternmost emergent reef in the territory, includes the Vailulu'u Seamount, supports a large population of seabirds and has a unique fish community (Kendall and Poti in prep.). Muliāva is also the only unit with extensive pelagic habitat.

Table 1-3: Summary of Sanctuary Unit Key Attributes.

ATTRIBUTE	SANCTUARY UNIT					
	Fagatele	Larsen	Aunu'u	Ta'u	Swains	Muliāva
Coral Cover	High	High	Moderate	Low	High	Low
Coral Richness	High	High	Moderate	High	Low	Low
Fish Biomass	Comparable	Lower	Low	Moderate	High	High
Fish Richness	Moderate	Moderate	High	Moderate	Moderate	Moderate
Unique Coral Community	No	No	No	Yes	Yes	Yes
Unique Fish Community	No	No	Yes	No	No	No
Cultural Sites	Yes	N/A	Yes	Yes	N/A	N/A

Source: Kendall and Poti in prep.
* Coral and reef fish variable values are relative to all of American Samoa. Green shading indicates sanctuary unit is within a regional hotspot for the variable. Coral and fish community uniqueness is for the overall bioregion(s) in which the sanctuary unit lies.

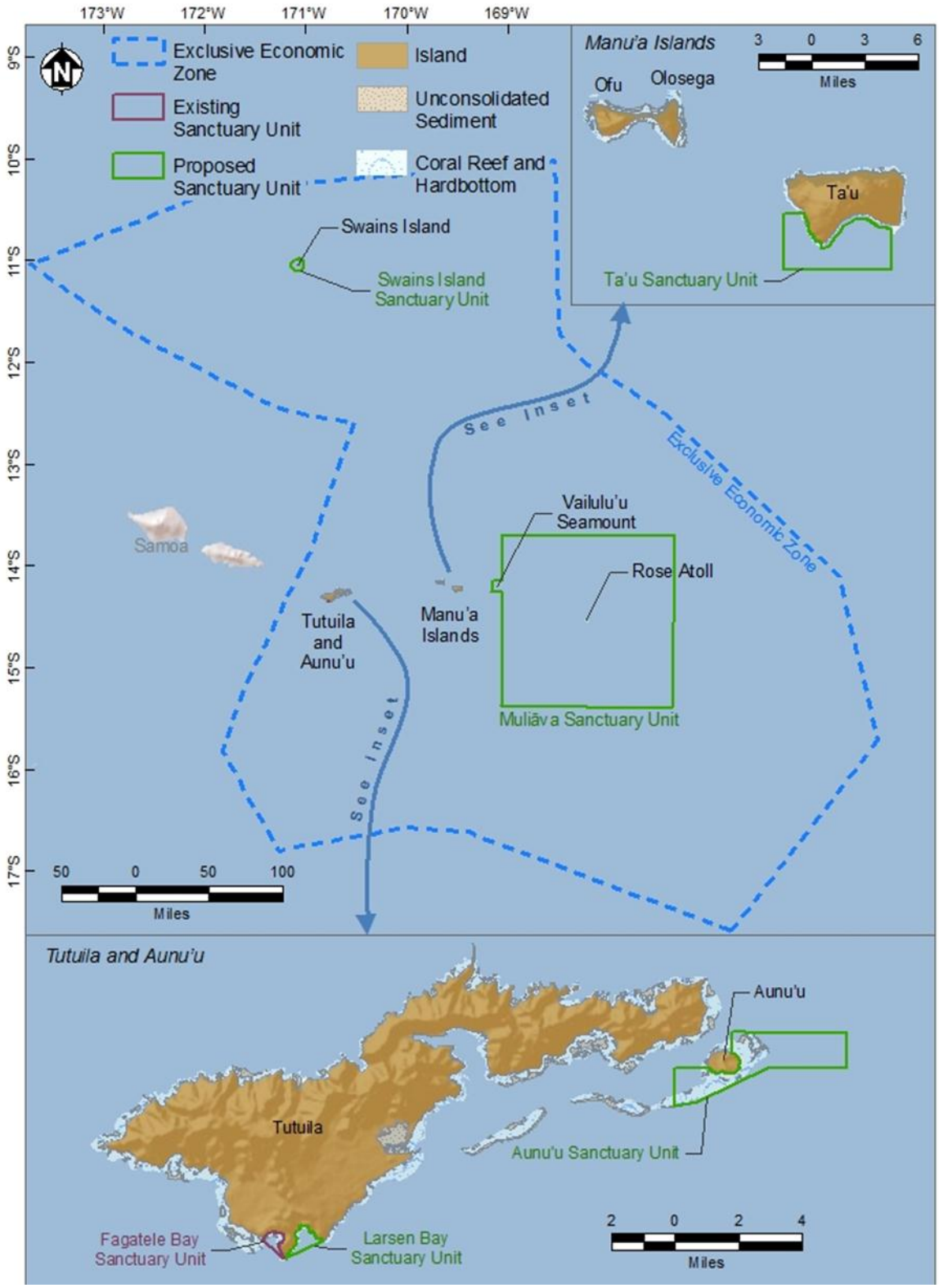

Figure 1-3: Proposed American Samoa National Marine Sanctuary Network.

1.6.3 Revision of Sanctuary Regulations

Existing regulations (15 CFR 922 Subpart F) would be in effect for all of the additional units described above, except for fishing regulations in the federal waters of the Muliāva unit.

1.6.3.1 Sanctuary-wide Regulations

Prohibited Gear

- Poisons, electrical charges, and explosives (already prohibited in territorial waters under American Samoa Code Annotated (ASCA) 24.0911-0915 and in federal waters under 50 Code of Federal Regulations (CFR) 665104(c) and 127(b));
- Drift gill nets (already prohibited in territorial waters under ASCA 24.0311 and in federal waters under 50 CFR 665.809);
- Seine, trammel net, or any type of fixed net;
- Scuba-assisted spearfishing (already prohibited in territorial waters under ASCA 24.0916).

Prohibited Take of Species

- Live hard coral and wild live rock (take is already prohibited in territorial waters less than 60 feet under ASCA 24.0927(a) and in federal waters under 50 CFR 665.125(c));
- Other bottom formations, including precious corals and crustose coralline algae (take of precious corals is already prohibited in territorial waters less than 60 feet under ASCA 24.0927(a)) (prohibition is not in effect for federal waters);
- Giant clams (prohibition is not in effect for federal waters);
- All species of live shells except the goldmouth turban snail *Turbo chrysostomus*, *alili* in Samoan (prohibition is not in effect for federal waters);
- Crown-of-thorns starfish *Acanthaster planci* (prohibition is not in effect for federal waters);
- Any marine mammal or sea turtle (already prohibited in territorial waters under ASCA 24.0934-0935 and in federal waters under the Endangered Species Act [ESA]).

Other Regulations

- No anchoring, and use a mooring buoy where available;
- No discharge of any material within or outside of sanctuary waters that could enter and injure sanctuary resources, both from land- and sea-based sources. Vessels operating within the Muliāva unit would be allowed to discharge effluent from a U.S. Coast Guard-approved Type I or Type II Marine Sanitation Device;
- Vessels must operate in a safe manner, including not exceeding 3 knots within 200 feet of a dive flag;
- No disturbing the benthic community by dredging, filling, dynamiting, bottom trawling, or otherwise altering the seabed;
- No damaging, removing or displacing any signs, notices, or placards, or stakes, posts, or other boundary markers related to the sanctuary;

- Divers operating from a vessel must display the international code flag alpha 'A' and a 'diver down' flag;
- Prohibition on the introduction or release of introduced species from within or into sanctuary waters;
- Prohibition on abandoning any structure, material, or other matter on or in the submerged lands of the sanctuary;
- Prohibition on deserting a vessel aground, at anchor, or adrift in the sanctuary;
- Prohibition on leaving harmful matter aboard a grounded or deserted vessel in the sanctuary;
- Prohibition on removing, damaging, or tampering with any historical or cultural resource;
- Creation of a management permit to assist in managing the sanctuary.

In addition to these regulations, the preferred alternative would include various gear restrictions and harvest prohibitions.

1.6.3.2 Site-specific Regulations

Site-specific regulations address only the take of living marine resources. These regulations are of two types: (1) allowable and restricted gear and (2) access restrictions. A no-take zone is proposed at some units, or in some locations within a given unit.

Fagatele Bay

The Fagatele Bay unit would become a complete no-take zone, encompassing the entire bay from Fagatele Point to Steps Point.

Larsen Bay

The use of all fishing gear, except for hook-and-line gear, would be prohibited within the boundaries of the Larsen Bay unit (*i.e.*, Steps Point to Sail Rock Point). Exceptions may be made for specific cultural harvest activities.

Aunu'u Island

The Aunu'u Island unit is divided into two zones. Zone A is the Multiple Use Zone, and would require any vessel operator to notify the sanctuary or its designee in the village of Aunu'u prior to each fishing trip. Zone B is the Research Zone, which would be designated no take for all marine resources.

Ta'u Island

There would be no site-specific regulations for the Ta'u Island unit.

Swains Island

Only sustenance harvest would be allowed within the Swains Island unit. There would be no site-specific gear restrictions proposed for this unit.

Muliāva (Rose Atoll)

There would be no additional fishing regulations (including all sanctuary-wide regulations) for the Muliāva unit at this time.

Violation of any of these regulations could be punishable under 15 CFR 922.45 with a civil penalty of up to $130,000 per incident, per day. In addition, violators could be held liable for response costs and damages resulting from any destruction, loss, or injury to any sanctuary resource (15 CFR 922.46).

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 ALTERNATIVE DEVELOPMENT PROCESS

The review of the Fagatele Bay National Marine Sanctuary management plan, required under NMSA Sec. 304(e), provided ONMS an opportunity to conduct public scoping in February and March 2009 and to gauge interest within American Samoa for possible sanctuary expansion through additional unit designations. Based on comments received, there was wide support for the designation of new sanctuary units across the archipelago, although some of the comments expressed concerns about designation of any additional areas. Specific comments received during this process are mentioned in the description of each of the considered sanctuary units. In addition to areas identified through the public scoping, a couple potential sanctuary units were identified by sanctuary staff or were listed in the original EIS. Finally, three sanctuary units were included for consideration based on a specific request of the Jennings family (Swains Island), input from the Secretary of Samoan Affairs (Ta'u Island), and a presidential directive (Rose Atoll). These locations were analyzed by NCCOS in the context of their Biogeographic Assessment of the Samoan Archipelago (Kendall and Poti in prep.).

After the list of potential sanctuary units was developed, the sanctuary advisory council established a Site Selection Working Group, consisting of members of the advisory council and members of the public, assisted by sanctuary staff. The Site Selection Working Group utilized NMSA criteria to evaluate the ecological, cultural, and economic value of nine marine areas that the public had proposed as potential new sanctuary units and made recommendations about which areas should be considered for sanctuary designation. This evaluation led to a preliminary set of alternatives that encompassed the range of options supported during the public scoping process. Location-specific regulations were developed through a collaborative process during community meetings between ONMS and AS DOC staff and village representatives. Issues addressed during the meetings included potential gear restrictions, fishing restrictions, and co-management of the sanctuary unit.

In addition to sanctuary expansion and regulatory changes, sanctuary staff and the advisory council have proposed an updated management plan, including revised goals and objectives, and new action plans that identified and prioritized specific activities. The new sanctuary goals and management plan revision are considered non-regulatory actions, which NOAA is proposing to implement under all of the proposed action alternatives. The management plan update, the new goals, and the addition of a management permit are the three actions proposed in Alternative 1, while variations of the proposed new sanctuary units and additional regulations, in addition to the management plan update, constitute the three other alternatives.

2.1.1 Alternatives Considered but Eliminated

A variety of strategies were put forth during the public scoping process, indicating strong support for expansion of the sanctuary from a single location at Fagatele Bay to a network of sanctuary units across the archipelago. Most of the locations, both those chosen for the alternatives as well as those eliminated from consideration, were supported for inclusion during this process. Of these, the following were eliminated from consideration for the reasons discussed below.

2.1.1.1 Pala Lagoon

Pala Lagoon is located at the terminus of the largest watershed on Tutuila, with important coastal features including the largest stand of mangroves in American Samoa (Volk 1991) and a large mudflat habitat, creating an ecosystem unique in American Samoa. This mangrove diversity was specifically mentioned during public scoping as a rationale for consideration among the network of proposed sanctuary units. Nevertheless, the marine waters at this location have relatively low biodiversity, low biomass, and poor water quality, giving it low marks for biological significance. The construction of American Samoa's international airport in the early 1960s altered the natural circulation patterns, and water quality is a major concern and the focus of a toxicity study (Volk 1991). Pala Lagoon is currently managed by the American Samoa Coastal Management Program as a Special Management Area, which provides a level of protection appropriate for its level of use, ecosystem health, and biological significance. Based on the low biodiversity, poor water quality, and existing legal protection, Pala Lagoon did not meet the standards set for inclusion as a candidate sanctuary unit.

2.1.1.2 Leone Bay

Leone Bay was suggested as a potential area for inclusion during public scoping based on concern for coral damage from human activities, primarily people walking on and damaging or destroying the reef. Recent in-water assessments indicate that 15 percent of the coral is stressed, a relatively high percentage compared with other areas surveyed (Brainard *et al.* 2008). While this concern is important, there are many external issues that detract from this location as appropriate for inclusion. Plans to expand the harbor at Leone Bay, first proposed in the early 1990s but since delayed for lack of adequate funding, would be complicated by sanctuary designation. Leone Bay is adjacent to a large village and is an area of high human use, including subsistence fishing and timber harvest of the small mangrove

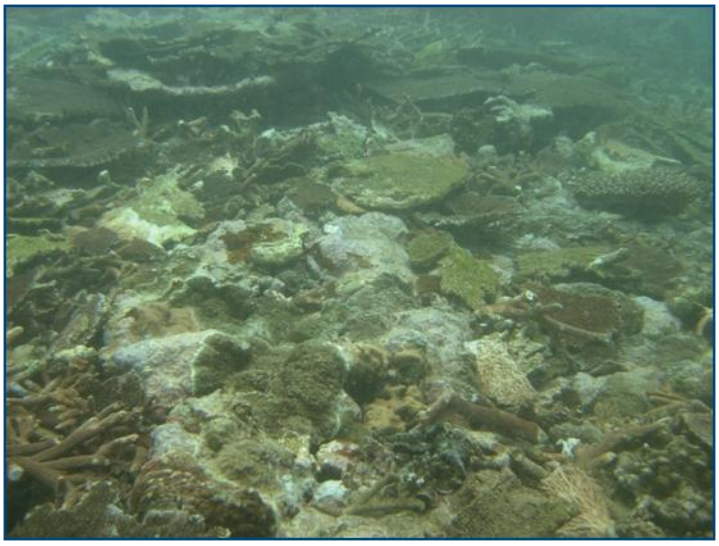

Photo 1: NOAA is not considering Leone Bay as a potential site for inclusion in the sanctuary due to a variety of factors, including low ecological significance relative to other sites. Photo: Doug Fenner.

stand, which would make a designation likely to result in a significant level of adverse socio-economic impacts (Volk 1991). As with Pala Lagoon, Leone Bay is currently managed by the American Samoa Coastal Management Program as a Special Management Area, affording it protection appropriate for its use and condition. Based on the relatively low ecological significance, existing legal protection, and potential socio-economic impacts, Leone Bay did not meet standards set for inclusion as a candidate sanctuary unit.

2.1.1.3 Outer Banks

An area known as the Outer Banks was initially put forth by the public as an area in federal waters with an expected high ecological value, as well as ecosystem characteristics different from the other proposed areas. This area is a heavily used and highly prized for recreational fishing (Wearing 2011). Because of its relative proximity to land and its consistently high catch rates, most boat-based fishers consider the Outer Banks the best fishing grounds within the American Samoa Exclusive Economic Zone (EEZ, ocean waters 3-200 nm from shore). In 2010, a NOAA research cruise surveyed South Bank, a portion of the outer banks, and found extremely low percentage of coral cover and overall poor coral reef habitat (Grimshaw 2011). This location was eliminated due to the low ecological value as well as potential high socioeconomic impacts that designation could impart to recreational fisheries.

2.1.1.4 Research Areas

The idea of an area of the sanctuary set aside solely for research became a strategic goal during alternative development. The idea originated during public scoping, as well as from the governor and within ONMS. The initial qualities required for a research area are a diversity of high-quality habitats, including both shallow and deep water reefs, and it must be a no-take zone. Based on these physical and biological requirements, a number of locations were identified through the biogeographic assessment initiative. All of the potential sanctuary units identified occur in the waters around Tutuila, one in the offshore waters north of the island, one on the west side, and one on the east side of Tutuila. Each of these locations was eliminated from consideration for different reasons. The area to the north was deemed inconvenient as it would take more than 2 hours from Pago Pago Harbor to access. The additional fuel cost of transiting this distance was also a factor for elimination. The location on the east side of the island (Research Unit A) was eliminated because of the relatively high use of the area by the associated

Photo 2: One method researchers employ to study benthic organisms is a photo quadrat survey, used here to study benthic algae at Rose Atoll (not proposed as a research site). NOAA Photo: By Jean Kenyon.

community (Spurgeon *et al*. 2004), which would likely cause significant socio-economic impacts, a concern specifically voiced by the governor. Socio-economic impacts would likely be exacerbated as Research Unit A is adjacent to the proposed Aunu'u Island sanctuary unit, which would create nearly 60 square kilometers of sanctuary covering most of the waters of eastern Tutuila. The location on the west side of Tutuila (Research Unit B) was eliminated from consideration because of the consistently rough seas, particularly during the winter months, that could pose unnecessary challenges as well as increased risk to human safety and in-water research equipment. After these three potential research units were eliminated from consideration, the idea of creating a research zone within the proposed Aunu'u unit was raised, which is discussed as part of Alternatives 3 and 4. It was also noted that the adjacent Fagatele and Larsen Bays could provide for specific research opportunities. For these reasons, the creation of a stand-alone research sanctuary unit was eliminated from consideration.

2.1.2 Selection of Alternatives

2.1.2.1 Biogeographic Assessment of the American Samoa Archipelago

NOAA's NCCOS Biogeography Branch has been supporting ONMS since 1998 with a biogeographical approach to inform the management of marine resources within both coral reefs and national marine sanctuaries.[1]

In 2008, NCCOS, after consultation with federal and territorial partners, designed an assessment that focused on corals and reef fish, transport of their larvae, and the reef habitats where they live. This assessment of biodiversity, abundance and community structure (Kendall and Poti in prep.) is based on the compilation of multiple pre-existing datasets, original analysis, and discussion not previously published. These data sets cover survey sites along all shorelines from each of the seven American Samoan islands, and Upolu and Savai'i islands of the independent nation of Samoa. Results from these analyses are intended to inform resource managers in identifying and prioritizing key areas in conservation and management planning, including understanding the connectivity among these islands to support the ongoing development of a network of marine protected areas in the Samoan Archipelago. Connectivity addresses larval transport from source to settlement and is an important parameter in understanding ecosystem dynamics and the relative vulnerability of different coral reef habitats to natural and man-made perturbations (Kendall and Poti in prep.).

[1] To date, nine ONMS sites and most of the coral reef ecosystems in U.S. states and territories have had some level of biogeographic characterization or mapping completed. The results of these ecological characterizations are available via website. For more information, see http://ccma.nos.noaa.gov/about/biogeography.

2.1.2.2 Development and Application of Criteria

The expansion of the Fagatele Bay National Marine Sanctuary into a network of units across the archipelago would be consistent with ongoing territorial and federal initiatives to provide additional protection and sustainable management of American Samoa's marine resources, including American Samoa MPA Master Plan to designate 20 percent of the territory's coral reef habitat no-take MPAs (Oram 2008), NOAA's Coral Reef Conservation Program (CRCP) management priorities, the Community-Based Fisheries Management Program (Kilarski *et al.* 2006; A.S.C.A. Administrative Rule 01-2008), and the *Two Samoas Initiative* to coordinate scientific research, share information, and jointly develop conservation targets for archipelagic marine and terrestrial resources. Globally, a network of marine reserves is the most effective way to protect fisheries and coral reefs without alienating local fishermen and residents, as large marine reserves are more difficult to enforce, tend to have higher impact on users, and regulations are often ignored (Sale *et al.* 2010). In developing the criteria, each of the proposed units had to meet sanctuary designation standards of Section 303 of the NMSA (see sidebar). The biogeographic assessments conducted by NCCOS specifically addressed these standards by evaluating the relative contribution of each unit's habitats, coral reefs, and reef fish to its overall value. The Site Selection Working Group considered human use, historic and cultural importance, as well as the level of management necessary to conserve these resources. Each surveyed area was then ranked, which helped to determine which of the potential units were appropriate for protection under the NMSA.

National Marine Sanctuaries Act Sanctuary Designation Standards

(1) The area is of special national significance based on:

(A) Its conservation, recreational, ecological, historical, scientific, cultural, archaeological, educational, or esthetic qualities;

(B)The communities of living marine resources it harbors;

(C)Its resource or human-use values;

(2) Existing state and federal authorities are inadequate or should be supplemented to ensure coordinated and comprehensive conservation and management;

(3) The area is of a size and nature that will permit comprehensive and coordinated management.

2.1.2.3 Selection of New Sanctuary Units

A number of comments raised during public scoping expressed concern over the expansion of sanctuary into a network of sanctuary units across the territory, as the territory already has a MPA process, and it was perceived that a federal presence would take over and not allow for a community focus on marine resource management. These concerns were taken seriously during alternatives development, and sanctuary staff worked closely with each of the villages associated with all of the potential sanctuary units to ensure their concerns were addressed. Sanctuary staff, after determining which units would be considered for inclusion in this action, held multiple meetings with each of the communities associated with these locations to foster consensus and collaboration with regards to how the unit would be managed. As a result, five additional units are proposed to make up the expanded sanctuary in the preferred alternative (Figure 2-1). The rationale for inclusion is unique for each unit.

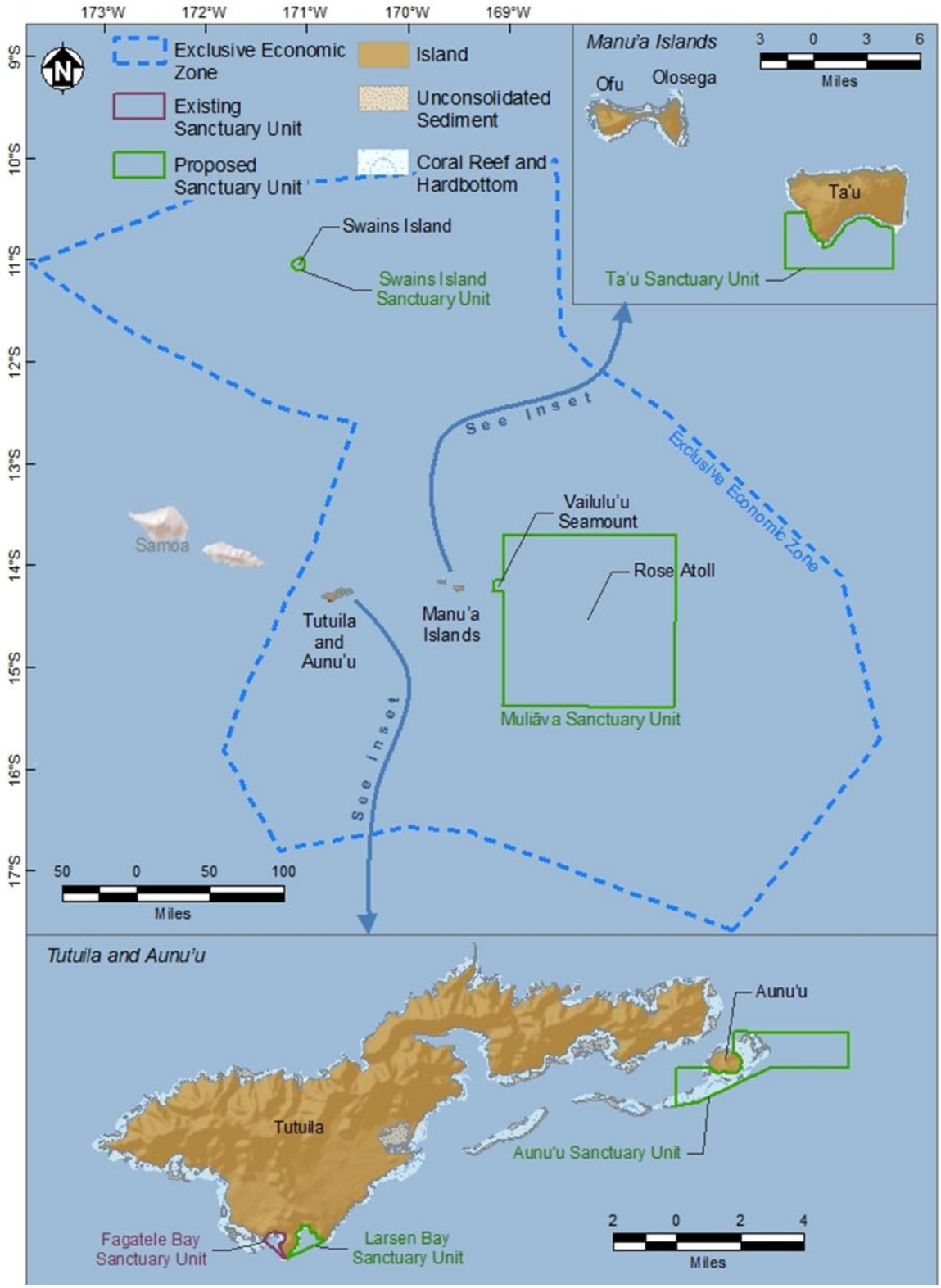

Figure 2-1: Map of the Samoan Archipelago with Proposed Sanctuary Units Identified.

Muliāva (Rose Atoll)

Proclamation 8337 (74 FR 1577) designating Rose Atoll as a Marine National Monument specifically directed the Secretary of Commerce to "initiate the process to add the marine areas of the monument to the Fagatele Bay National Marine Sanctuary." The monument boundaries form a 13,448 square mile square that extends approximately 50 nautical miles (nm) into the deep pelagic waters from the mean low waterline of Rose Atoll. The approximately 20 acres of emergent land and 1,600 acres of lagoon waters, established as a National Wildlife Refuge in 1973, are included as part of the Monument. Rose Atoll meets the standard of a potential national marine sanctuary unit, considered one of the world's most pristine atolls, with a dynamic reef ecosystem uniquely dominated by crustose coralline algae, home to endangered turtles, birds, and marine mammals, as well as an abundance of other species depleted elsewhere in the world. The proclamation specifically prohibits commercial fishing, while allowing for noncommercial sustenance, recreational, and traditional indigenous fishing. To address USFWS concerns and fulfill the requirement of the Proclamation, this document analyzes the Muliāva unit both without an overlay of the Rose Atoll NWR (Alternatives 2 and 3) and with an overlay (Alternative 4).

Larsen Bay

Numerous comments during public scoping supported the expansion of the sanctuary into Larsen Bay, as well as making this proposed unit more accessible by land. The bay is composed of Fagalua and Fogama'a Bays and is bordered by Futiga and Vaitogi villages. Larsen Bay is adjacent to the sanctuary, sharing the Steps Point boundary point, and extending to the east to Sail Rock Point. The location was identified as an area of high ecological value in the NCCOS biogeographic analysis, as it has high coral cover and richness. Within an MPA network, Larsen Bay functions as a replicate to Fagatele Bay, providing protection and enhance resiliency of this type of coral reef ecosystem (*i.e.*, a fringing coral reef within a collapsed volcanic crater). Larsen Bay was also noted for its potential research value, as its physical, biological, and social attributes are similar to Fagatele Bay, providing a replicate study site for various research.

Aunu'u Island

Aunu'u Island was identified as an area with highly valued natural resources during the biogeographic assessments of American Samoa in 2008 to 2010 NCCOS (Kendall and Poti in prep.). This assessment found reef pinnacle formations, patch reefs, and overall high habitat diversity in the waters surrounding the island, as well as diverse and abundant coral and fish species. Because of this assessment and high ranks from the Site Selection Working Group, sanctuary staff included this location as a potential sanctuary unit. During alternatives development, Aunu'u Island was proposed to include a research zone because of its unique and healthy reefs, as well as the occurrence of mesophotic (deep water) reefs adjacent to the shallow waters of Aunu'u. The waters to the west and south of the island include shallow reef habitat, while waters to the east spans multiple habitat types, including the mesophotic reefs and deep waters. Based on the healthy reefs and high habitat diversity, this eastern area was identified as a suitable potential research zone.

Photo 3: Aunu'u Island as seen from Tutuila. Photo: Sarah Kinsfather.

Ta'u Island

Photo 4: Western reefs offshore from Ta'u include large Porites *coral that may be the largest coral heads in the world. Photo: Doug Fenner.*

The waters surrounding Ta'u Island are home to both biologically and culturally significant resources. Massive *Porites* coral colonies, possibly the largest coral heads in the world, occur in the nearshore waters along the southwestern coast (Brown *et al*. 2009). The largest among these dozen coral heads is estimated to be between 360 and 800 years old, among the oldest known shallow water coral. The size, health and proximity of these giant corals indicate that conditions favorable to coral growth have been stable for a long time. Protecting these big corals and their surrounding ecosystem as part of the sanctuary was mentioned during public scoping.

Much of the island is part of the NPAS, which extends one-quarter mile into the coastal waters along the southern and eastern shore. The culturally important site known as *Taisamasama*, the Yellow Waters of Tui Manu'a, occurs in the waters off the southern shore. The Office of Samoan Affairs (Secretary of Samoan Affairs) requested that *Taisamasama* be considered for inclusion in the sanctuary. During meetings with the AS DOC and the Governor, a single sanctuary unit that includes the large corals, *Taisamasama*, and substantial offshore waters was proposed. This boundary alternative includes all nearshore waters from Vaita Point on the eastern shore to Si'u Point on the southern shore, as well as substantial offshore waters. During alternative development and analysis, the National Park Service (NPS) expressed opposition to a sanctuary unit that overlaid NPAS waters (C. Lehnertz 4 April 2011; C. Lehnertz 8 July 2011), citing sufficient protection of these resources per NPAS regulations (Public Law 100-571), as well creating the potential for public confusion and redundant costs due to the overlay. Furthermore, the NPS stated opposition to any sanctuary presence around Ta'u, indicating that park expansion would be a more cost-efficient method to protect the giant corals and other exceptional marine resources around Ta'u. Because of these concerns, three sub-alternatives have been developed for analysis of the proposed Ta'u sanctuary unit; one with no sanctuary unit at Ta'u (Alternative 3A), one where NPAS waters are adjacent to the sanctuary unit (Alternative 3B, Figure 2-8), and one where the sanctuary unit overlays NPAS waters (Alternatives 4A and 4B, Figure 2-11).

Swains Island

Swains Island was included as a proposed sanctuary unit after ONMS received a request for consideration from the Jennings family, who own the island. The island is the northernmost emergent reef within the American Samoan EEZ and is geologically separate from the rest of the archipelago. The remoteness of the island has allowed for its surrounding marine ecosystem to remain undisturbed, characterized by high biomass and richness and very high coral cover (Brainard *et al.* 2008).

2.1.2.4 Community Meetings

After the decision that the above proposed sanctuary units would be included as part of the preferred alternative, ONMS staff used the OSA as a conduit to the villages and held community meetings with each of the associated villages. Sanctuary staff consulted with OSA before all village meetings. Meeting details, including participants, time, date, location, and other considerations, were confirmed through OSA before sanctuary and AS DOC staff met with the villages. OSA identified representatives for the initial meeting for each village. The intent of this first meeting was to provide an understanding of ONMS and the sanctuary and to create a collective vision focused on marine resources in the area and how the villages envision their marine environment, both present and future. For subsequent meetings, County Chiefs, after consultation with the village mayors, decided whether other village personnel should be involved and ensured community participation at scheduled meetings. Sanctuary staff at these meetings presented boundary options and discussed potential regulations that would be implemented. Staff also discussed community involvement and joint management opportunities.

2.1.2.5 Customary Marine Tenure and Village Partnership

Customary Marine Tenure (CMT) refers to a traditional resource management strategy that builds on ownership and use rights (Govan *et al.* 2009). Within the context of *fa'a-Samoa*, the village *matai* maintains stewardship over the marine resources from the shoreline to the reef flat adjacent to the village. In addition to spatial and temporal bans on specific areas or species observed by the community, CMT protocol ensures that people from outside of the village request permission to harvest the marine resources of the reef flat adjacent to the village, which can be granted by the *matai*. Among the revised objectives of the sanctuary management plan is to increase community involvement and stewardship of the resources of the sanctuary. Community involvement requires increased awareness and sense of responsibility from the community that can be fostered by support from federal and territorial agency for the practice of CMT. Village participation in establishing restrictions, sanctuary management, and enforcement enhances the level of cooperation and promotes long-term sustainable use of the resources. By integrating CMT principles into the management at each of the units, unsustainable and possibly destructive fishing practices that may occur by those outside the village can also be reduced. Alternative 3 provides a notification requirement for boat-based fishing that incorporates CMT principles intended to protect the resource and foster community partnership.

2.2 DESCRIPTION OF ALTERNATIVES

For each alternative, the proposed unit and associated boundaries are described, as well as location-specific fishing and other regulations. Proposed sanctuary-wide regulations occur in Alternatives 2, 3, and 4, and are described once in the first alternative in which they appear. These include boating regulations, research regulations, pollution discharge regulations, access issues to each of the proposed units, permitting, and regulations specific to non-ESA species. The management plan revision is first proposed under Alternative 1, and is also an aspect of Alternatives 2, 3, and 4. A summary for each alternative explains how it is consistent with the goals of the sanctuary.

2.2.1 No Action

No Action indicates that a statutorily-mandated management plan review (NMSA Sec. 304(e)) was conducted but no revisions would be made to the plan and no regulatory changes would be proposed. Section 1.2 addresses the requirements of the review, including evaluating progress made towards implementing the management plan and goals for the sanctuary. Sanctuary activities would remain focused on Fagatele Bay, although new education and outreach programs would be expected for the sanctuary visitor center, the completion of which is expected in mid 2012. Also, the newly acquired sanctuary vessel R/V *Manumā* would likely enhance research and other activities beyond that outlined in the 1984 management plan.

2.2.2 Alternative 1 – Update Sanctuary Management Plan

Alternative 1 proposes an update of the 1984 management plan, and proposes the addition of a management permit as the single regulatory change for the sanctuary. The revised plan updates the vision, goals, and objectives to better reflect the new paradigm of sanctuary management within ONMS, removes old tasks and incorporates new and planned management strategies and activities outlined in Chapter 4. These activities would apply only to Fagatele Bay, while activities directly related to other units would be removed from the management plan (e.g., *Activity CH&CE-4.3: Initiate maritime heritage and cultural resource surveys at the remote atolls of American Samoa (Rose Atoll and Swains Island) within 2 years*). The size of the sanctuary would remain the same and would include Fagatele Bay in its entirety (Figure 2-2: Fagatele Bay). The size of the sanctuary is 0.25 square mile (0.65 square km). Funding and staff required to carry out the activities described in the management plan would increase relative to No Action, but would likely be substantially less than what is proposed in Chapter 4.

2.2.2.1 Alternative 1 Regulations

Prohibited activities related to the harvest or harm to marine resources include:

- Taking, damaging or destroying any invertebrate or plant species, including the crown-of-thorns starfish.
- Possessing or using poisons, electrical charges, explosives, spearguns, bang sticks, or any similar devices.
- Possessing or using seine, trammel net, or any type of fixed net.
- Ensnaring or entrapping sea turtles.
- Dredging, filling, dynamiting, bottom trawling, or otherwise altering the seabed.
- Removing, damaging, or tampering with any historical or cultural resource.
- Commercial fishing and fishing poles, handlines, or trawls may be used only in Zone B Figure 2-2).

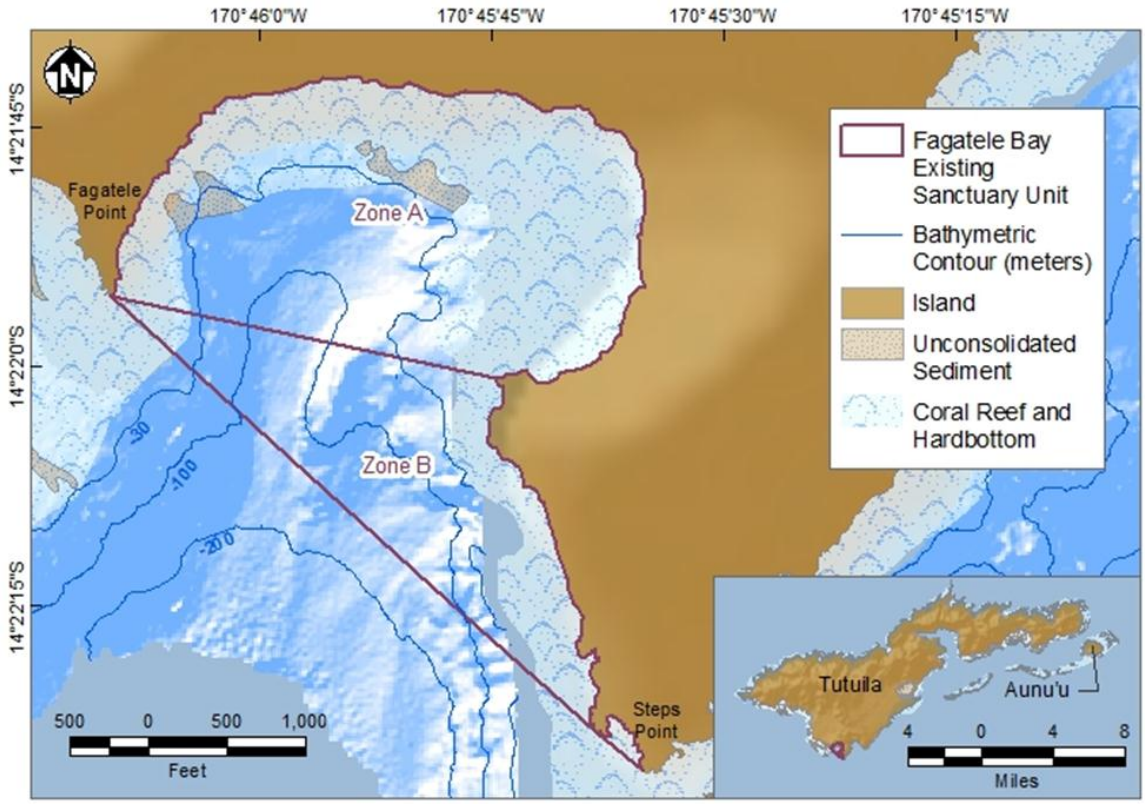

Figure 2-2: Alternative 1 Boundaries of the Fagatele Bay Unit.

Boating regulations within the sanctuary include:

- Prohibitions on exceeding 3 knots when operating closer than 200 feet (60.96 meters) from another vessel displaying a dive flag.
- Operating a vessel in a manner that causes the vessel to strike or otherwise damage the natural features of the sanctuary.
- Conducting dive operations without flying the international code flag alpha ‘‘A.’’ Dive flags are not required for shore-based diving.

Other prohibited activities include:

- Littering, depositing, or discharging, into the waters of the sanctuary, any material or other matter.
- Except for law enforcement purposes, using or discharging explosives or weapons.
- Damaging, removing or displacing any signs, notices, or placards, or stakes, posts, or other boundary markers related to the sanctuary.

Permits for activities prohibited by regulation would continue to be issued on a case-by-case basis employing current criteria outlined in 15 Code of Federal Regulations (CFR) 922.48 – *National Marine Sanctuary permits-application procedures and issuance criteria*, and specifically authorized within the Fagatele Bay National Marine Sanctuary permit procedures and criteria (15 CFR 922.104). Existing categories of permits that may be issued are for research, education, and salvage activities. The management permit proposed for all four alternatives includes the authority to issue a superintendent’s permit as well as permits to third parties for activities that assist in managing the sanctuary. Under Alternative 1, the management plan will be updated and include eight action plans, described below. Activities described in the action plans would focus primarily on Fagatele Bay, but would expand education and outreach programs based on those planned for the new visitor’s center.

New Management Plan Action Plans

- Cultural Heritage and Community Engagement*
- Marine Conservation Science
- Climate Change*
- Operations and Administration
- Ocean Literacy
- Resource Protection and Enforcement
- Partnerships and Interagency Cooperation*
- Program Evaluation

**New action plan*

2.2.2.2 Management Plan Revision

NOAA prepared this management plan in cooperation with the AS DOC and the advisory council, and with input from the public, territorial and federal agencies, and other stakeholders. This management plan would serve as a policy framework for addressing the issues facing the sanctuary over the next 5 to 10 years. The core of the management plan (Chapter 4) consists of eight action plans, with three of the action plans addressing issues not discussed in the 1986 management plan.

Each action plan begins with background information on current sanctuary programs and an overview of the direction sanctuary staff will take to address current management needs. Each also highlights which sanctuary goal its activities can help achieve. Strategies describe how management needs will be met and goals achieved for a particular issue or program area. Each strategy is divided into specific activities for sanctuary staff to complete. Action plan resource requirements are estimated based on the overall needs for conducting the strategies, including staff salaries. These estimates have been developed to represent the full requirements to conduct programs and projects, including outside funding, as described over a 5-year period. Full implementation of these action plans depends on continued support from territory and federal funding, grants, donations, and contributions from partners. The Program Evaluation Action Plan identifies performance measures for each of the other action plans to assist in evaluating the sanctuary's progress over time. As these measures are monitored, data are collected on progress toward the achievement of outcomes. In areas where the sanctuary is falling short of targets, staff will work to identify the obstacles that prevent the sanctuary from reaching its targets. Results will be compiled, synthesized, and then reported by the sanctuary superintendent annually at an advisory council meeting.

2.2.3 Alternative 2 – Designation of Muliāva (Rose Atoll Marine National Monument)

Alternative 2 would expand the sanctuary to include the 13,448 square miles (34,830 square km) of marine waters of the Rose Atoll Marine National Monument as described in Proclamation 8337 (Figure 2-3), naming the new sanctuary unit Muliāva, while the boundaries of Fagatele Bay would remain the same. The proclamation directs the Secretary of Commerce to initiate the process of adding the marine areas of the monument to the sanctuary. Rose Atoll is a remote and pristine atoll composed of 20 acres of land, 1,600 acres of lagoon, and a significant amount of reef crest that lies approximately 130 miles east-southeast of Pago Pago Harbor. Under Alternative 2, the sanctuary would not include the land or lagoon waters that make up the Rose Atoll National Wildlife Refuge (NWR)[2], managed by the USFWS. The seaward boundary of the NWR would define the interior boundary of the Muliāva unit, while the exterior boundary is a 100 nm by 100 nm square defined by the four coordinates of the monument listed in the proclamation. The monument, as described in Proclamation 8337, would remain a legal designation managed cooperatively by the Departments of Commerce and Interior.

[2] The exterior boundary of the refuge is the "extreme low waterline outside the perimeter reef except at the entrance channel where the boundary is a line extended between the extreme low waterlines on each side of the entrance channel" (Greenwalt 1974).

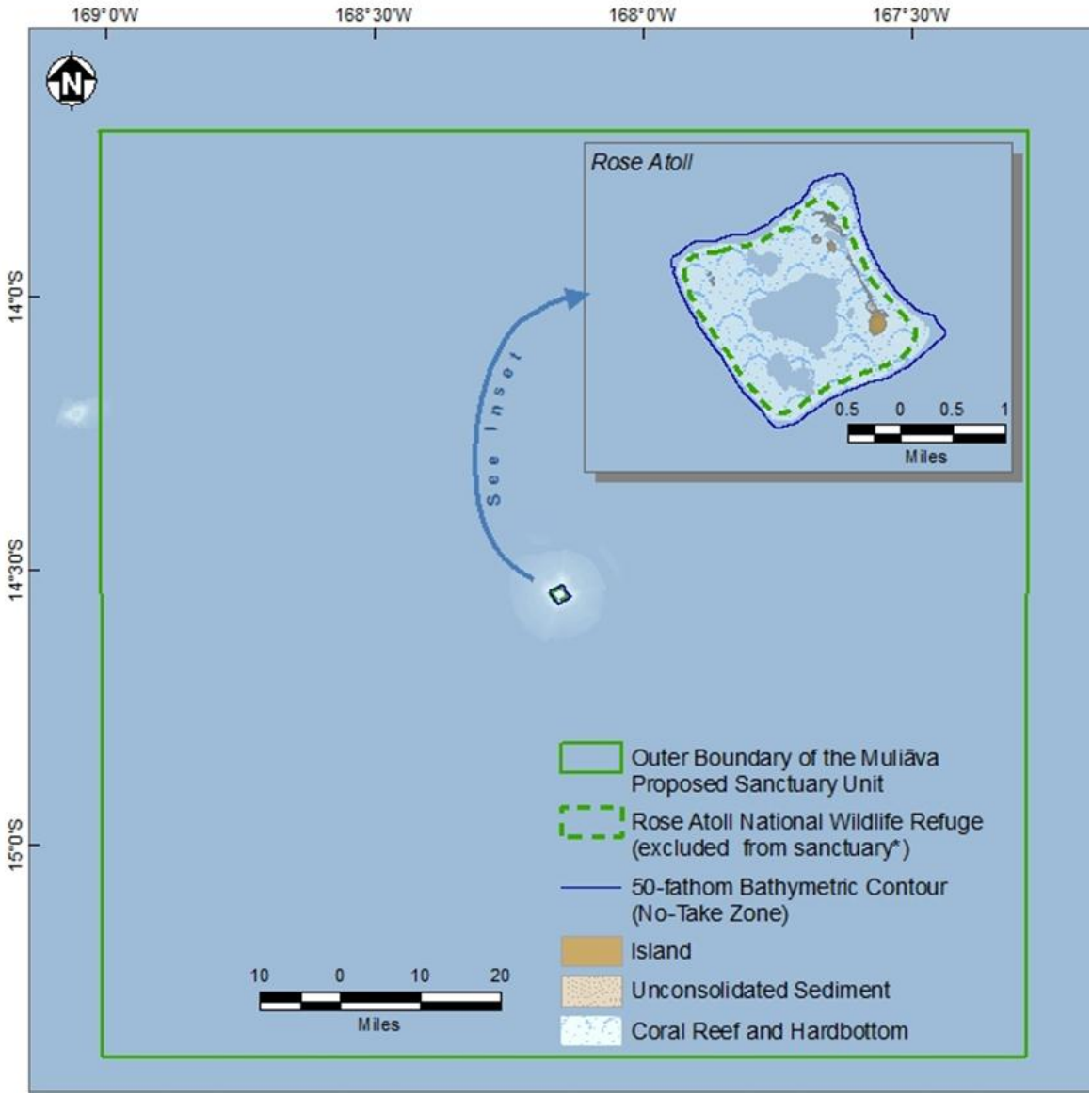

Figure 2-3: Alternative 2 Boundaries of the Muliāva Unit.
*This line represents both the seaward boundary of the NWR and the inner boundary of the Muliāva Unit.

2.2.3.1 Alternative 2 Regulations

Alternative 2 includes all existing regulations for Fagatele Bay described in Alternative 1, and includes five new regulations common across the sanctuary system (Table 2-1). The prohibition on anchoring and requiring the use of mooring buoys when available strengthens the current regulation on disturbing the seabed, addressing a primary threat to coral reefs. The Resource Protection and Enforcement Action Plan *Strategy RP&E-4: Minimize anchoring impacts to sensitive marine habitats, particularly coral reef formations, while providing reasonable access*

to sanctuary resources includes actions for the assessment, planning and installation of mooring buoys within five years. New regulations prohibiting abandoning or deserting vessels, structures or materials provides new protections for the benthic habitat and other sanctuary resources. The prohibition on the release of introduced species is common to the sanctuary system, due to the high threat and devastating impacts introduced species have imparted on marine systems worldwide. The sanctuary-wide regulations of Table 2-1would be in effect for both the Fagatele Bay and Muliāva units. In addition, the current vessel discharge prohibition would be revised to strengthen enforceability while providing special consideration for research vessels operating within the sanctuary waters surrounding Rose Atoll that have U.S. Coast Guard (USCG)-approved Type I or Type II marine sanitation devices (MSDs).

Table 2-1: Proposed Alternative 2 Regulations.

SANCTUARY-WIDE REGULATIONS
Prohibit anchoring and use mooring buoys when available
Prohibit release of introduced species
Prohibit abandoning structures or materials
Prohibit deserting a vessel
Prohibit leaving harmful materials on abandoned vessel
Must display dive flag when diving from a vessel*
Do not exceed 3 knots when operating a vessel 200 feet from dive flag*
Do not operate a vessel in a manner that causes the vessel to strike or damage sanctuary resources*
Prohibit disturbing the benthic community by dredging, filling, dynamiting, or otherwise altering the seabed*
Prohibit removing, damaging, or tampering with historical and cultural resources*
Prohibit littering, depositing, or discharging, into the waters of the sanctuary, any material or other matter*
Prohibit ensnaring, entrapping or fishing for sea turtles or marine mammals*
Prohibit the use or discharge of any explosives or weapons, except by law enforcement*
Prohibit defacing or removing any sanctuary signs or markers*
FAGATELE BAY SPECIFIC REGULATIONS[1]
Prohibit the gathering, taking, breaking, cutting, damaging, destroying, or possessing any invertebrate, coral, bottom formation, or marine plant, including the crown-of-thorns starfish *
Prohibit possessing or using a drift gill nets, bottom trawls, seine, trammel net, or any type of fixed net*
Prohibit the possession or use of poisons, electrical charges, explosives, or similarly destructive fishing methods*
Possessing or using spearguns, Hawaiian slings, pole spears, arbalettes, bows and arrows, bang sticks, or any similar taking device*

[1] No fishing regulations are being proposed in federal waters at this time as ONMS awaits recommendations from the WPFMC

* Existing Fagatele Bay prohibited activities (15 CFR 922 Subpart J)

There are currently no regulations related to the prohibition of commercial fishing within the monument, per Proclamation 8337 declaration. ONMS is awaiting NMFS action on the Western

Pacific Fishery Management Council (WPFMC) recommendations (including commercial fishing prohibition) through the fishery management process. Under Alternative 2, drift nets, already prohibited by territorial and federal regulations, would be added to the list of prohibited gear at Fagatele Bay. No additional fishing regulations would be proposed, either for Muliāva or Fagatele Bay units, and existing fishing-related regulations for Fagatele Bay would not apply in the Muliāva unit.

Sanctuary regulations common to all 13 national marine sanctuaries would be in effect at both units (see 15 CFR 922 Subparts A, D, and E). Permits would be issued for prohibited activities based on the same criteria described under the Alternative 1. In addition to permits for research, education, and salvage activities, Alternative 2 also incorporates a management permit as described under Alternative 1, which would provide a mechanism for issuing permits for otherwise prohibited activities to assist in managing the sanctuary.

Subpart E – Regulations and General Applicability of the National Marine Sanctuary Program[3] Regulations (15 CFR 922.45) allows for civil penalties of up to $130,000 per day for each violation of the NMSA or the relevant regulations of this chapter. In addition, 15 CFR 922.46 gives the authority to the Secretary to hold liable "any person who destroys, causes the loss of, or injures any sanctuary resource" for response costs and damages resulting from these damages. This authority would be extended to Muliāva, providing a strong enforcement mechanism currently not afforded under Monument designation.

2.2.4 Alternative 3 (A and B) – Multi-village Sanctuary Unit Expansion

Alternative 3 has two sub-alternatives, with a single difference between them. Alternative 3A expands the sanctuary to include an enlarged Muliāva unit, and three additional units across the archipelago. Alternative 3B adds one more unit at Ta'u, as previously discussed in section 2.1.2.3. Regulations described for Alternative 2 are also included in Alternative 3, with some modifications. Location-specific regulations are also included in this alternative. The management permit discussed in Alternatives 1 and 2 would remain for this alternative.

[3] Any leases, permits, licenses, or rights of subsistence use or access in existence on the date of designation of any new sites within Fagatele Bay National Marine Sanctuary shall not be terminated, although they may be regulated consistent with the purposes for which the sanctuary was designated (15 CFR 922.47).

2.2.4.1 Alternative 3 Proposed Units and Boundaries

Fagatele Bay

The unit would retain the same boundaries described in Alternative 1, although Zone A and B would be removed as the entire unit would be designated no-take (Figure 2-4).

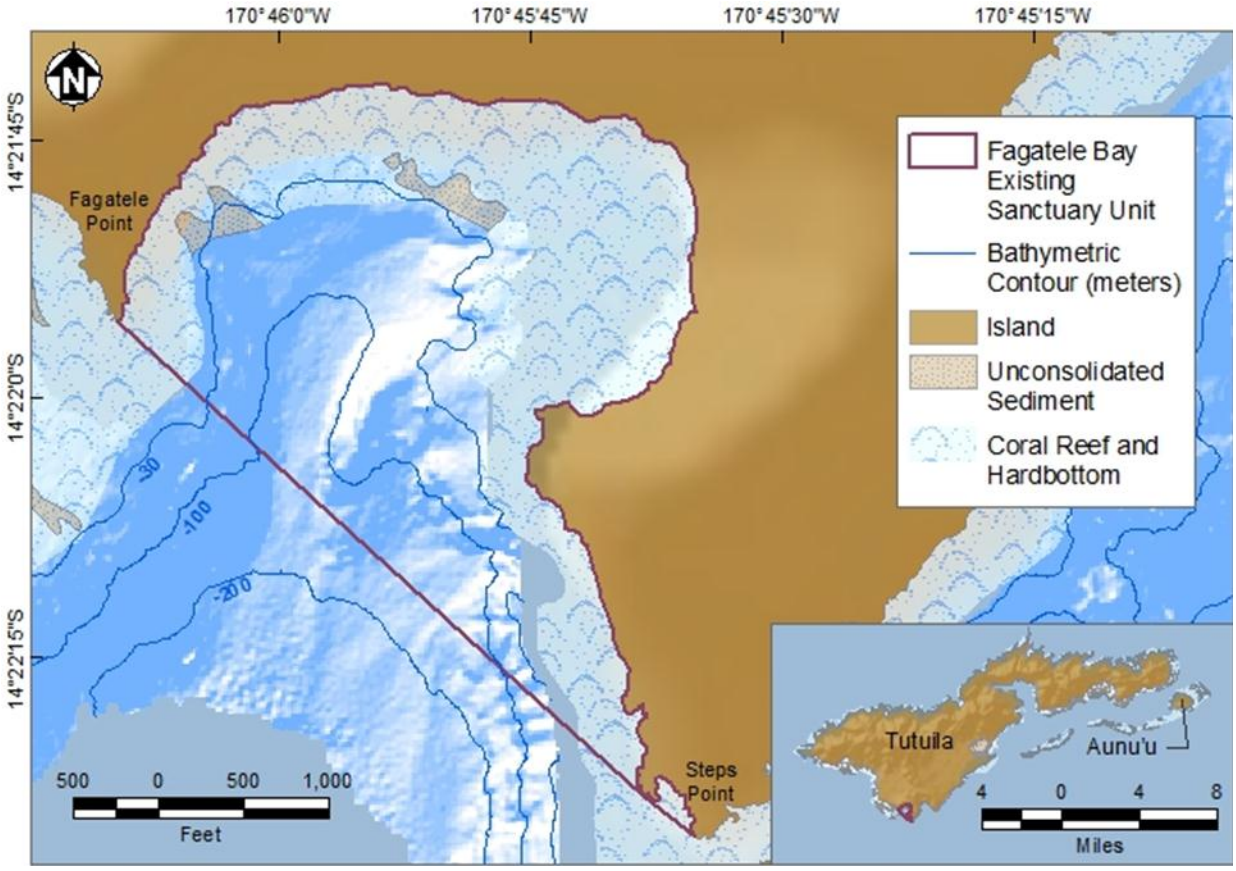

Figure 2-4: Alternative 3 Boundaries of the Fagatele Bay Unit.

Muliāva

The unit would be defined by the boundaries as described in Alternative 2, with an extension of the northwestern boundary to include 59.8 square miles (154.9 square km) of waters surrounding the Vailulu'u Seamount, the only hydrothermally active seamount within the EEZ (Figure 2-5).

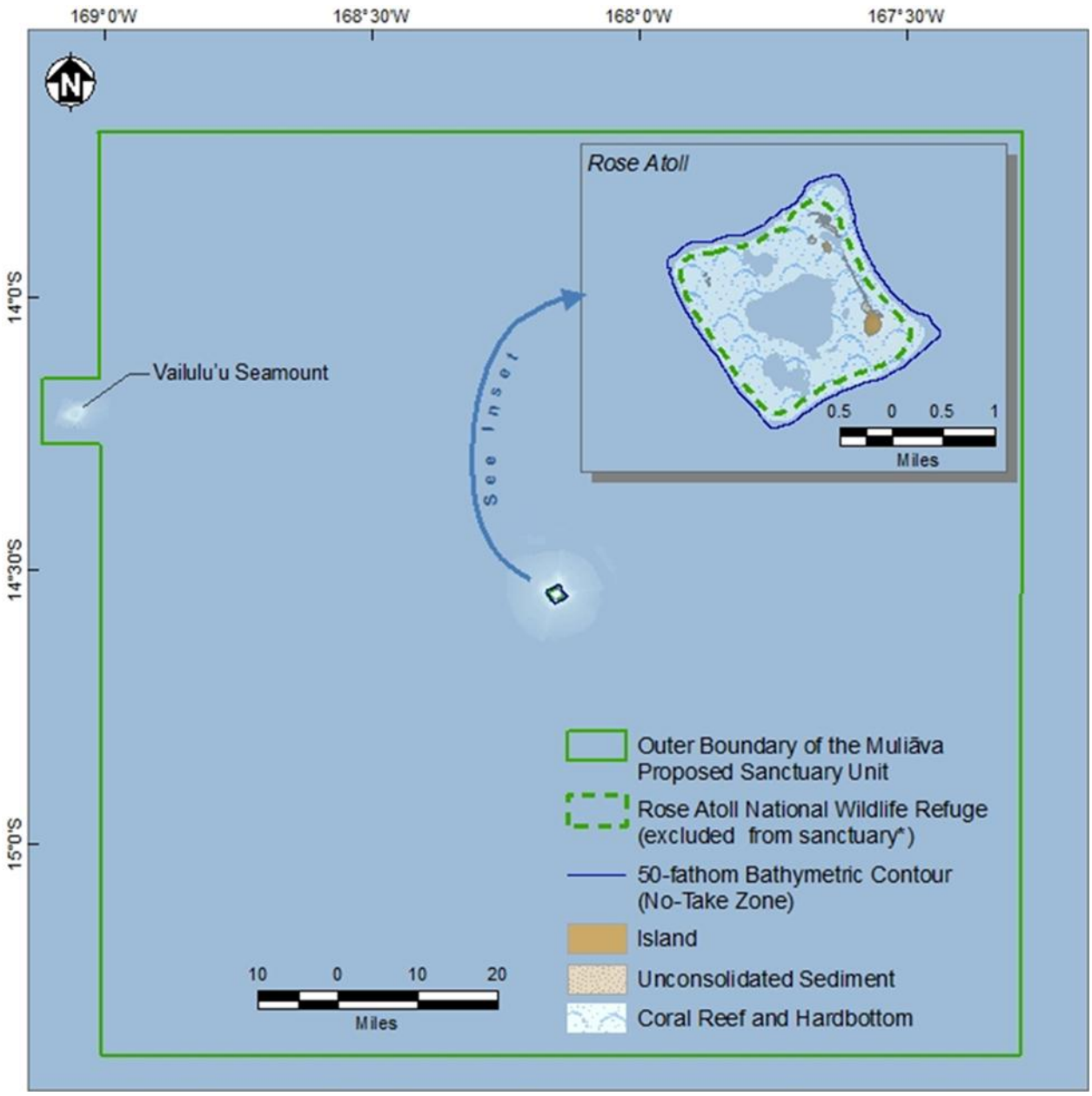

Figure 2-5: Alternative 3 Boundaries of the Muliāva Unit Including the Vailulu'u Seamount.
*this line represents both the seaward boundary of the NWR and the landward boundary of the proposed Muliāva Unit

Larsen Bay

The unit would encompass both Fagalua and Fogama'a Bays adjacent to Fagatele Bay on Tutuila, and associated with Futiga and Vaitogi villages (Figure 2-6). Larsen Bay is slightly larger than Fagatele Bay at 0.46 square miles (1.2 square km)

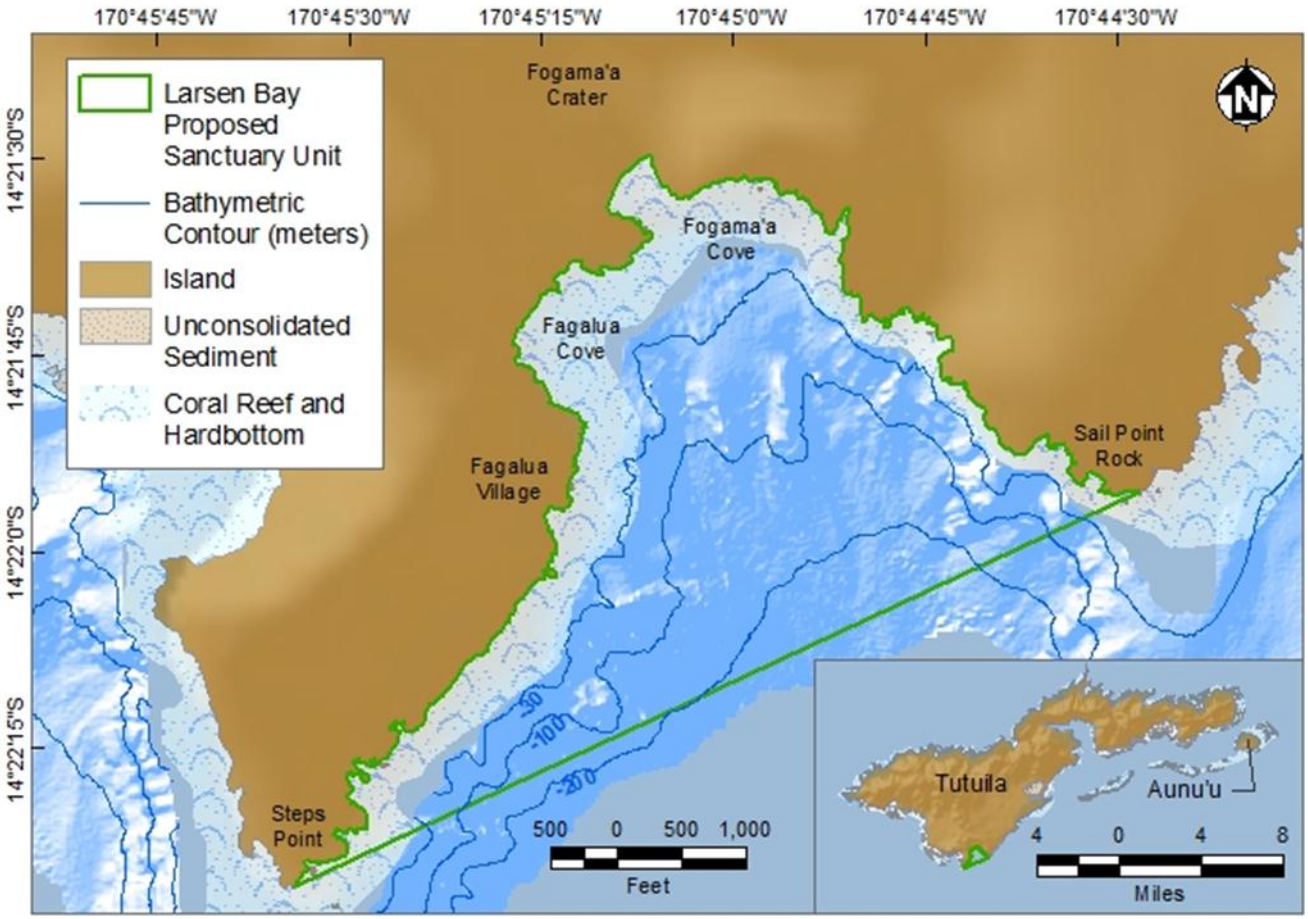

Figure 2-6: Alternative 3 Boundaries of the Larsen Bay Unit.

Aunu'u Island

The unit would border the island on three sides, with the southern border approximating the 30-meter isobath, while extending almost to the boundary of federal waters 3 nm to the east of Aunu'u (Figure 2-7). The western and southern waters of the proposed unit include shallow reef habitat, while the eastern area spans multiple habitat types, including the mesophotic reefs and deep waters. A number of the proposed boundaries of this unit were established based on identifiable landmarks (*e.g.*, Taugamalama Point, Salevatia Point) to assist potential boat-based users in identifying whether they are within or outside sanctuary boundaries. Based on the healthy reefs and high habitat diversity, this eastern area was identified as a suitable potential research zone. The Research Zone is proposed as no-take for all resources. The proposed Multiple Use Zone is 1.9 square miles (4.9 square km), and the proposed Research Zone is 3.9 square miles (10.1 square km).

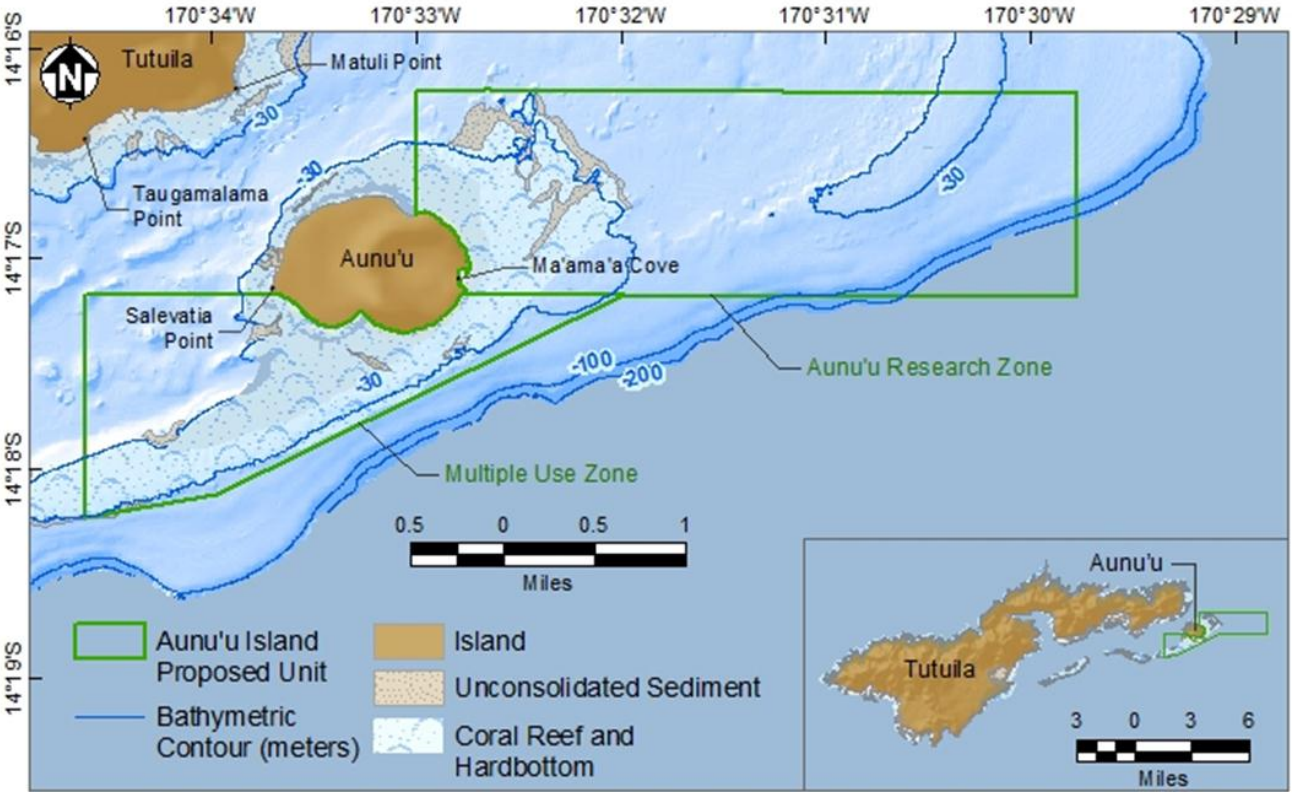

Figure 2-7: Alternative 3 Boundaries of the Aunu'u Island Unit.

Ta'u Island

The Ta'u unit is excluded as part of Alternative 3A. Under Alternative 3B, the Ta'u unit would include nearshore waters from Si'ufa'alele Point to Vaita Point along the western coast, extending approximately one nm seaward from Vaita Point. Along the southern coast, the sanctuary would extend 1 nm from the seaward boundary of the NPAS at Si'ufa'alele Point, extending along that parallel until reaching due south of Si'u Point. The inner boundary along the southern coast between Si'ufa'alele Point and Si'u Point would be adjacent to the nearshore waters of the NPAS, which extends 0.25 nautical miles from shore (Figure 2-8). The extension of the sanctuary boundary to include pelagic waters act as a buffer zone that protect both the large corals colonies on the east and the culturally important *Taisamasama*, the yellow waters of Tui Manu'a, on the south. The Ta'u unit is approximately 14.6 square miles (37.8 square km).

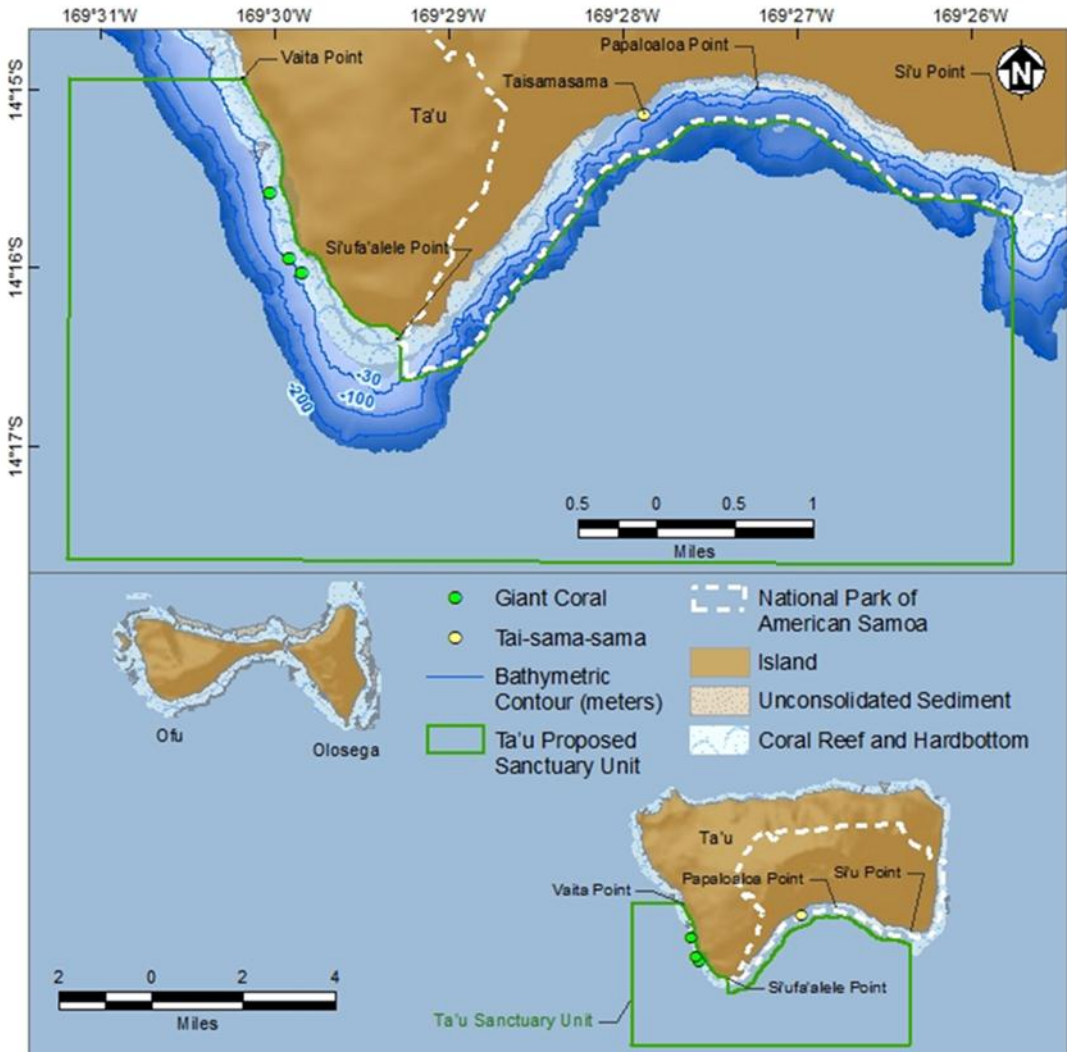

Figure 2-8: Alternative 3 Boundaries of the Ta'u Island Unit.

Swains Island

The unit would include territorial waters within a 3 nm circle of the island (Figure 2-9). The size of this unit is 54 square miles (140 square km). While straight line boundaries generally provide a clearer understanding by the public and greater ease for enforcement purposes, the boundary overlays the territorial waters boundary, which is well established and already exists on many nautical maps.

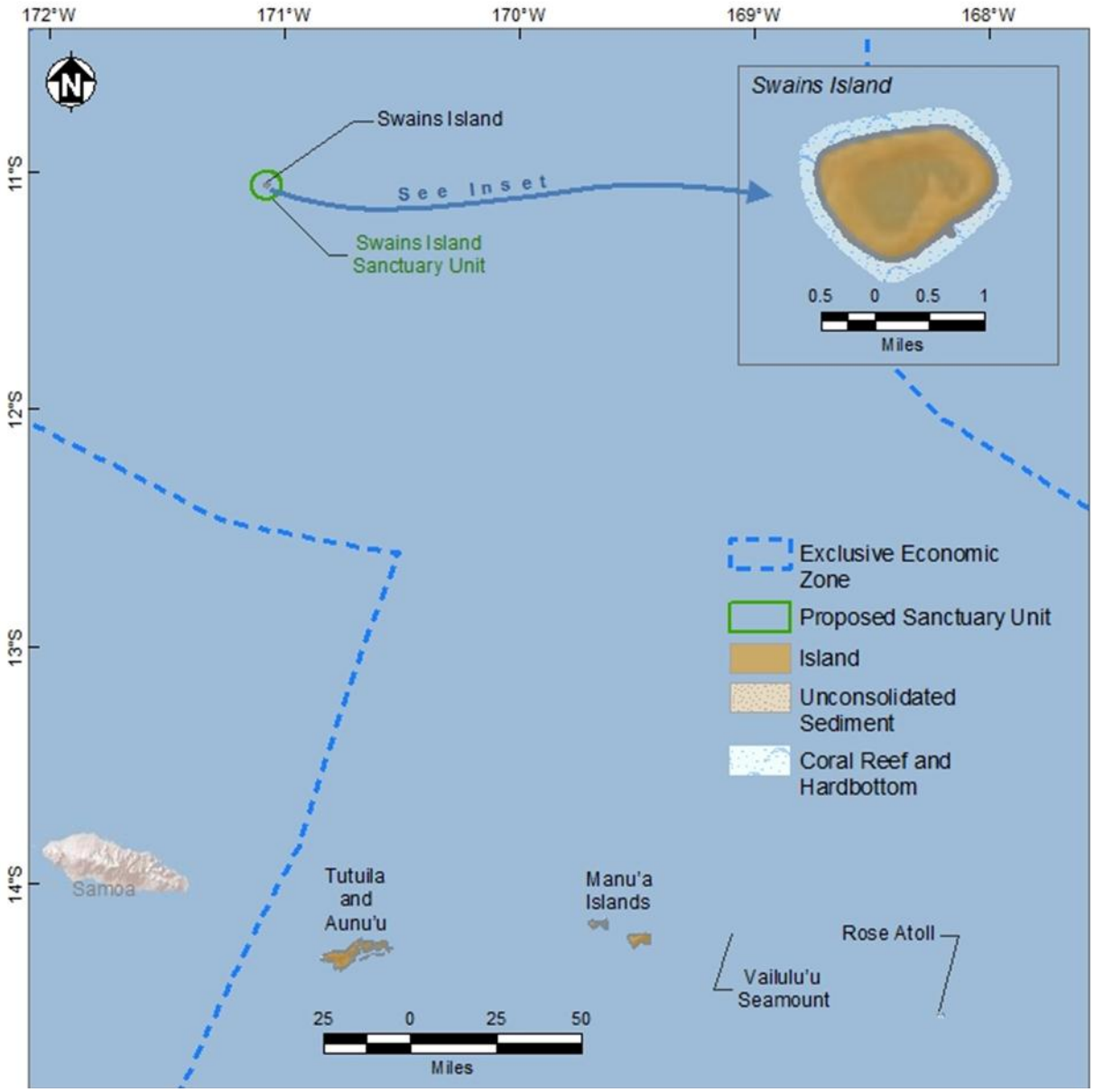

Figure 2-9: Alternative 3 Boundaries of the Swains Island Unit.

2.2.4.2 Alternative 3 Regulations

ONMS program-wide regulations (15 CFR 922 Subparts A-E) would be in effect at all six units, as well as the existing regulations described in Alternative 1, and the five program-wide regulations and modified discharge regulation described in Alternative 2 (Table 2-2).

Table 2-2: Proposed Alternative 3 Regulations.

SANCTUARY-WIDE REGULATIONS - ALL UNITS
Prohibit anchoring and use mooring buoys when available
Prohibit release of introduced species
Prohibit abandoning structures or materials
Prohibit deserting a vessel
Prohibit leaving harmful materials on abandoned vessel
Must display dive flag when diving from a vessel*
Do not exceed 3 knots when operating a vessel 200 feet from dive flag*
Do not operate a vessel in a manner that causes the vessel to strike or damage sanctuary resources*
Prohibit dredging, filling, dynamiting ,or disturbing seabed*
Prohibit removing, damaging, or tampering with historical and cultural resources*
Prohibit littering or discharge of any material into or that enters the sanctuary*
Prohibit ensnaring, entrapping or fishing for sea turtles or marine mammals*
Prohibit defacing or removing any sanctuary signs or markers*
SANCTUARY-WIDE REGULATIONS - ALL UNITS (with the Exception of Muliāva)[1]
Prohibit the gathering, taking, breaking, cutting, damaging, destroying, or possessing live coral, wild rock, bottom formation, giant clam, crown-of-thorns starfish, and all species of live shell except the goldmouth turban snail *Turbo chrysostomus* *
Prohibit possessing or using drift gill nets, seine, trammel net, or any type of fixed net*
Prohibit the possession or use of poisons, electrical charges, explosives, or similarly destructive fishing methods*
Prohibit SCUBA-assisted spear fishing
Prohibit disturbing the benthic community by bottom trawling

UNIT-SPECIFIC REGULATIONS	UNIT						
	Fagatele	Muliāva	Larsen	Aunu'u		Ta'u[2]	Swains
				Multi-Use	Research		
Prohibit all harvest (No-take)	X				X		
Prohibit all harvest except hook and line			X				
Prohibit all harvest except sustenance harvesting							X
Monitor use through the sanctuary or village designate				X			

1 No fishing regulations are being proposed at this time as ONMS awaits recommendations from the WPFMC
2 The Ta'u unit is included only under Alternative 3B.
* Existing Fagatele Bay prohibited activities (15 CFR 922 Subpart J)

With the exception of the Muliāva unit, where no fishery regulations are being proposed at this time, additional sanctuary-wide and location-specific fishing and resource harvesting regulations would be promulgated under Alternative 3. Of these, one is slightly modified to allow the collection of the goldmouth turban snail, and another is added to parallel an existing DMWR spear fishing regulation.

Sanctuary-wide Regulations

Many of these regulations parallel existing territorial or federal regulations. Of the **proposed prohibited gear**, 1) poisons, electrical charges, and explosives are prohibited in territorial waters under ASCA 24.0911-0915 and in federal waters under 50 CFR 665.104(c) and 127(b), 2) drift gill nets are prohibited in territorial waters under ASCA 24.0311 and in federal waters under 50 CFR 665.809, 3) scuba-assisted spearfishing is prohibited in territorial waters under ASCA 24.0916, and 4) bottom trawls are prohibited while fishing for any bottomfish, coral reef, or precious coral species in federal waters under 50 CFR 665.104(a), 127, and 164. Of the proposed **prohibited species**, the take of 1) live hard coral and wild live rock is prohibited in territorial waters in waters less than 60 feet under ASCA 24.0927(a) and in federal waters under 50 CFR 665.125(c), 2) precious corals is prohibited in territorial waters less than 60 feet under ASCA 24.0927(a), 3) marine mammals and sea turtles are prohibited in territorial waters under ASCA 24.0934-0935 and in federal waters under the Endangered Species Act.

Location-specific Regulations

Location-specific regulations address only the take of living marine resources, and include (1) allowable and restricted gear, and (2) allowable or restricted commercial fishing, and (3) a notification requirement to monitor fishing activity. A no-take zone is proposed at some units, or in some locations within a given unit.

Fagatele Bay

The Fagatele Bay unit would become a complete no-take sanctuary unit (Fagatele Point to Steps Point), prohibiting the seldom (if ever) employed traditional baskets and throw nets currently allowed in the inner bay (shoreward of the line from Fagatele Point to Matautuloa Benchmark), as well as commercial and other fishing allowed in the outer bay.

Muliāva

No location-specific regulations for the Muliāva unit would be proposed at this time.

Larsen Bay

The use of all fishing gear, except for hook-and-line gear, would be prohibited within the boundaries of the Larsen Bay unit (Steps Point to Sail Rock Point). ONMS program-wide definition of hook and line gear[4] would be modified to include fishing from shore, as this is the

[4] Conventional hook and line gear means any fishing apparatus operated aboard a vessel and composed of a single line terminated by a combination of sinkers and hooks or lures and spooled upon a reel that may be hind- or electrically operated, hand-held or mounted. This term does not include bottom longlines (15 CFR 922.3).

primary means this gear is used in American Samoa. The revised definition will be completed as a separate program-wide action to ensure the change does not alter the meaning for other sanctuaries within the system. Traditional cultural fishing practices, including the harvest of palolo worms, would still be permitted within the unit.

Aunu'u Island

The Aunu'u Island unit would be divided into two zones. The Multiple Use Zone requires any boat-based fisher to notify the sanctuary or its designate on the island of Aunu'u prior to conducting any fishing activity, effectively monitoring use through the village. The Research Zone would be designated no-take for all marine resources. No location-specific gear restrictions are proposed for this unit.

Ta'u Island

Under Alternative 3B, no location-specific regulations are proposed for the Ta'u Island unit.

Swains Island

Only sustenance harvesting would be allowed within the Swains Island unit. Sustenance harvesting allows the take of non-prohibited species only for consumption within the sanctuary unit or on Swains Island. Harvested marine resources may not be taken outside of the Swains Island boundary. There are no location-specific gear restrictions proposed for this unit.

Violation of any of these regulations could be punishable under 15 CFR 922.45 with a civil penalty of up to $130,000 per day, per violation. In addition, violators could be held liable for response costs and damages resulting from any destruction, loss, or injury to any sanctuary resource (15 CFR 922.46).

2.2.5 Alternative 4 – Multi-village Sanctuary Unit Expansion with Buffer Zones and Additional Regulations

Alternative 4 is separated into two subparts, with most attributes in common, but differences in management measures at the Muliāva unit, including an overlay of the Rose Atoll NWR and an expanded no-take zone under Alternative 4B.

2.2.5.1 Alternative 4 Boundary Changes

Alternative 4 would include the same proposed sanctuary units described under Alternative 3, although the total area would be expanded at the Muliāva, Aunu'u Island, Ta'u Island, and Swains Island units.

Aunu'u Island

The boundary for the Aunu'u unit would be extended eastward to include 0.33 square mile (0.85 square km) of federal waters to encompass deep waters and mesophotic reefs (Figure 2-10).

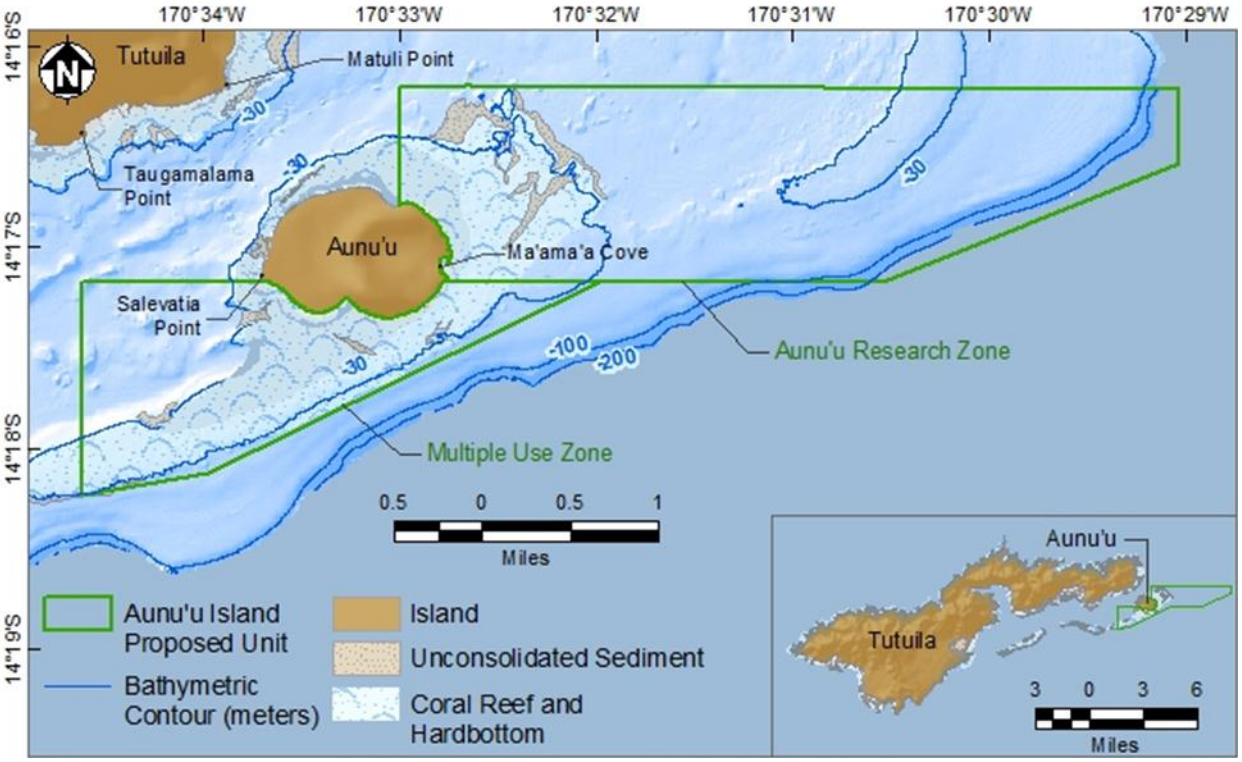

Figure 2-10: Alternative 4 Boundaries of the Aunu'u Island Unit Including Federal Waters.

Ta'u Island

The Ta'u Island unit would have the same seaward boundaries as those described for Alternative 3B, but would extend 1.4 square miles (3.6 square km) along the southern shoreline, overlapping the nearshore NPAS waters to include *Taisamasama* (Figure 2-11). The inclusion of *Taisamasama* as part of the expanded sanctuary was requested by the Secretary of Samoan Affairs, while the extension of the sanctuary unit into pelagic waters to provide a buffer zone for the valuable nearshore resources was requested by the Governor of American Samoa. Protecting deep water habitats is also becoming a high priority to ONMS (Puglise *et al*. 2009), with recent breakthroughs in SCUBA technology providing the first access of this kind to mesophotic coral reefs. Remarkable recent discoveries in the Papahanaumokuakea Marine National Monument include two to three new species discovered for every hour of deep-water diving surveys (R. Kosaki 2011). In addition, this research is leading to new and improved understanding of the connection between the shallow and deep reef habitats. The boundary proposed in this alternative, covering 16.0 square miles (41.4 square kilometers) was approved in meetings with Ta'u villages. The overlap of the NPAS boundary would also add nearshore areas of high coral cover, high fish biomass, and high coral and fish diversity near Si'u Point (Kendall and Poti in prep.).

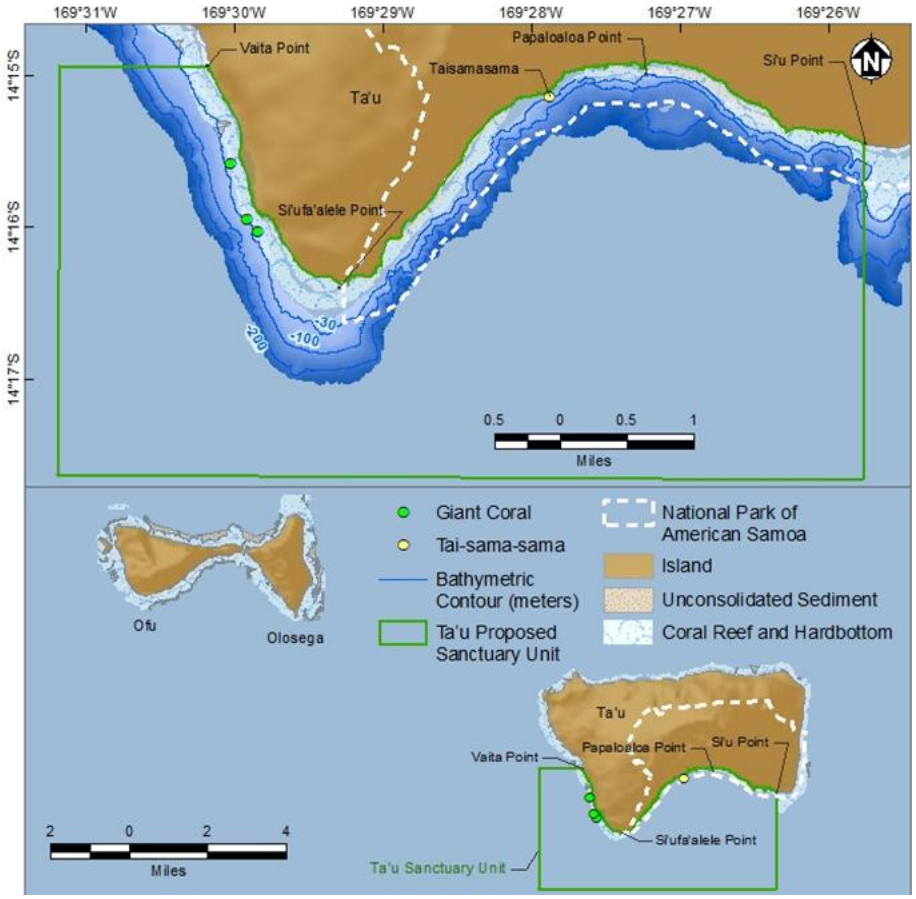

Figure 2-11: Alternative 4 Boundaries of the Ta'u Island Unit including NPAS overlay.

Swains Island

The boundary for Swains Island would be expanded from the 3-nm circle described in Alternative 3 to a 12-nm square that would include both territorial and federal waters (Figure 2-13). The size of the Swains Island unit under this alternative is approximately 844 square miles (2,187 square km).

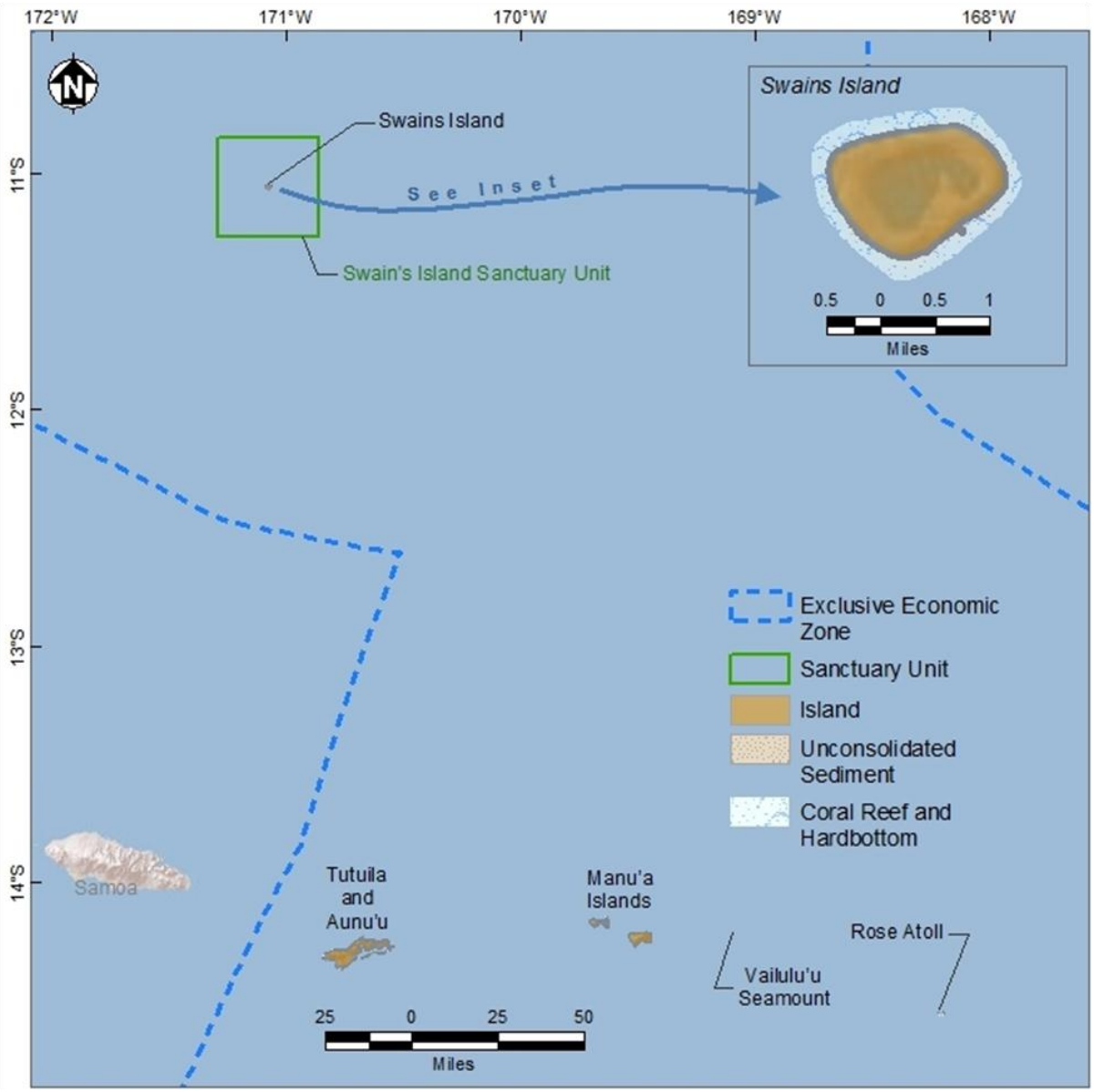

Figure 2-12: Alternative 4 Boundaries of the Swains Island Unit Including Federal Waters.

Muliāva

An additional no-take zone would be added to the Muliāva unit under Alternative 4A (Figure 2-13), but the boundary would not be increased from that described in Alternative 3. Under Alternative 4B, the boundary at Muliāva would be changed to include the marine areas of Rose Atoll NWR, per the direction from Proclamation 8337, adding 2.6 square miles (6.7 square km) of reef crest and lagoon habitat, but would not include any terrestrial habitat (Figure 2-14). While the proclamation states the "Secretary of Commerce shall initiate the process to add the marine areas of the monument to the Fagatele Bay National Marine Sanctuary," it also maintains that the "Secretary of the Interior shall continue to manage the Rose Atoll National Wildlife Refuge."

2.2.5.2 Common Management Measures

Regulations outlined in Alternative 3 would also be included under Alternative 4 (see Table 2-2). In addition, regulations would be promulgated prohibiting the take of specific fish species within the territorial waters of all proposed sanctuary units. The list of species, which includes the Māori wrasse *Cheilinus undulates*, bumphead parrotfish *Bolbometopon muricatum*, giant grouper *Epinephelus lanceolatus*, giant trevally *Caranx ignoblis*, and six shark species, is based on the low level and small size of these species observed across the territory during resource assessment surveys (Fenner *et al.* 2008b).

2.2.5.3 Regulations Specific to Alternative 4A

Under Alternative 4A, the waters of the Muliāva unit as described in Alternative 3 would become no-take from the landward sanctuary boundary that borders the Rose Atoll NWR to 12 nm from the center of the atoll (Figure 2-13). Federal fishery regulations currently designate all EEZ waters landward of the 50-fathom curve around Rose Atoll as a no-take MPA (50 CFR 665.99) and prohibit vessels longer than 50 feet from fishing for Pacific pelagic management unit species (MUS) within 50 nm of Rose Atoll (50 CFR 665.817). This would increase the size of the no-take zone from approximately 3 square miles (7.8 square km, NPS waters and 50-fathom no-take zone combined) to 802 square miles (2,077 square km). Regulations prohibiting commercial fishing promulgated through the proclamation would be incorporated into this alternative, which will provide clear directive for enforcement agents to carry out the intent of the proclamation.

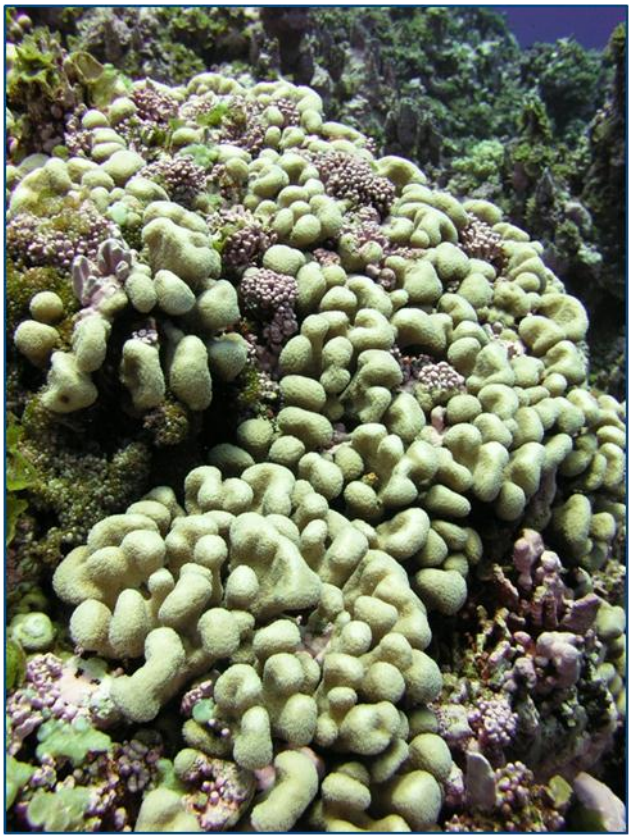

*Photo 5: The sanctuary anchoring prohibition proposed under Alternatives 2, 3 and 4 would help protect Rose Atoll's reefs, including this leaf coral (*Pavona maldivensis*). NOAA Photo: By J. Kenyon.*

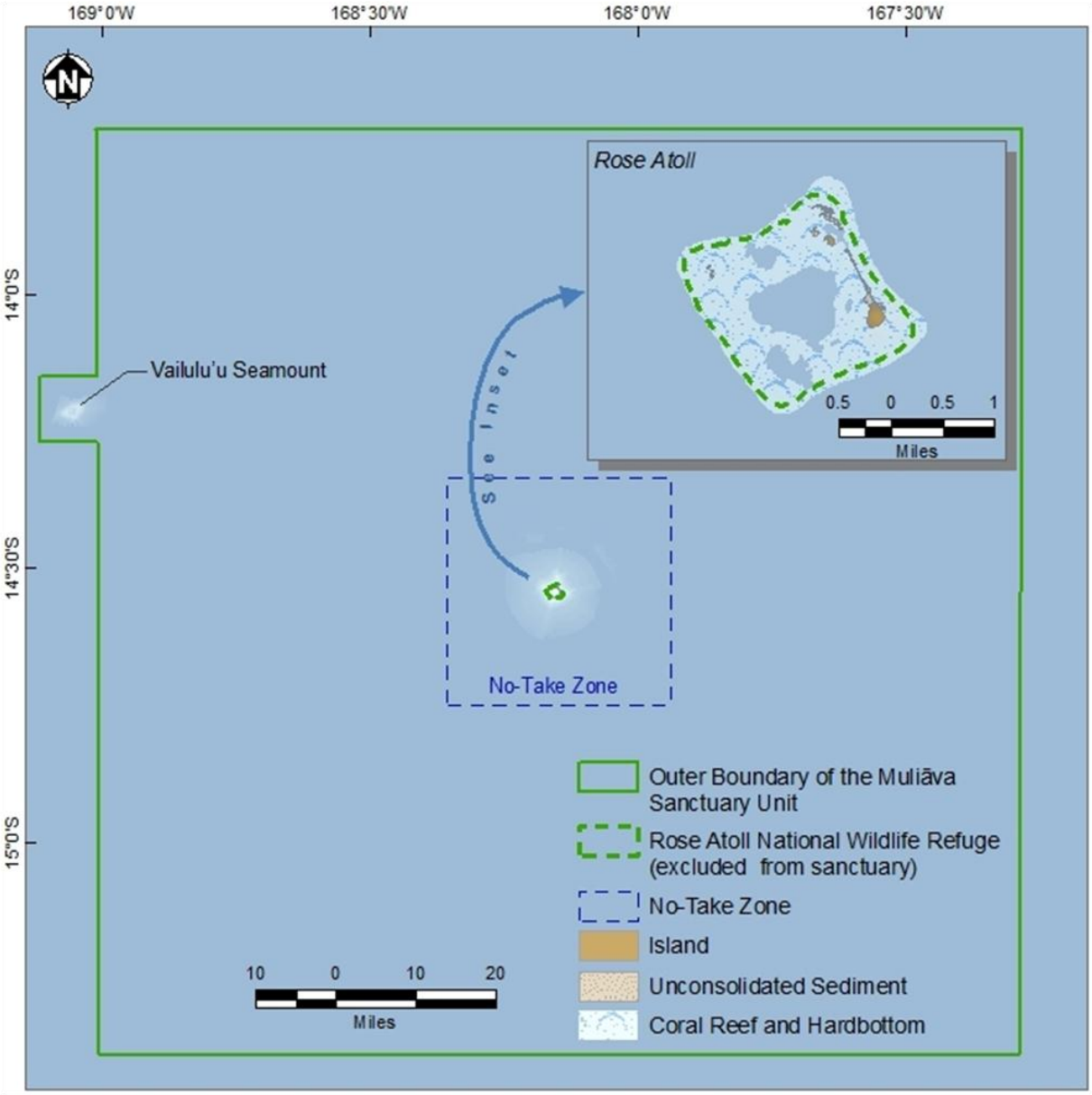

Figure 2-13: Alternative 4A Boundaries of the Muliāva Unit Including 12 nm No-Take Zone.

2.2.5.4 Regulations Specific to Alternative 4B

Alternative 4B would add the shallow reef and lagoon waters adjacent to the atoll as a sanctuary overlay to the Rose Atoll NWR (Figure 2-14:). Rose Atoll NWR is managed as a no-take MPA that is closed to the public. Special use permits issued by the U.S. Fish and Wildlife Service are required to conduct scientific research. Under Alternative 4B, all sanctuary-wide regulations described in Alternative 3 would be in effect for the lagoon and nearshore overlay waters. In addition to fishery regulations (prohibited gears and species) that would reinforce the no-take status of the NWR, vessels operating within the overlay waters would be required to adhere to anchoring and discharge prohibitions. Those wishing to enter these waters may be required to obtain both a USFWS Special Use Permit as well as an ONMS permit for any research, education, management, or salvage activities.

Alternative 4B would also designate all waters of the Muliāva unit as no take. This restriction would include the nearshore overlay waters described above, all waters with the 50-nm square surrounding Rose Atoll, and the waters surrounding the Vailulu'u Seamount, as described in Alternative 3. As described for Alternative 4A above, federal fishery regulations already prohibit large vessels from fishing these waters and prohibit all fishing within the 50-fathom curve of Rose Atoll. These restrictions are in addition to those pertaining to the Muliāva unit described for Alternative 3.

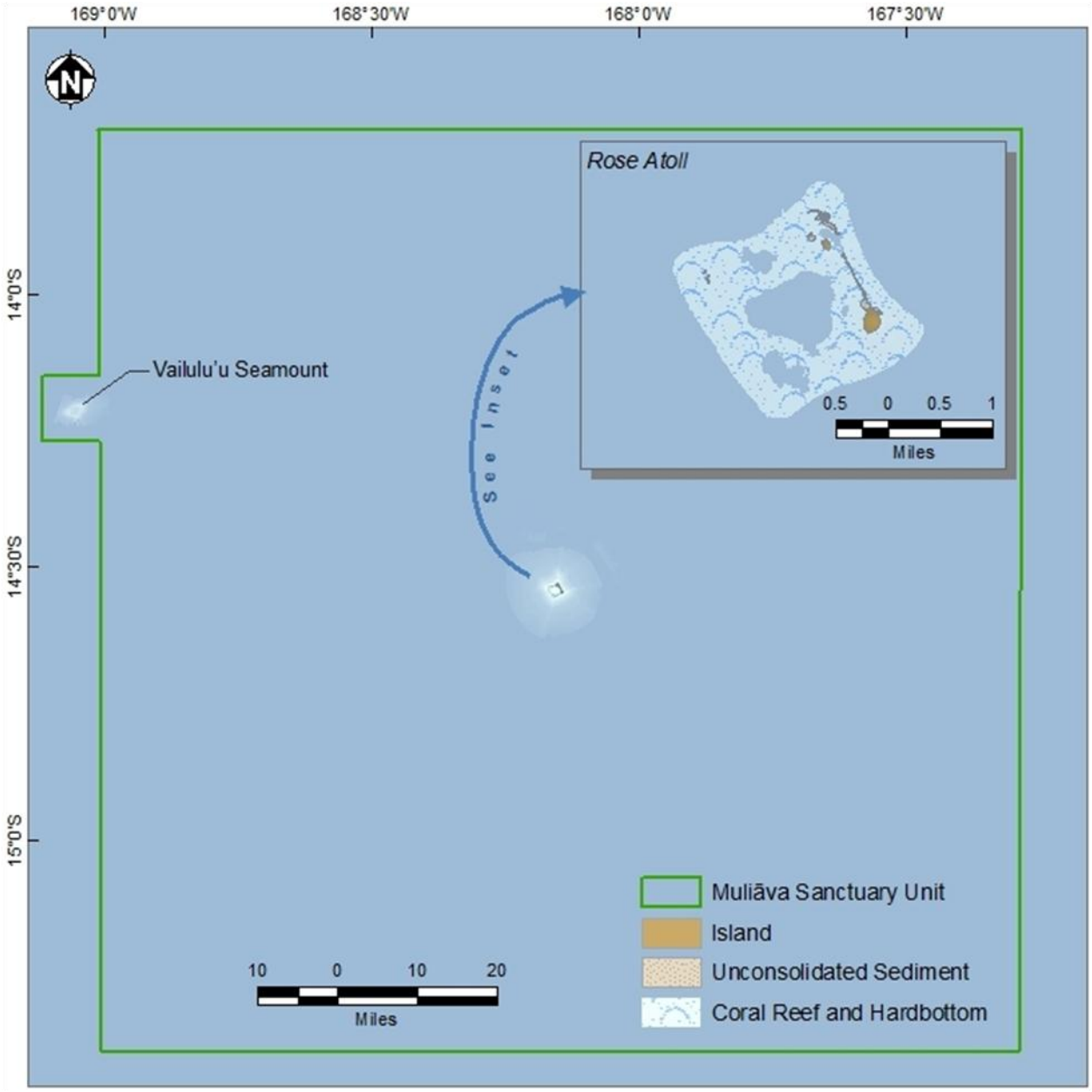

Figure 2-14: Alternative 4B Boundaries of the Muliāva Unit Overlapping the NWR.

2.3 COMPARISON OF ALTERNATIVES

In general, each subsequent alternative expands the size of the sanctuary and incorporates additional regulations to protect sanctuary resources. The no action alternative would maintain the status quo, including, with a few exceptions to staff the new visitor center and maintain the new research vessel, maintaining the current sanctuary budget and staff to continue to carry out the goals of the existing management plan. Alternative 1 updates the management plan for Fagatele Bay, and would likely include additional budget and staff to carry out new initiatives.

Alternative 1 also introduces the new management permit, which is an aspect of all four alternatives. Alternative 2 adds the marine waters of the Rose Atoll MNM (Muliāva unit), providing some additional protection to that imparted by Proclamation 8337. Funding would likely be increased to manage these additional waters. Alternative 3A includes three additional proposed sanctuary units located across the archipelago, as well as a number of new regulations, including gear restrictions and no-take areas designed to protect special habitats and a diverse and abundant array of living resources. Alternative 3B adds Ta'u Island to the network, including the giant corals in the nearshore environment and offshore waters south of *Taisamasama*. Ta'u, Swains and Muliāva include large areas of deepwater that provide buffer zones for important cultural and living resources that occur in the nearshore habitat as well as providing the means for exploration and protection of potential deep water resources. Funding and additional staff would be increased to that described in Chapter 4, in order to carry out the management required for the sanctuary network. Alternative 4 expands the pelagic habitat at Swains Island, and incorporates the nearshore waters of the NPAS adjacent to the pelagic habitat of the Ta'u unit. Alternative 4A includes all of the units and regulations of Alternative 3, while designating additional no-take zones at the Aunu'u and Muliāva units and a prohibition on the harvest of large reef fish species in all sanctuary waters. Alternative 4B incorporates the waters of the Rose Atoll NWR, as well as designating the entire Muliāva unit as a no-take zone. Funding and staff is expected to be the same as that for Alternative 3.

Table 2-3 explains the regulatory differences among alternatives and Table 2-4 explains the physical and administrative differences among the alternatives.

*Photo 6: Peppermint sea stars (*Fromia monilis*) are just one of the many species of colorful sea stars in American Samoa. NOAA CRED Photo.*

Table 2-3: Regulatory Differences between Alternatives

PROPOSED REGULATIONS	UNIT						NOTES
	FB	M	LB	AI	TI	SI	
Alternative 1							
Update management plan	√						
Create management permit	√						
Existing regulations (15 CFR 922 Subpart J)	√						
Alternative 2 (Incorporate Muliāva Unit)							
Incorporate Muliāva unit into sanctuary		√					
Update management plan	√	√					
Create management permit	√	√					
Existing prohibitions (15 CFR 922 Subpart J)							
1. Prohibit gathering, taking, breaking, cutting, damaging, destroying, or possessing any invertebrate, coral, bottom formation, marine plant, or crown-of-thorns starfish	√						Fishery regulations not applicable for M
2. Prohibit the possession or use of poisons, electrical charges, explosives, or drift nets	√						Fishery regulations not applicable for M
3. Boating and diving regulations: • Display dive flag when diving from a vessel • Operate vessel at low speed when 200 feet from dive flag • Operation vessel so that vessel does not strike or damage sanctuary resources	√	√					
4. Prohibit dredging, filling, dynamiting, or disturbing seabed	√	√					
5. Prohibit removing, damaging, or tampering with historical and cultural resources	√	√					
6. Prohibit littering or discharge of any material into or that enters the sanctuary	√	√					Clarifies existing regulation
7. Prohibit ensnaring, entrapping or fishing for sea turtles or marine mammals	√	√					
8. Prohibit defacing or removing any sanctuary signs or markers	√	√					
New regulations							
1. Prohibit anchoring and use mooring buoys when available	√	√					Clarifies existing regulation
2. Prohibit release of introduced species	√	√					
3. Prohibit abandoning structures or materials	√	√					
4. Prohibit deserting a vessel	√	√					
5. Prohibit leaving harmful materials on abandoned vessel	√	√					
Alternative 3 (Multi-Village Expansion)							
Include four (3A) or five (3B) additional units into sanctuary; expand Muliāva to included Vailulu'u Seamount		√	√	√	√	√	Ta'u Island is not included under Alternative 3A
Update management plan	√	√	√	√	√	√	
Create management permit	√	√	√	√	√	√	
Existing prohibitions (15 CFR 922 Subpart J)							
1. Prohibit take or damage of selected invertebrate and plant species (coral, live rock, crustose coralline algae, bottom formation, giant clams, crown-of-thorns starfish, and live shells)	√		√	√	√	√	Modifies existing prohibition 1 of Alternative 2; not applicable for M
2. Prohibit the possession or use of poisons, electrical charges, explosives, or drift nets	√		√	√	√	√	

PROPOSED REGULATIONS	UNIT						NOTES
	FB	M	LB	AI	TI	SI	
3-8. Same existing prohibitions described for Alternative 2	√	√	√	√	√	√	
New regulations							
1-5. Same new prohibitions described for Alternative 2	√	√	√	√	√	√	
6. No-take zones	√			√			Entire FB unit; Research Zone at AI
7. Prohibit commercial fishing						√	Commercial fishing at M prohibited by Proclamation
8. Restrict gear to hook and line only			√				
9. Prohibit use of scuba-assisted spearfishing	√		√	√	√	√	Not applicable for M
10. Notification requirement for boat-based fishing				√			Only for Zone A at AI
Alternative 4A and 4B (Multi-Village Expansion, with Buffer and Regulations)							
1. Increase size of unit		√		√	√	√	Sanctuary overlay of marine areas of NPAS at TI and RA NWR (4B), buffer zone at SI, research zone expansion at AI
2. Update management plan	√	√	√	√	√	√	
Create management permit	√	√	√	√	√	√	
3. Existing regulations (described in Alternative 3)	√	√	√	√	√	√	
4. New regulations (described in Alternative 3)	√	√	√	√	√	√	
5. No-take zones	√	√		√			Entire FB unit, expanded research zone at AI; to 12 nm at M (4A); entire M unit (4B)
6. Prohibit take of large fish species	√	√	√	√	√	√	

Notes:
1. FB (Fagatele Bay), M (Muliāva), LB (Larsen Bay), AI (Aunu'u Island), TI (Ta'u Island), SI (Swains Island), NPAS (National Park of American Samoa), RA NWR (Rose Atoll National Wildlife Refuge)
2. Federal waters exist at M (entire unit), AI (Portion of Research Zone, Alternative 4), SI (outside 3 nm, Alternative 4)
3. As Alternative 3A does not include the Ta'u Island Unit, all checks (√) relate only to Alternative 3B.

Table 2-4: Physical and Administrative Differences between Alternatives.

	NO ACTION	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3		ALTERNATIVE 4	
				3A	3B	4A	4B
Number of Proposed Units	1 Unit	1 Unit	2 Units	5 units	6 Units	6 Units	
Total Area	0.25 mi^2	0.25 mi^2	13,448 mi^2	13,568 mi^2	13,583 mi^2	14,375 mi^2	14,378 mi^2
Diversity of Units	None	None	Low	High	Highest	Highest	
Level of Protection	Lowest	Lowest	Low	Medium		High	Highest
Management Needs	No additional needs	No additional needs	Develop research plans for Muliāva	Develop community management capacity, develop research plan for all new units		Agreement with NPS for sanctuary overlay	Agreements with USFWS and NPS for sanctuary overlay
No-take areas	None	None	None	All of Fagatele Bay, Aunu'u Island Research Zone		Entire FB unit, Aunu'u Island Research Zone	
						Muliāva unit to 12 nm	Entire Muliāva unit
Species Protection	No harvest of any living bottom formations or any invertebrates; sea turtle and marine mammal protections	Same as No Action; harvest restrictions only in Fagatele Bay	Same as No Action; harvest restrictions only in Fagatele Bay	No harvest of coral, live rock, coralline algae, giant clams, crown-of-thorns starfish, or live shells		In addition to protections of Alternative 3, no harvest of vulnerable large reef fish species	
Fishery Regulations	None	None	None	Some nearshore closed areas, some gear restrictions		Additional nearshore closed areas, large area of pelagic waters closed	
Enforcement Requirements	No additional enforcement requirements	No additional enforcement requirements	Enforcement challenges would occur at the remote Muliāva unit	Depends heavily on community support		Same as Alt 3; buffer zones and no-take regulations at Aunu'u, Ta'u, and Swains minimize confusion	

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3.0 AFFECTED ENVIRONMENT

Chapter 3 describes the affected environment across American Samoa in general, followed by a detailed description of the affected environment at specific locations proposed for incorporation in the sanctuary.[1]

3.1 AMERICAN SAMOA

The Samoan Archipelago, which includes the Independent State of Samoa and American Samoa, could be characterized as a Large Marine Ecosystem (LME), even though it is not included among the 64 documented LMEs (Sherman and Hempel 2009). Typical of an LME, the Samoan Archipelago is exposed to a common range of oceanographic conditions and environmental and anthropogenic stressors. Submerged geomorphologic features — including reef, slope, bank, submarine canyon, and abyssal plain habitats — support a diverse range of shallow and deepwater marine life. Small islands, islets, and atolls provide critical breeding grounds and nesting sites for endangered, threatened, and rare species, which forage on land and throughout the coral reef, deepwater, and pelagic marine ecosystems of the archipelago.

3.1.1 Physical Setting

This section describes physical attributes of American Samoa including its geography, geology, oceanography, water quality, climate, and habitats.

3.1.1.1 Geography

American Samoa constitutes the eastern portion of the Samoan archipelago, a 301 mile (485 km) long volcanic island chain in the South Pacific Ocean region of Polynesia (see Figure 3-1). The archipelago lies in a west-northwest trending direction between 168 and 173 degrees (°) west longitude, approximately 1,000 miles (1,600 km) south of

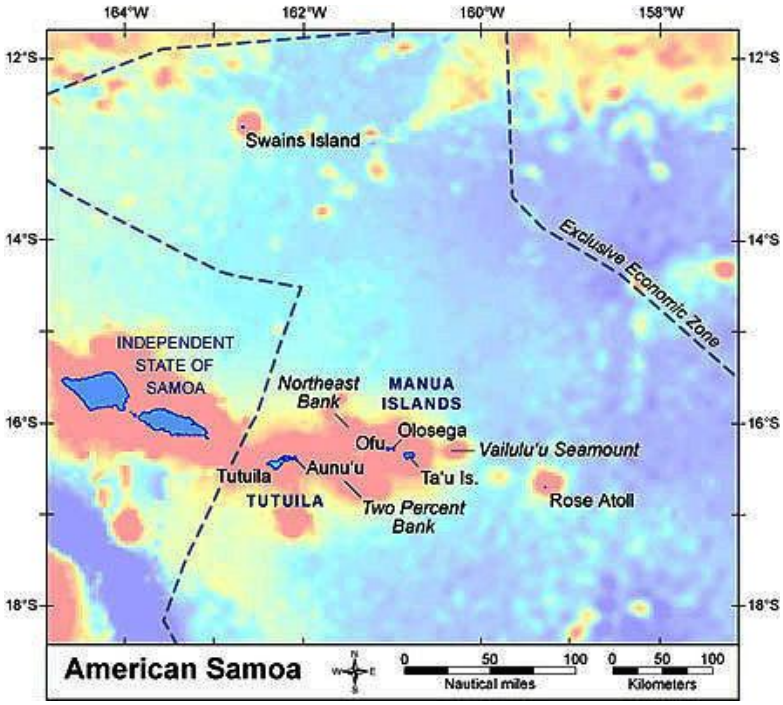

Figure 3-1: Samoan Archipelago, with Rose Atoll and Swains Island.

[1] Detailed descriptions of the physical and biological environment in American Samoa are found in Coral Reef Ecosystem Monitoring Report for American Samoa 2002-2006 (Brainard *et al.* 2008), *Fishery Ecosystem Plan for the American Samoa Archipelago* (WPFMC 2009), and Biogeographic Assessment of American Samoa (Kendall and Poti in prep.). The resources are incorporated by reference and augmented by additional information where applicable.

the equator. American Samoa is the only U.S. territory south of the equator and is composed of seven land masses, including five volcanic islands, and two coral atolls. From west to east American Samoa's islands are Tutuila, Aunu'u, Ofu, Olosega and Ta'u (the latter three are collectively known as the Manu'a Islands). Rose Atoll is about 100 miles (160 km) east of Olosega, and Swains Island is about 200 miles (320 km) northwest of Tutuila. The islands of Savai'i and Upolu to the west form the independent nation of Samoa and the western portion of the Samoan archipelago.

American Samoa's total land mass is about 77 square miles (200 square km), and its EEZ is approximately 150,580 square miles (390,000 square km; WPFMC 2009a). Tutuila is the largest island at about 136 square km, and is home to about 96 percent of the territory's 69,000 residents. About 88 percent of the population is ethnically Samoan, with the remainder being Tongan, Asian, Caucasian, and mixed or other. Annual population growth is about 1.5 percent (Craig 2009).

Oral History of Island Origins

According to Manu'a oral traditions, the Creator God *Tagaloalagi* first created Ta'u island and upon striking it a piece fell away to become Ofu island; he then created Fiji, Tonga, and the other Samoan islands (Kramer 1994: 536). The god *Fuailagi* created Olosega by digging up land on Ta'u belonging to a chief named *Niuleamoa*, who took his followers on the floating island until it came to rest in its present spot (Turner 1884: 225). According to various legends, Tutuila is named after a man called *Tutu* and his wife *Ila* who either escaped from war in *Papatea* to the island that now bears their names (Turner 1884: 223), or whose dying request of their daughter was to remember their names (Turner 1884: 226).

Tagaloa, the earthly offspring of the Creator God, brought the first Samoan *fale* (house) to Ta'u, which became *fale'ula* - the house of the *Tui Manu'a* (the line of sacred high chiefs of Manu'a that was also founded by Tagaloa; Linnekin *et al.* 2006).

3.1.1.2 Geology

The Samoan archipelago's geologic features are the result of plate tectonics, volcanism, and reef accretion.[2] The archipelago is 124 miles (200 km) north of the convergence of the Australian and Pacific crustal plates. Volcanism and island formation are in part the result of a geologic hot spot (a stationary source of molten rock) located 31 miles (50 km) east of Ta'u island, and over which the Pacific plate moves westward at a rate of about 2.75 inches (7 centimeters [cm]) per year (Craig 2009). Because of this movement, the age of the islands increases to the west (Thornberry-Ehrlich 2008). Vailulu'u (also spelled Vailu'ulu'u) seamount, approximately 2.8 miles (4.5 km) high and 1,640 feet (500 m) below the sea surface, is currently forming, collapsing, and reforming constantly over the hot spot (Pacific Islands Benthic Habitat Mapping Center 2008). Tutuila is about 1.5 million years old, Ofu and Olosega are about 300,000 years old, and Ta'u is about 100,000 years old (Brainard *et al.* 2008). Swains Island and Rose Atoll arose from much older volcanoes and are geologically separate from the Samoan volcanic chain (Hart *et al.* 2004).

[2] Comprehensive characterizations of regional geology are found in WPFMC (2009) and Thornberry-Ehrlich (2008).

Reef accretion occurs as reef building organisms grow around the perimeter of the islands. Reef building organisms, namely coralline algae and corals, build fringing reefs and reef flats around the islands. Coral reefs become massive habitat forming structures because of the highly productive symbiotic relationship between the coral polyp (an invertebrate taxonomically related to jellyfish) and zooxanthellae (single-celled algae). These algae live inside the coral animal, converting sunlight, carbon dioxide, and water into food for the coral. The coral, through filter-feeding of tiny organic particles, provides nutrients as well as a safe and stable environment for the algae. Because of this relationship, coral reefs and reef building organisms can grow only in the upper layer of the ocean, where sunlight is strong enough to allow for photosynthetic growth (the euphotic zone). As the islands sink due to the movement of the Pacific and Australian plates, corals descend out of the euphotic zone and ultimately die, while new corals grow on top of these skeletons that remain near the surface. An atoll is formed when the island is completely submerged, leaving only a coral ring (the atoll) at the ocean's surface (Garrison 1999; see Figure 3-2).

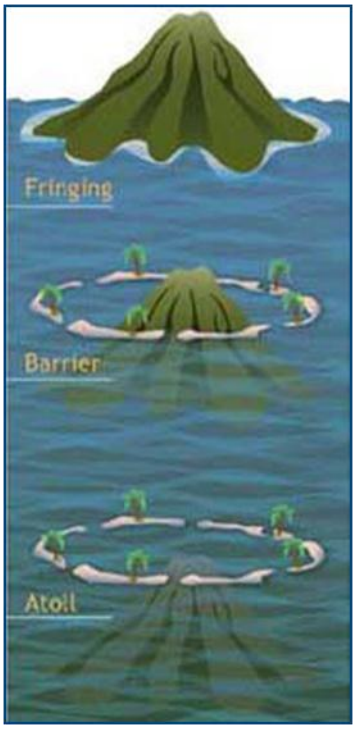

Figure 3-2: Schematic of Atoll Formation.

3.1.1.3 Oceanography[3]

Oceanography is the study of the interactions among the physical, chemical, biological, and atmospheric processes within the varied habitats of the ocean. Physical processes include temperature, pressure, density, and the movement of water, light, and sound through the ocean. Chemical processes included dissolved nutrients, salts and gases. Biological processes include marine plants, animals, and bacteria. Atmospheric processes include evaporation, precipitation, and solar heating. While this field is diverse, complex, and highly scientific, thousands of practical applications are discovered and employed through its study. Topics specifically relevant to the American Samoa sanctuary include those that aid in an understanding of connectivity between the proposed sanctuary units and across the Samoan archipelago (*e.g.*, currents and larval transport), ecosystem health (*e.g.*, water quality and climate), ocean safety (*e.g.*, tides, tsunamis, and weather), and biological diversity (*e.g.*, habitats, food webs, and species biology). Although the sanctuary management plan primarily provides protection of marine resources through the control of human activities, an understanding of these natural processes is important in developing effective action plans and activities.

[3] Detailed descriptions of ocean water characteristics, layers, zones, circulation, currents and eddies are found in the Biogeographic Assessment of American Samoa (Kendall and Poti in prep.).

Currents

Ocean currents transport, among other things, water, nutrients, marine life, heat, oxygen, and carbon dioxide. At the broadest scale, the Samoan archipelago lies along the northern edge of the South Pacific Gyre, a series of connected ocean currents with a counter-clockwise flow that spans the Pacific basin (Alory and Delcroix 1999; Tomczak and Godfrey 2003; Craig 2009). At a regional scale centered on the Samoan Archipelago, the major surface currents and eddies that affect the archipelago are the westward flowing South Equatorial Current, which occurs all year between 5° and 15° S; the South Equatorial Counter Current, which interrupts the South Equatorial Current between 9° and 12° S by during the summer; and the Tonga Trench Eddy, an eddy that regularly occurs between September and December south of the archipelago (Kendall and Poti in prep.). Of these, the South Equatorial Counter Current is the most prominent current feature in the region, occurring at approximately 200 m depth, and strongest in January and February (Kessler and Taft 1987; Chen and Qui 2004).

Tides

The vertical growth limit of corals on reef flats is closely tied to the height of low tides. Coral colonies in the reef flat zone have flattened tops that clearly demarcate water depths suitable for growth and survival during average sea surface height conditions. NOAA maintains one tidal station in American Samoa, within Pago Pago Bay. Tides in the archipelago consist of two highs and lows daily with a mean range of 0.77 m (2.51 feet) as measured at Pago Pago, with extremes of 2 m (6.61 feet) and 0.32 m (1.05 feet) (http://tidesandcurrents.noaa.gov/).

Photo 1: A diver removes debris from the seafloor left by the 2009 tsunami. NOAA CRED Photo.

Tsunamis

The tsunami generated by the Chilean earthquake in 1960 produced a runup (or height above ambient sea level) of 1.37 m (4.5 feet) at the Pago Pago harbor entrance and 3.26 m (10.7 feet) at the extreme inner end of the harbor (U.S. Department of Commerce 1984). More recently, on September 29, 2009 a significant tsunami devastated American Samoa, Samoa, and Tonga. The 2009 tsunami was generated by a magnitude 8.0 outer-rise earthquake (occurring on the subducting crustal plate before it enters the subduction zone) about 250 km southwest of Pago Pago near the Kermadec-Tonga trench (USGS 2009). Preliminary data indicate that the 2009 runups reached as high as 12 m (39.4 feet) (USGS 2009).

3.1.1.4 Water Quality

Land-based pollution is the main threat to American Samoa's near-shore[4] water quality (AS-EPA 2010a). Activities that contribute to this threat include;

- Development that changes hydrology and shading along streams, causes erosion, and increases turbidity;
- Inadequate human and pig waste disposal systems that discharge excess nutrients and bacterial pollution; and
- Solid waste from improperly disposed of trash in open coastal waters and embayments.

Runoff from development and other disturbances in the watershed discharges into streams that can then affect near-shore waters and embayments. It is unknown whether offshore waters are affected by pollution. To meet the requirements of Clean Water Act (CWA) Sections 303(d), 305(b), and 314, the AS-EPA prepared an "Integrated Water Quality Monitoring and Assessment Report," which was released to the public and submitted to federal agencies in 2010 (AS-EPA 2010a). This report uses data from 2003 to 2009 for parameters such as temperature, light penetration depth, pH, dissolved oxygen, turbidity, chlorophyll-a, total nitrogen, total phosphorus, and bacteria (E. coli and Enterococcus) to assess whether territorial waters meet water quality standards. Using these data, the AS-EPA categorizes water bodies according to a "Consolidated Assessment and Listing Methodology" (CALM) for the designated uses (*e.g.*, swimming, aquatic life, and fish consumption). The AS-EPA CALM categories are as follows (AS-EPA 1010):

- Category 1 means that no uses are impaired for any designated uses;
- Category 2 means that, while some designates uses are met, there are insufficient data to determine if it meets that water quality standards for all uses;
- Category 3 means that there is insufficient data to determine if any of the designated uses are met or not;
- Category 4 means that the data determined that at least one designated use is impaired and a Total Maximum Daily Load may be necessary to restore water quality to meet the standard for those designated uses;
- Category 5 means that the data determined that the water body is impaired and a Total Maximum Daily Load is required.

The AS-EPA's integrated assessment takes a watershed unit approach looking at multiple hydrologic and land-based factors that affect water quality. AS-EPA assesses and monitors water quality for human use as well as for benthic, coral, and fish habitat. The main islands of American Samoa are divided into 41 watersheds, as shown on Figure 3-3. AS-EPA has been monitoring 31 of the 41 watersheds, where more than 95 percent of the territory's population lives. Of these 31 watersheds, 17 were designated as Category 3, while the remaining 14

[4] The report from which this information is derived considers near-shore waters to extend 0.25 mile off shore.

watersheds were classified as “not supporting” swimming uses. Eleven of those 14 were classified as “not supporting” aquatic life use (AS-EPA 2010a).

Conclusions from the AS-EPA’s water quality assessment pertaining to fresh surface waters and ocean shoreline are as follows.

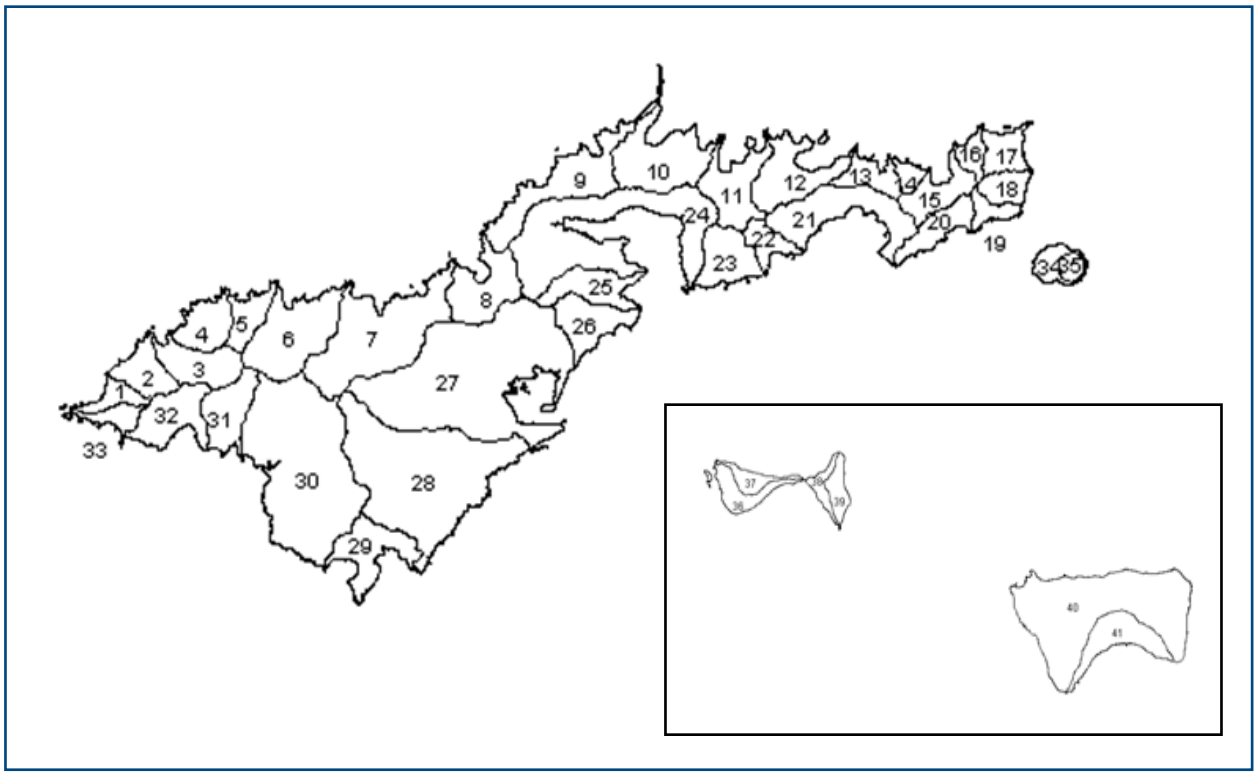

Figure 3-3: Map of American Samoan Archipelago Identifying the 41 Watersheds of the Island
Source: AS-EPA 2010a
The coral atolls, Rose Atoll and Swains Island, do not have watersheds and were not included in the AS-EPA 2010a report.

Fresh surface waters assessment: Major stressors, and the associated sources, on stream water quality include development along a stream that alters hydrology and shade; erosion from development within watersheds that increases turbidity in streams; and nutrients, low dissolved oxygen, pathogen indicators, and turbidity from intensive animal feeding operations, sewage, and animal waste collection and treatment system failure (AS-EPA 2010a).

Ocean shoreline assessment: Major stressors, and the associated sources, on ocean shoreline water quality and reef habitat include those discussed under fresh water. In addition, coastal waters and embayments are affected by nonpoint source runoff from development within watersheds and solid waste from improperly discarded trash. Stressors specific only to Pago Pago Harbor water quality include polychlorinated biphenyls and mercury (AS-EPA 2010a).

In addition to natural processes, clearing land for agriculture or construction can hasten erosion of the islands' steep slopes, particularly during times of heavy rain. This erosion leads to sedimentation on the nearshore reefs. Sediment in the nearshore environment can pose a serious threat to coral reef health by (1) reducing area suitable for new coral growth, (2) creating cloudy or turbid water that decreases the amount of light available for photosynthesis by symbiotic algae that live within the coral, and (3) disrupting coral feeding (Hodgson 1990). Corals appear to have the ability to minimize moderate amounts of sedimentation stress (Philipp and Fabricius 2003), but under extremely high levels of sediment input, can be buried, leading to colony mortality.

American Samoa's Climate-Coral Connection

"Overall, the Samoan Archipelago lies in a region with relatively stable oceanic conditions compared to areas to the north and south… The relative constancy of conditions may be among the factors that have allowed the very long-term survival and growth of some of the largest individual hermatypic coral colonies in the world such as those located off the island of Ta'u at the eastern extremity of the archipelago. Some Porites colonies are up to 41 m in circumference and 500-1000 years old (Brainard *et al.* 2008, Brown *et al.* 2009)."

From Kendall and Poti (in prep.) Biogeographic Assessment of Samoa and American Samoa

Given that the reefs of the archipelago have developed in a region with relatively stable conditions, oceanic anomalies or trends exacerbated by climate change may have greater affects on Samoan reefs than in regions adapted to such perturbations (U.S. EPA 2007a).

Sedimentation rates measured at multiple sites along the south shore of Tutuila averaged 10 times higher in bay sites than on the outer reef, and 60 times higher on reefs adjacent to stream mouths (Fenner *et al.* 2008b).

The proposed sanctuary units include AS-EPA watersheds 29, 34, 35, 40, and 41. None of these watersheds has water bodies listed as impaired (AS-EPA 2010a). All of the watersheds within the proposed sanctuaries were assigned a CALM assessment Category 2 or Category 3. Stressors that affect fresh water or nearshore waters may, or may not, be present in all of these watersheds, but are likely found in watershed with more extensive development. See the Site-Specific Affected Environment (Section 3.2) for further discussion of the five watersheds and the CALM assessment classification and explanation of nearshore water quality associated with the proposed sanctuary units.

3.1.1.5 Climate[5]

Understanding the climate and how its trends and variability may impact marine life and habitats is a priority for the territory and a major component of this management plan (see the Climate Change Action Plan). For example, planktonic marine larvae that reach the archipelago via ocean

[5] A detailed discussion of prominent ocean meteorological features is found in WPFMC (2009), with additional details provided in Craig (2009).

currents and thrive must be adapted to the climatic and oceanographic conditions that characterize the region, including temperature, winds, waves, nutrients, tides, sea level, and other factors. Reef ecosystems can be stressed and modified by a wide range of climate-related phenomena such as elevated ocean temperatures, sea level fluctuations, and ocean acidification. Many oceanographic and atmospheric processes affecting Samoan reefs are in flux as a result of global climate change (Chase and Veitayaki 1992; Timmerman *et al.* 1999; U.S. EPA 2007a; Young 2007).

American Samoa's tropical climate is characterized by year-round mild air temperatures, high humidity, persistent Trade Winds, and infrequent but severe cyclonic storms, and is influenced by global climate trends and inter-annual variability associated with shifts in ocean-atmospheric conditions. Mean daily air temperature varies between 22°C and 30°C (SPSLCMP 2007). The islands are noted for high annual rainfall that averages 3,048 millimeters (mm) (120 inches) per year (http://www7.ncdc.noaa.gov/CDO/cdo). Maximum rainfall occurs in the austral summer (December to February), where it can exceed 300 mm/month. In winter (June to August), rainfall is 30 percent lower, at approximately 200 mm/month.

Winds[6]

American Samoa is dominated by the southeasterly Trade Winds, which are typically stronger in winter (July) than in summer (Merrill 1989). The South Pacific Convergence Zone is a low-pressure area of light winds and high rainfall that is located at about 30°S, but moves seasonally, crossing over the Samoan archipelago twice a year, most clearly during the summer months (December to February), when rainfall from this system is greatest (Alory and Delcroix 1999; Folland *et al.* 2002). When it crosses the archipelago in winter (June to August), the South Pacific Convergence Zone shifts slightly northward, resulting in stronger winds and lower rainfall (Alory and Delcroix 1999). Interannual and decadal-scale variability of winds and many other aspects of climate within the Samoan archipelago are associated with the El Niño and Southern Oscillation (ENSO) phenomenon (Alory and Delcroix 1999; Halpin *et al.* 2004).

Cyclones

Cyclonic storms (also called tropical storms, hurricanes or typhoons)[7] are infrequent but severe departures from the typical wind climate described above. The Samoan EEZ lies along the eastern edge of a region conducive to development of cyclonic storms in the south Pacific (Craig 2009). American Samoa experiences major cyclones, which can yield maximum winds of 150 miles per hour (mph), approximately once every 5 years. They normally approach from the north, but occasionally approach from the east, southeast, or west. Six cyclones have struck or passed near the Samoan Archipelago in the past 30 years, including two recent and very

[6] A detailed discussion on climate is found in Kendall and Poti (in prep.) and at http://www.cpc.noaa.gov.

[7] Cyclones and hurricanes are essentially the same phenomenon. Hurricanes occur in the northern hemisphere and as a result of the Coriolis effect caused by the earth's rotation spin counterclockwise, while cyclones occur in the southern hemisphere and spin clockwise.

powerful Category 5 storms with sustained winds over 155 mph. The most recent cyclones have occurred at intervals of 1 to 13 years and have had varying impacts across the islands (Craig 2009).

Waves

Wave power exposures are typically highest on the eastern- and southern-facing coasts of Samoan islands but can vary seasonally and among years (Barstow and Haug 1994). The wave climate can be split into two main components: short period (about 1 to 2 seconds) "wind seas" that result from local forces such as the easterly Trade Winds, and long period (about 10 to 20 seconds) "ocean swells" that originate from storms, many of which are far south of the archipelago (Barstow and Haug 1994). Ocean swell from the south and wave power in general are highest during May to September (6.5 to 9.8 feet [2 to 3 m] wave height is common) with the increased intensity of the Trade Winds and frequency of swell producing storms at higher latitudes (Barstow and Haug 1994; Brainard *et al.* 2008). November through March is a period often characterized by shorter period waves, lower wave heights (about 2 m), and more variable directionality (Brainard *et al.* 2008). In contrast to the typical seasonal and interannual patterns, anomalous wave events occur when cyclones pass (*e.g.*, wave heights larger than 8 m were recorded during Cyclone Ofa in 1990 and Heta in 2004) and even storms in the north Pacific can cause unusually large swells on the usually more calm northern coasts of the islands (Barstow and Haug 1994; Brainard *et al.* 2008).

Sea Surface Temperature (SST)

The entire Samoan Archipelago experiences relatively high and stable ocean temperatures throughout the year, with an average SST range from 27.2° C in August to 29.5° C in March. SST gradually increases northward, with the waters around Swain's Island 0.5 to 1 °C warmer than around the rest of the Samoan Islands. Sea surface temperature fronts that frequently occur at higher latitudes and are associated with enhanced biological productivity (Polovina *et al.* 2001) are essentially absent from the Samoan EEZs.

The Coral Reef Temperature Anomaly Database (CoRTAD) has produced monthly average SST estimates for a 20-year period (January 1985 to December 2005) at a resolution of 2.5 mi (4 km) (Selig 2008). The data revealed trends, as well as seasonal and irregular patterns including an about 1 °C increase from 1985 through 2006. All years since the major El Niño of 1997 and 1998 showed generally positive SST anomalies in the Samoan Archipelago, indicating warmer than average conditions.

Inter-annual Climate Variability[8]

Inter-annual climate variability in American Samoa is associated with ENSO events and inter-decadal Pacific oscillations (described below). Southern Oscillation is the change in atmospheric pressure between the eastern and the western regions of the South Pacific (Chowdhury *et al.*

[8] Detailed discussions of inter-annual variability are provided in WPFMC (2009), Carter *et al.* (2001), and Craig (2009).

2007). The Southern Oscillation Index measures the strength of the oscillation. The ENSO cycle occurs in two phases: El Niño, and La Niña. The ENSO cycle typically lasts for about 1 year, and occurs approximately every 2 to 7 or 10 years.

El Niño conditions in south Pacific islands can yield below normal rainfall amounts, increased risk of intense tropical cyclones, coral bleaching caused by both increased water temperature and increased ultraviolet radiation penetration as a result of decreased sea level, and changes in local abundance and distribution of reef and pelagic fish species important to commercial and subsistence fisheries (Carter *et al.* 2001).

Positive Southern Oscillation Index values indicate La Niña episodes where equatorial Trade Winds are strengthened. The La Niña phase of the ENSO cycle occurs when the location of unusually low pressures is reversed, and equatorial Pacific SSTs are anomalously cold. In American Samoa, SSTs are warmer than normal during La Niña (Fenner *et al.* 2008b).

Inter-decadal Pacific Oscillation

The Inter-decadal Pacific Oscillation is an approximately 15- to 30-year time scale fluctuation in SST and circulation across the Pacific basin (Power *et al.* 1999). Folland *et al.* (2002) concluded that both the Inter-decadal Pacific Oscillation and the ENSO alter the mean location of the South Pacific Convergence Zone. During the "positive phase" of the Inter-decadal Pacific Oscillation, sea surface temperatures are relatively warmer and precipitation increases approximately 20 percent around the Samoan archipelago compared with the "negative phase." The last positive phase ended in 1998 (Salinger *et al.* 2001).

Global Climate Trends

Over the 20th century, the Pacific region has exhibited several climate related trends including increasing temperatures and sea level rise. These trends are detailed in Carter *et al.* 2001. Average annual air temperatures in the Pacific islands have increased by about 0.2 °C (0.4 °F). On a global scale sea level has risen by 10 to 20 cm (4 to 8 in), with significant local variability. Absolute sea level rise has also occurred in the Pacific; however, sea level rise with respect to Pacific islands is highly variable as a result of island subsidence and geologic uplift. A positive trend in mean sea level of 2.07 mm/year is evident at Pago Pago from 1948 to the present (http://tidesandcurrents.noaa.gov/sltrends). Extreme variability in relative sea level is also caused by transient events such as ENSO, storm surges, and extreme lunar tides. Globally, sea levels are predicted to rise two to five times faster in the current century versus the last century because of glacial melting and thermal expansion of ocean water. Several studies indicate that with a rise in global temperatures, the Pacific climate tends toward an El Niño-like state, though there is uncertainty as to how increased temperatures may affect the frequency and severity of hurricanes (Carter *et al.* 2001, unless otherwise noted.)

3.1.1.6 Habitats

American Samoa is an oceanic archipelago without a continental shelf. Therefore, shallow water habitats generally only occur within 0.5 to 2 miles from shore because of the steep slope of the seafloor (Craig 2009). As such, pelagic (open-ocean) waters constitute the primary habitat within the archipelago, overlaying deep ocean floor, banks, drowned reefs, and seamounts. Nearshore benthic (bottom) habitats include coral reefs and reef slopes, seagrass beds, mangrove forests, and sandy, hard, and rubble substrate in the subtidal and intertidal zones.[9]

Pelagic and Deep-Ocean Habitat

Most of American Samoa's marine habitat is pelagic. Even though the pelagic habitat consists entirely of water hundreds of kilometers wide and thousands of meters deep, it should not be considered without structure and associated ecosystem zones. It is separated into five vertical zones relative to the amount of sunlight that penetrates through seawater:

1. Epipelagic – from the surface to 200 m;
2. Mesopelagic – 656 to 3,281 feet (200 to 1,000 m);
3. Bathypelagic – 3,281 to 13,123 feet (1,000 to 4,000 m);
4. Abyssopelagic – 13,123 to 19,685 feet (4,000 to 6,000 m); and
5. Hadalpelagic – 19,685 feet (6,000 m) and below.

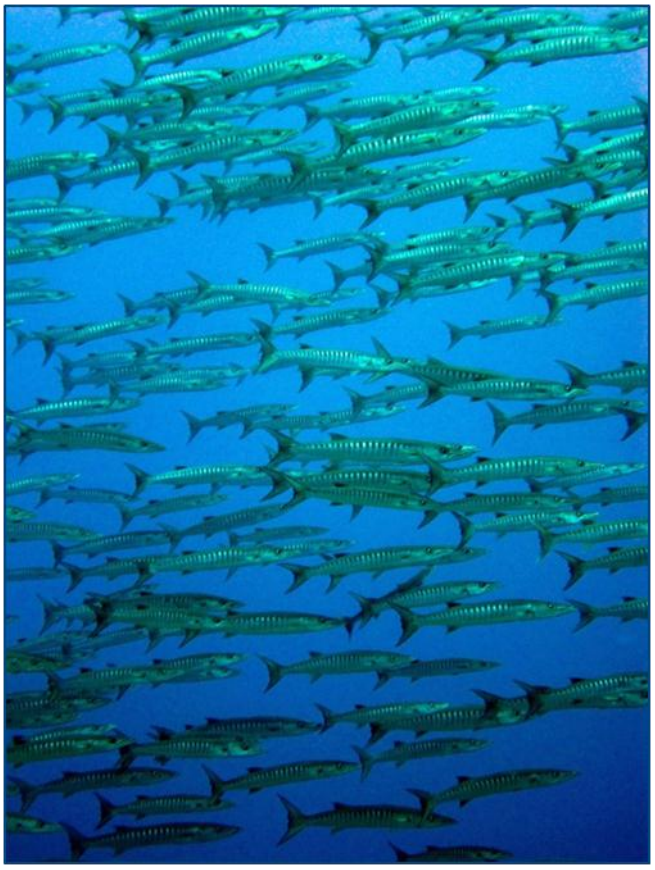

*Photo 2: These Cheveron Barracuda (*Sphyraena qenie*) near Swains Island are an example of pelagic nekton. NOAA CRED Photo.*

The epipelagic zone is also known as the photic zone, where there is sufficient light for photosynthesis, and consequently the range limit for phytoplankton (microscopic marine plants that require light to synthesize their food

Pelagic, or open-water, organisms are classified as either plankton (passive drifters moving with the water such as jellyfish and larval fish) or nekton (actively swimming organisms such as squid, jacks, tunas, sharks, sea turtles, whales and dolphins). Pelagic species are closely associated with their physical and chemical environments, and

[9] Fenner *et al.* (2008), Brainard *et al.* (2008), and Kendall and Poti (in prep.) provide detailed habitat characterizations and benthic habitat maps for the entire archipelago.

thus their habitat range and distribution may be significantly altered by oceanographic variability, including that caused by phenomena such as ENSO events. Some organisms migrate through different pelagic zones, or between pelagic and benthic habitats, during different life cycle phases. Others are found in different zones during different activities such as migration, foraging, and reproduction. Throughout the pelagic ocean, relatively dense aggregations of fish, squid, and other animals, known as the deep scattering layer, migrate toward the ocean's surface at night, descending into darkness at daylight (Garrison 1999).

Deep ocean benthic habitat includes hard, soft, and biogenic habitats at water depths below 655 feet (200 m), and are by far the largest benthic habitats in the world (Neighbors and Wilson 2006). Soft sediments are made up mostly of mud and sand and are generally low in biological productivity. However, biological hot spots of invertebrate communities may be found near hydrothermal vents or hotspots such as the Vailulu'u Seamount.

Banks, Drowned Reefs, and Seamounts

Banks, drowned reefs, and seamounts are provide a variety of habitats for fish and other species, sustain important ecological communities, and enhance ocean mixing. Banks are undersea hills, separated from the mainland (or island in the case of American Samoa) during rifting, compression, or some other geological event. Drowned reefs are coral reefs that could not maintain vertical growth to keep up with sea level rise, and die for lack of sunlight (Grigg 2008). Seamounts are underwater volcanic mountains, rising from the seafloor, and occur throughout all ocean basins (Wessel *et al.* 2010). There are 48 seamounts within the American Samoa EEZ (Kendall and Poti in prep.), with the majority rising from depths around 13, 123 feet (4,000 m; WPFMC 2009a). Vailulu'u seamount is the only hydrothermally active seamount within the EEZ (Koppers *et al.* 2010). There is also an elevated ridge around the seaward rim of Tutuila's insular shelf, which is likely a drowned barrier reef complex and where areas of high coral cover have been observed (Brainard *et al.* 2008).

Fish distribution across these habitats is affected by depth, substrate type, and composition. Deep-slope fisheries typically occur between 328 feet (100 m) and 1640 feet (500 m), with a rapid decrease in species richness typically occurring between 656 feet (200 m) and 1312 feet (400 m). Most bottomfish are associated with hard substrates, holes, ledges, or caves (Chave and Mundy 1994) and are believed to not migrate between isolated seamounts. Taylor column eddies (eddies that form above seamounts) are believed to retain pelagic larvae, though seamount populations of snappers and groupers apparently rely on inputs of larvae from external sources (WPFMC 2009a).

Taema and Nafanua Banks are located in the nearshore environment along the south shore of Tutuila. Taema Bank, located directly outside of Pago Harbor is approximately 0.75 square miles (2 square km) in size. Nafanua Bank located east of Taema Bank, is approximately 1.25 square miles (3.3 square km) and is adjacent to the southern reef flat of Aunu'u Island (Poti 2011). Because of their proximity to land, these two banks are known to be frequented by small boat fishermen, trolling for small pelagic species (*e.g.*, dogtooth tuna) and bottomfish (*e.g.* snappers).

Coral Reef and Reef Slope Habitat

Coral reefs in American Samoa consist of fringing coral reef flats bordered by coral reef slope (or shelf, Figure 3-4). Coral reefs and reef-building organisms are confined to the upper euphotic zone, where there is sufficient light for photosynthesis. Reef-building corals do not generally occur at depths greater than 328 feet (100 m) because of their symbiotic relationship with photosynthetic zooxanthellae algae (Hunter 1995), and few well-developed reefs are found below 164 feet (50 m) (WPFMC 2009a).

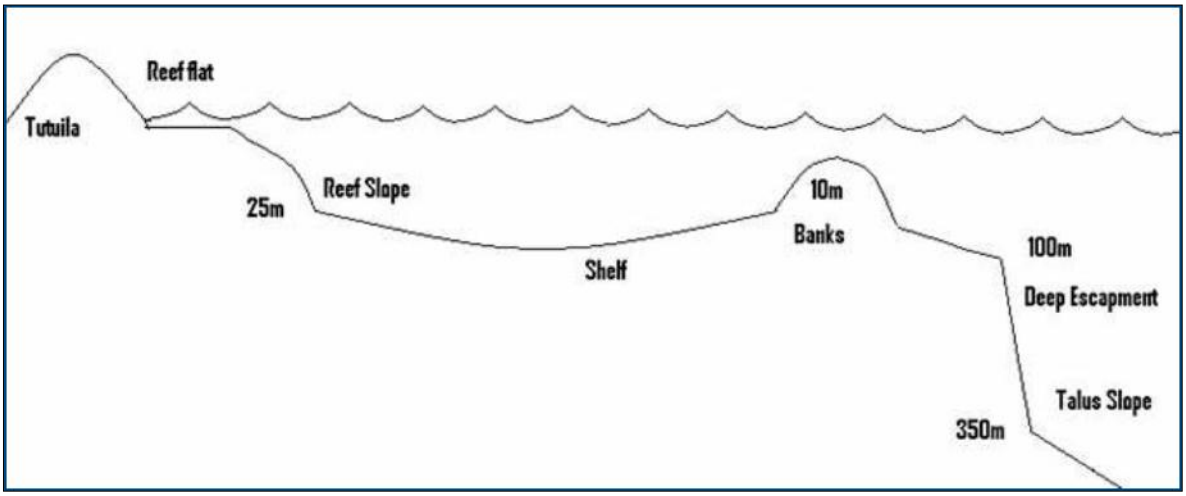

Figure 3-4: Schematic Diagram of Reef and Slope Features.
Source: Fenner *et al.* 2008

Reef slope extending from depths of 164 to 328 feet (50 to 100 m) borders many coral reefs and consists primarily of carbonate rubble, algae, and microinvertebrate communities (WPFMC 2009a). Spur and groove reef formations (linear patterns of coral interspersed with sand channels) are common on slope habitats (Fenner *et al.* 2008b). Coral reefs at depths between 98 to 164 feet (30 and 50 m), or even deeper, have been found on several of the spurs extending seaward from corners of the Manu'a Islands (Brainard *et al.* 2008). Bare *et al.* (2010) report on mesophotic coral reefs (zooxanthellate, scleractinian coral reefs that generally occur at depths from 98 feet (30 m) to more than 492 feet (150 m) documented around Tutuila. Tutuila has approximately 17.2 square miles (44.5 square km) of coral reef habitat, which constitutes more than half of the total coral reef habitat in the archipelago. The Manua Islands, Rose Atoll, and Swains Island combined have approximately 12.3 square miles (31.9 square km) of coral reef habitat (NOAA-NCCOS 2005).

There are approximately 2,700 known species associated with coral reef habitat in American Samoa. The benthic communities are dominated by crustose calcareous algae, followed by live hard corals, dead corals (less common and almost none recently dead), and brown macroalgae (very rare). Invertebrate filter feeders are rare, small, and physically similar in appearance, making total species counts problematic. Fish fauna is dominated by small to medium-sized herbivores, with some large reef fish species uncommon to rare (Fenner *et al.* 2008b).

The fauna associated with coral reefs represent 32 of the 33 animal phyla and span several trophic levels. Primary producers include phytoplankton, algae, seagrasses, and the dinoflagellate zooxanthellae living within coral tissue. Primary consumers include corals, mollusks, crustaceans, echinoderms, sea turtles, and fishes. Secondary consumers include anemones, urchins, crustaceans and fish, while tertiary consumers include eels, octopus, barracudas and sharks. Slope habitat ecology is poorly known, but it may provide important nursery grounds for coral reef fish and for several species of lobster (WPFMC 2009a).

Seagrass Habitat

While two species of seagrasses are known in American Samoa (Skelton 2003), seagrass beds are uncommon, and distribution is not described in any of the recent comprehensive habitat descriptions (Skelton 2003; Brainard *et al.* 2008, Fenner *et al.* 2008b, WPFMC 2009a). Seagrasses in the Pacific region are generally found in shallow lagoons between coral reefs and shoreline mangroves (Ellison 2009). Seagrass beds are highly productive and complex microhabitats that support a wide variety of marine species. Seagrasses provide habitat and food for a unique assemblage of plants, invertebrates, and fishes (den Hartog 1970). Skelton (2003) describes six functions of seagrasses in coral reefs:

1. Stabilizing and holding bottom settlements;
2. Promoting sedimentation and inhibiting re-suspension of organic and inorganic matter;
3. Providing shelter and refuge for resident and transient animals (many of which are commercially and recreationally important);
4. Providing food for grazers and detritivores;
5. Sustaining high production and growth; and
6. Internalizing ecosystem nutrient cycles by producing and trapping detritus and secreting dissolved organic matter.

Green sea turtles forage on seagrasses, which in turn helps maintain seagrass beds and cycle nutrients (WPFMC 2009a). Seagrass beds also provide habitat for certain commercially valuable shrimps, and food for reef associated species such as surgeonfishes (Acanthuridae) and rabbitfishes (Siganidae; WPFMC 2009a).

Mangrove Habitat

The American Samoa archipelago represents the easternmost natural extension of mangroves in the Indo-Pacific (Gilman *et al.* 2006). Mangroves are salt-tolerant shrubs and trees found in the intertidal zone, whose roots provide important habitat for many marine species, including nursery habitat for juveniles of certain reef species. Although mangrove wetlands historically were found at the mouths of most freshwater streams in the territory, only five significant stands remain as most have been filled in since the early 1900s (WPFMC 2009a). Bardi and Mann (2004) provide details about the distribution and status of mangrove habitat in American Samoa and report that only the islands of Tutuila and Aunu'u contain mangrove forests, which are located near eight villages: Alofau, Aoa, Aua, Leone, Masefau, Nu'uuli, and Vatia (all on Tutuila), and Aunu'u (on Aunu'u). Recent estimates of total mangrove habitat area range from

approximately 0.19 to 0.20 square miles [50 and 52 hectares] (Bardi and Mann 2004, Gilman *et al.* 2007a). American Samoa is estimated to be losing approximately 0.008 square miles (2 ha) of mangrove forest per year. Of the 10 forests surveyed by Bardi and Mann (2004), three are in good health, four are in good health but threatened, and three are severely impaired. Main anthropogenic threats to American Samoa mangroves include (1) incremental filling for development, solid waste disposal, and placement of piggeries; (2) altered sedimentation and hydrological processes from land use changes in contributing watersheds; and (3) relative sea-level rise and other outcomes of climate change. These threats, in combination with adjacent coastal development, hinder natural landward mangrove migration (Bardi and Mann, 2004; Gilman *et al.* 2007a, b, 2008). Efforts to rehabilitate degraded mangroves have met with mixed success (Gilman *et al.*, 2007c).

Sandy, Hard and Rubble Subtidal Habitat

Brainard *et al.* (2008) provide detailed information on subtidal habitat from the 2002 to 2004 American Samoa Reef Assessment and Monitoring Program (ASRAMP) research, and select highlights follow. Banktop (defined as all submerged marine habitats at depths between the shoreline and 328 feet [100 m]) is greatest around Tutuila and Aunu'u (combined), where the depth interval declines gradually from shoreline to about 328 feet (100 m). Ta'u, has significantly smaller surrounding banktop habitat, with depth intervals descending much more steeply from shoreline to about 328 feet. Rose Atoll and Swains Island have only limited shallow banktop, with depths that descend rapidly from 66 to 328 feet (20 to 100 m) Tutuila has an insular shelf that averages about 2.5 mi (4 km) wide, while Ofu and Olosega have a shelf that is about 0.62 mi (1 km) wide and banks that extend about 1.24 mi (2 km) offshore, and Ta'u has an insular shelf a few hundred meters to 0.62 mi (998 m) wide (except where it is generally absent on the south and eastern sides of the island). The volume of sediment present on shelves is correlated to shelf area.

With sand retention apparently related to shelf area, Brainard *et al.* (2008) observed that the percentage of benthic sand cover decreases from west to east and north across the archipelago. Rose Atoll and Swains Island (which lack an insular shelf), have very little benthic sandy habitat seaward of the reef crest (Brainard *et al.* 2008). Bare *et al.* (2010) observed sand as the second most common substrate around Tutuila (after hard bottom) at depths from 38 feet (11.5 m) to 345 feet (105 m), with the majority between 131.2 feet (40 m) and 197 feet (60 m), typically covering 32.3 to 56.0 percent for most depths (with mean sand cover at about 82.5 percent in the 80 m depth interval).

Brainard *et al.* (2008) (whose benthic habitat mapping occurred in the depth range 9.8 to 262 feet (3 to 80 m) observed that Swains Island, Ta'u and Tutuila had the lowest hard substrate while Ofu, Olosega and Rose Atoll had the greatest. Bare *et al.* (2010) found that in their surveys exclusively around Tutuila, hard bottom comprised 41.4 to 100 percent of the substrate type observed for most depths (surveyed between 38 and 345 feet, except at 262 feet where it was 14.6 percent.

Intertidal Zone Habitats

Intertidal zones consist of a variety of coastal habitats periodically covered and uncovered by waves and tides. This transition zone between sea and land is the strip of shore ranging from the uppermost surfaces wetted during high tides to the lowermost areas exposed to air during low tides. As noted above, tidal heights within Pago Pago can be as high as nearly 7 feet (2.1 m), but average 2.5 feet (0.76 m). On surf-swept rocky cliffs, the wave splash can extend water upward of another 15 feet (4.5 m) or more.

Rocky shores support a rich assortment of plants and animals, including green, brown, blue-green, and red algae, and two species of seagrass (Skelton 2003). The specific range of sedentary and mobile invertebrates in the intertidal may be controlled by the ranges of predators, competing species, and their physiological limits and varying temperature and desiccation tolerances. Fishes in intertidal habitats are limited to tidepools or passing through the intertidal zone at high tide. Seabirds forage in the intertidal at low tide, while some roost in aggregations on cliffs just above the shore.

3.1.2 Biological Setting

Within the context of the above physical setting live the organisms which make up American Samoa's biological setting. Species diversity decreases for many taxa of plants, invertebrates and fish from west to east across the South Pacific (Ellison 2009; WPFMC 2009a; Dalzell *et al.* 1996).

3.1.2.1 Plankton

Plankton, microscopic marine plants (phytoplankton) and animals (zooplankton) form the base of the food web. Many species of plankton inhabit American Samoa, and marine life is highly dependent on their growth and productivity. Their numbers, biomass, and production vary greatly both spatially and temporally. The larvae of numerous marine species, including the majority of coral reef invertebrates, are dispersed into the pelagic environment to feed on various types of plankton (WPFMC 2009a).

Photo 3: Crustose coralline algae play an important role in reef formation and dominate this reef patch at Rose Atoll and. NOAA Photo: By J. Kenyon.

3.1.2.2 Coastal and Marine Plants

American Samoa's coastal and marine ecosystems include a diversity of marine plants from the above mentioned phytoplankton, to *limu* (Samoan for seaweed, seagrasses, moss, and freshwater weeds; Skelton 2003), and mangroves, each of which is described briefly below.

Algae

Algae in American Samoa include zooxanthellae, microalgae, macroalgae, coralline algae (both crustose and branching forms), and filamentous algae. Zooxanthellae are dinoflagellate algae engaged in a symbiosis with many coral species wherein both organisms provide one another with a source of nutrients. The coral polyp provides habitat, carbon dioxide, and nutrients for the algae, while the algae provide the polyps with oxygen and carbohydrates, among other mutual benefits. Coralline algae also play a key role in and are dominant on many coral reefs, including Rose Atoll and Swains Island (NCCOS 2005). They are important in reef formation, cementing rubble together to form stable substrate (Skelton 2003; Craig 2009), and also because some species release chemicals prompting larval coral settlement (Craig 2009).

Photo 4: Several species of Caulerpa *green algae are found in American Samoa, such as this dislodged specimen observed during 2009 tsunami surveys at Tutuila. NOAA CRED Photo.*

There are 243 known species of benthic macroalgae in American Samoa (Skelton and South 2004), including 43 previously undocumented species of Chlorophyta (green algae, 35 species) and Phaeophyta (brown algae, eight species). The authors indicate more species will likely be identified as they examine Cyanophyta (blue-green algae) and Rhodophyta (red algae) collected from recent surveys. Skelton (2003) includes an illustrated guide to common and interesting macroalgae of American Samoa.

During the 2002, 2004, and 2006 ASRAMP benthic habitat surveys, Brainard *et al.* (2008) found similar algal percent cover results among all islands in all survey years, with 15 to 30 percent cover of turf algae and macroalgae combined, and less than 10 percent cover of macroalgae. High levels of macroalgae and turf algae cover around Rose Atoll and Swains Island observed in 2002 and 2006 may have been a result of natural perturbations (Brainard *et al.* 2008). Bare *et al.* (2010) found that mean percent cover of observed macroalgae was highest in the 164 to 230 feet (50 to 70 m) depth interval around Tutuila, and that it tapered off in both shallower and greater depths.

Seagrasses

Seagrasses, as noted above, provide important habitat and forage for a variety of marine species, yet they remain poorly studied in American Samoa. Skelton and South (2006) identified three of the 13 species found in the Pacific islands: *Halophila ovalis*, *H. ovalis bullosa*, and *Syringodium isoetifolium* although their presence in American Samoa remains to be confirmed. *H. ovalis* is the most common seagrass in the independent nation of Samoa, where it is found from the intertidal to 49 feet (15 m) depth in both dense meadows and as small patches.

Mangroves

Three mangrove species and several mangrove associate species are present in American Samoa's mangrove communities (Amerson *et al.* 1982a; Bardi and Mann 2004), which are dominated by the oriental mangrove *Bruguiera gymnorrhiza*. The red mangrove *Rhizophora mangle*) occurs primarily along seaward margins and tidal creeks (Amerson *et al.* 1982a; Bardi and Mann 2004). The monkey puzzle-nut or cannonball tree *Xylocarpus granatum* is rare, with only a few individual trees found at Nuʻuuli and Aunuʻu mangroves (Amerson *et al.* 1982a; Bardi and Mann 2004). *B. gymnorrhiza* allows for the formation of marshes landward of some mangrove areas (American Samoa Coastal Management Program 1992; Ellison 1999). Bardi and Mann (2004) provide additional details about mangrove forests in American Samoa.

3.1.2.3 Invertebrates[10]

Photo 5: Sea sponges, one of the many varieties of invertebrates found in American Samoa, are benthic animals that filter their food from the water column. NOAA CRED Photo.

Marine invertebrates may be benthic or pelagic, and may range in size from microscopic (micro-invertebrates) to the more commonly known macro-invertebrates. American Samoa invertebrates include a diversity of coral, sponge, mollusk, echinoderm, crustacean, annelid, bryozoans, and tunicate species. Summaries of key macro-invertebrates in American Samoa are provided below.

Brainard *et al.* (2008) report on abundance and distribution of key macro-invertebrates during ASRAMP 2002, 2004 and 2006 surveys, including crown-of-thorns starfish, giant clams, sea cucumbers, and sea urchins. They found extremely low densities of crown-of-thorns starfish archipelago-wide except at Swains Islands, where a 500 percent increase in mean density occurred between 2002 and 2006, which may reflect coral damage and stress caused by a 2004 typhoon and a 2005 cyclone. Other than crown-of-thorns starfish, Swains Island has an unusually low percentage of herbivores (10 percent) compared with other areas (50 percent) (Brainard *et al.* 2008). Mean sea urchin densities were highly variable in time and space, with the highest numbers and densities around Tutuila, Ofu, Olosega and Ta'u, and consistently very low mean densities at Rose Atoll and Swains Island. Mean densities of sea cucumber were fairly consistent in all survey years,

[10] Madrigal (1999), Fenner *et al.* (2008), and WPFMC (2009) provide more details on invertebrates, namely of the benthic variety.

with the highest densities around Ofu and Olosega, followed by Ta'u, and few individuals at Rose Atoll and Swains Island.

Brainard *et al.* (2008) found island-wide mean densities for the giant clam were relatively consistent between islands, with the highest mean densities at Ta'u in all survey years, followed by Ofu, Olosega and Tutuila, and low numbers at Rose Atoll and Swains Island. However, extremely high densities occur within the lagoon at Rose Atoll, with more than 1,000 individuals observed during each survey year (Brainard *et al.* 2008), while lowest densities are observed around the populated areas (Green and Craig 1999). Giant clams are considered overharvested even though no proper stock assessment has been conducted (Sabater 2010). Analysis of fishery data indicates that mollusks stocks in general may have declined in recent years because of an unsustainable level of harvest during the mid-1990s using scuba gear. This harvest may have been caused by concentrated effort in the accessible and limited shallow reef habitat for sessile and relatively slow growing species (Sabater 2010). A reduction in local abundance can interfere with successful reproduction because benthic invertebrates like the giant clam rely on mass spawning to bring eggs and sperm together in the water column. When the population density drops below a certain level, spawning success decreases and future recruitment to the population is put in jeopardy (Murray *et al.* 1999). No-take reserves protect not only the mature individuals that make up the broodstock, but also the new recruits that are essential to population maintenance.

At least four lobster species occur in American Samoa: two spiny lobsters (*Panulirus penicillatus* and *P. versicolor*) and two slipper lobsters (*Parribacus caledonicus* and *P. antarcticus*). *P. versicolor* and *P. antarcticus* are rare while *P. penicillatus* and *P. caledonicus* are shallow-water (less than 33 feet [10 m] depth) targeted fishery species. Lobsters generally forage on the reef crest at night, remaining hidden in holes within the reef during the day, with juveniles and adults sharing the same habitat (Pitcher 1993). A 2001 population assessment (Coutures 2003a) estimated only 9,300 spiny lobsters around Tutuila, in part because their preferred habitat is a narrow band only about 66 to 82 feet (20 to 25 m) wide seaward of the reef crest. While fishery landings are relatively small, there is no indication of overfishing (Coutures 2003a).

Live Scleractinian Coral

During the 2002 to 2006 ASRAMP surveys, Brainard *et al.* (2008) found the following with regard to live scleractinian coral:

- Percent cover ranged from about 5 percent to 40 percent;
- Greatest cover was found on southeastern Ta'u at > 50 percent, Rose Atoll at 20 percent to 29 percent, and Swains Island at 20 percent to 75 percent;
- Tutuila's high coral cover areas tend to occur in sheltered locations (*e.g.*, Fagatele Bay), or on ridges extending out toward open ocean;
- At least 37 scleractinian genera observed at Tutuila, 34 at Ofu and Olosega, 34 at Ta'u, 23 at Rose Atoll, and 18 at Swains Island;
- *Montipora*, *Pocillopora* and *Porites* taxa are ubiquitous and abundant;
- *Acanthastrea*, *Leptoseris/Pachyseris* and *Psammocora* taxa are ubiquitous but uncommon;
- *Gardineroseris*, *Mycedium*, *Plesiastrea*, *Stylocoeniella* and *Tubastrea* taxa are rare.

Corals

Corals belong to the phylum cnidaria, class anthozoa (along with sea anemones and sea pens). Octocorals (*e.g.*, soft, pink, and bamboo corals) generally have polyps with eight tentacles, while hexacorals (*e.g.*, true, stony, and scleractinian, gold and black corals) generally exhibit symmetry in multiples of six. There are more than 250 species of coral in American Samoa that compose several distinct communities: nearshore reef flats, reef crest, and reef slope (Craig 2009). Of the 82 species recently listed as candidate species for the federal ESA, 62, including 21 Acropora species, are listed as occurring in American Samoa (Brown and Wolf 2009). None of the two threatened coral species or two coral species of concern corals occurs in American Samoa waters. See text box for recent research results about scleractinian corals in American Samoa.

While data are lacking on precious corals (filter feeders lacking symbiotic algae) in America Samoa, they likely occur at depths from 328 to 4,921 feet (100 to 1,500 m) on hard substrate (shell sandstone, limestone, or basaltic rock with a limestone veneer) in areas swept by strong to moderate currents (Grigg 1993). Their occurrence in the region is unverified, but 11 are federally managed by the American Samoa Archipelago Fishery Ecosystem Plan (WPFMC 2009a).

3.1.2.4 Fish

Wass (1984) provides an annotated checklist of fishes of American Samoa, and WPFMC (2009) provides details on benthic and pelagic species of economic importance. Wass (1984) listed 991 species. Of these, 890 are shallow (above 197 feet [60 m]) or reef species, 56 are deep (197 feet to 1,640 feet [500 m]) bottom species and 45 are pelagic surface (below 656 feet [200 m]) species. Wass (1984) also indicated that 40 species which were known only from Samoa likely occur in American Samoa as well. Dominant families are damselfish (Pomacentridae), surgeonfish (Acanthuridae), wrasse (Labridae) and parrotfish (Scaridae). During the ASRAMP 2002 to 2006 survey, total reef fish (all sizes) and large fish (larger than 19.7 in [50 cm]) biomass were observed to be highest around the unpopulated islands of Rose Atoll and Swains Island, and least around the populated islands of Tutuila and the Manu'a islands (Brainard *et al.* 2008). Brainard *et al.* (2008) also found that herbivores made up more than 50 percent of total biomass of the archipelago's fish communities except at Swains Island, where they were only 10 percent of biomass and about 60 percent of biomass was large predators such as barracudas, snappers, and jacks.

Photo 6: Clownfish like this Amphiprion *species are in the Pomacentridae (damselfish) family, and are common in American Samoa. Photo: Doug Fenner.*

WPFMC (2009) describes commonly harvested species. For coral reef associated organisms, these include surgeonfishes (Acanthuridae), triggerfishes (Balistidae), jacks (Carangidae), parrotfishes (Scaridae), soldierfishes/squirrelfishes (Holocentridae), wrasses (Labridae), octopus (*Octopus cyanea*, *O. ornatus*), goatfishes (Mullidae), and giant clams (Tridacnidae). Targeted bottomfish and seamount fish include snappers (Lutjanidae), groupers (Serranidae), jacks (Carangidae), and emperors (Lethrinidae). The most commonly harvested pelagic species in the Western Pacific region are tunas (*Thunnus obesus*, *T. albacares*, *T. alalunga*, *Katsuwonus pelamis)*, billfish (*Tetrapturus auda*, *Makaira mazara*, *Xiphias gladius*) dolphinfish (*Coryphaena hippurus*, *C. equiselas*), and wahoo (*Acanthocybium solandri*; WPFMC 2008). Pelagic highly migratory species such as tropical tunas (*e.g.*, yellowfin, skipjack, and bigeye) appear to roam extensively within a broad expanse of the Pacific centered on the equator, though their migration patterns are not easily understood or categorized (WPFMC 2009b). These species, in addition to mackerels and billfishes, are extremely important to fisheries, accounting for one-third of total annual worldwide catch (Food and Agriculture Organization of the United Nations 2005, 2009). Because of their economic importance and highly migratory nature, these species in the western Pacific are managed through the Western and Central Pacific Fisheries Commission. Stock assessments of the four major tuna species show that bigeye tuna are undergoing overfishing, while yellowfin is being fished close to the sustainable limit, and albacore and skipjack are showing signs of concern (SPC 2010).

Data from 22 permanent monitoring sites on Tutuila indicate that a few species of Acanthuridae and Scaridae herbivorous fish dominate the coral reef habitat, with carnivorous fish species more abundant in locations with higher abundance of food and live coral cover (Sabater and Tofaeono 2007). Herbivores generally occur in higher numbers where there is an abundance of fleshy and filamentous algae and coralline algae. Fish biomass is significantly higher on the south shore and on reefs exposed to high energy waves, a result seen in other reef habitats in the Pacific (Gust *et al.* 2001).

*Photo 7: The Humphead or Maori wrasse (*Chelinus undulates*) is one of several rare American Samoa reef species considered for a general no-take prohibition by DMWR. Photo: Leslie Clift.*

The total standing biomass for coral reef species at Tutuila, Ofu, Olosega, Ta'u, Rose Atoll, and Swains Island is approximately twice that for the biomass of Tutuila alone (see Table 3-1). This ratio correlates well with the total available coral reef habitat, which is 17.2 square miles (4,448 ha) for Tutuila and a combined 12.3 square miles (3,188 ha) for all other sites (NOAA-NCCOS 2005 *in* Sabater 2010). On average, Tutuila has 800 pounds of coral reef fish per hectare, while

the whole archipelago averages 782 pounds of coral reef fish per hectare. Biomass of many families of reef fish appears to be increasing, likely a result of the overall low level of fishery mortality (1.2 percent) and declining fishing effort in recent years (Sabater 2010).

Across the Indo-Pacific, apex predators are increasingly rare on coral reefs, as they are highly prized and targeted by fishermen, have naturally low population numbers, generally reach maturity at a later age than herbivorous species, and in the case of sharks, produce few offspring (DeMartini *et al.* 2008; Fenner 2009b). Because of their vulnerability to even moderate levels of fishing, specific reef fish have been of particular concern in American Samoa. These include the Maori wrasse (*Chelinus undulatus*), bumphead parrotfish (*Bolbometopon muricatum*), giant grouper (*Epinephelus lanceolatus*), giant trevally (*Caranx ignoblis*), and six shark species. The bumphead parrotfish has also been included by NOAA Fisheries on the ESA species of concern list because of fishing, night spearfishing and habitat degradation. NOAA Fisheries received a petition to list the bumphead parrotfish under the ESA and a species status review is being conducted (NMFS 2010). A recent underwater census indicates low number and small sizes of these species, which led to an effort by the DMWR to prohibit their take by any means in territorial waters in 2007 (Fenner 2009b). This data was met with skepticism that their overall low numbers was a result of fishing pressure, as there has been no stock assessment or thorough analyses of fishery data on these species (Ochavillo 2011). In addition, with the exception of sport fishing for the giant trevally, these groups of fishes are not targeted in the local fishery (Sabater 2011). Limited available juvenile habitat may be a primary factor in the low numbers of some of these species on American Samoan reefs (Sabater 2011).

Table 3-1: Coral Reef Fish Stock Size.

Family/Species Group	Archipelagic Biomass (lbs)	Tutuila Biomass (lbs)
Emperor	142,052	93,529
Goatfish	64,341	45,492
Groupers	251,288	95,680
Jacks	129,683	56,351
Parrotfish	962,975	598,237
Reef Shark	86,308	15,644
Rudderfish	19,175	4,424
Snappers	337,665	137,419
Squirrelfish	100,586	32,714
Wrasse	215,655	117,176
Surgeonfish	1,775,574	1,095,494
Others	1,890,055	1,269,789
TOTAL	5,975,358	3,561,950

Source: Sabater 2010

3.1.2.5 Birds[11]

Craig (2009) provides a comprehensive list of American Samoa's seabirds, shorebirds and water birds, along with island-specific information on abundance, native or introduced status, and whether they are resident (breeding) or visiting species. They include 29 seabird species and 10 shore and water bird species of shearwater, tropicbird, noddy, tern, gull, booby, petrel, storm petrel, frigate bird, curlew, duck, godwit, heron, lapwing, plover, sanderling, tattler, and turnstone. From September through April, ruddy turnstones, Pacific golden plovers, and wandering tattler migrate to American Samoa from their nesting grounds in Alaska and Northern Canada (Craig 2009). While well south of its range, the ESA-listed Newell's shearwater is reported as a visiting species (on Tutuila). Most seabirds, shore birds, and water birds are protected by the Migratory Bird Treaty Act.

3.1.2.6 Sea Turtles

WPFMC (2009) provides a comprehensive characterization of sea turtles in the Pacific and American Samoa. Pacific sea turtles species include olive ridley, leatherback, loggerhead, hawksbill, and green sea turtles. All sea turtles are protected by the ESA, and all are protected in the American Samoa Sea Turtle and Marine Mammal Sanctuary. Leatherbacks are extremely rare in American Samoa, olive ridleys are uncommon, and there are no reports of loggerheads in the territory. Hawksbill and green sea turtles are the most common species in American Samoa. The primary green sea turtle nesting location in the territory is at Rose Atoll, where several dozen nests are laid between October and March. While nesting trend data are unavailable, anecdotal information suggests major declines in the last 50 years (Maison *et al.* 2010). After they nest, most green sea turtles migrate long distances from Samoan waters to foraging grounds across the South Pacific, including Fiji, Vanuatu, and French Polynesia (WPFMC 2009a). Of seven post-nesting green sea turtles satellite-tagged in 1993 to 1995, six migrated nearly directly to Fiji, possibly to feed on Fiji's extensive seagrass beds (Craig *et al.* 2004). Sub-adult and adult green sea turtles also occur in low abundance in nearshore waters around Tutuila, Ofu, Olosega, Ta'u and Swains Island, with sporadic, low-level nesting on Tutuila and Swains Island (Maison *et al.* 2010). Hawksbills are most commonly found at Tutuila and the Manua islands, with an estimated 50 females nesting annually on Tutuila and 30 on the

Sea Turtles – *I'a sa*

According to Samoan folklore, the *I'a sa* (or "sacred fish") have the power to bring fishermen lost at sea safely to shore. Traditional Samoan culture incorporates sea turtles in cuisine, art, song, and legend. Historically, in addition to providing a food source, sea turtles were harvested for their shells, which were crafted into fishing hooks, bracelets, combs, and the headpiece worn by a princess during important dance ceremonies. There are turtle petroglyphs in Faga'itua and Leone. According to legend and song, from the cliffs in the village of Vaitogi one might see past visitors who were magically transformed into a turtle and shark. (Adapted from Craig 2009)

In Samoan, hawksbill turtles are known as *laumei fai uga*, and green sea turtles are known as *laumei meamata* and *tuālimu*.

[11] A Bird Checklist for American Samoa may be found at: http://www.nps.gov/archive/npsa/5Atlas/partzj.htm.

Manu'a Group (WPFMC 2009a).

3.1.2.7 Marine Mammals[12]

There is a dearth of scientific information on American Samoa marine mammal species and their abundances (Utzurrum *et al.* 2006). There are two marine mammal groups in the western Pacific region: (1) whales, dolphins, and porpoises (cetaceans); and (2) seals and sea lions (pinnipeds). Only cetaceans have been observed in American Samoa. All marine mammals in American Samoa are protected under the Marine Mammal Protection Act of 1972 (MMPA) and the American Samoa Sea Turtle and Marine Mammal Sanctuary. Additionally, some marine mammals are protected under the ESA.

Twelve of the 33 species of marine mammals known to occur in the tropical South Pacific have been observed in American Samoan waters (Dolar 2005). There are two mysticetes (baleen whales): humpback, and minke whale (Utzurrum *et al.* 2006). There are 10 odontocetes (toothed cetaceans): sperm whale, killer whale, short finned pilot whale, common bottlenose dolphin, spinner dolphin, pan-tropical spotted dolphin, rough toothed dolphin, Cuvier's beaked whale, dwarf sperm whale, and false killer whale (Utzurrum *et al.* 2006; Johnston *et al.* 2008). The humpback whale and sperm whale are listed as endangered under the ESA. It is estimated that the Oceania[13] population of humpback whales was reduced by 95 percent prior to the cessation of commercial whaling in 1966 (Craig 2009). Constantine *et al.* (2010) estimated the Oceania population of humpbacks (stocks E2, E3 and F) to be 3,520 whales in 2005, but with no data to indicate a population trend. Humpbacks winter in American Samoa's territorial waters, where they mate and deliver their calves (Robbins and Matilla 2006). They arrive in June and remain through December, with peak numbers in September and October (Dolar 2005). Researchers have identified 150 unique individuals in American Samoan waters between 2003 and 2008 (IUCN 2009). Migratory routes to and from the islands remains unknown. No human-related mortalities of humpback whales have been recorded in American Samoan waters (IUCN 2009).

Photo 8: Rough-toothed dolphins swimming with Humpback whale. NOAA Photo: By Dave Matilla.

[12] Additional information on marine mammals in the region is in Dolar (2005), Robbins and Mattila (2006), Johnston *et al.* (2008), Fenner *et al.* (2008), Craig (2009) and WPFMC (2009).

[13] Oceania refers to the islands of the Central and South Pacific, including Melanesia, Micronesia, and Polynesia.

Spinner dolphins and rough-toothed dolphins are the most common cetaceans found in the waters surrounding Tutuila. Recent photo-identification of individuals suggests that groups of both of these species are largely resident populations (Johnston *et al.* 2008). However, genetic diversity of the spinner dolphins is high, indicating interbreeding with spinner dolphins from surrounding islands over generations. Other cetaceans around Tutuila appear to be more transient, with little known of their distribution and residency across the archipelago.

3.1.2.8 Flying Fox[14]

Although flying fox (large fruit bats) are terrestrial, they are part of the affected environment because Fagatele Bay is adjacent to the main roost for this endemic species. Of the two species of flying fox — *Pteropus samoensis* and *P. tonganus* — the former is endemic to the Samoan archipelago and Fiji (Craig 2009). Combined with one species of insect-eating bat (*Emballonura semicaudata*), they are the only land mammals native to American Samoa. Thousands of *P. samoensis* roost in the coastal forest between Seumalo Ridge and Fagatele Point at the southwestern terminus of Fagatele Bay (U.S. Department of Commerce 1984). These bat colonies are infrequently encountered in other locations on Tutuila and are susceptible to human disturbance (U.S. Department of Commerce 1984).

3.1.2.9 Special-Status Marine Species

Photo 9: Green sea turtles (this one is in the Hawaiian Islands Humpback Whale sanctuary) are protected by both territorial and federal regulations in American Samoa. Photo: Claire Fackler, NOAA National Marine Sanctuaries

Special status marine species include those afforded special protection by the territorial and federal government. In 2003, the territorial waters of American Samoa were designated a sanctuary for marine mammals and sea turtles (ASG Executive Order 005-2003), protecting these species and their habitats within territorial waters. Federal protection for special-status marine species is afforded primarily through the ESA and the MMPA.

The ESA provides measures to conserve and recover a designated list of species. NOAA Fisheries is charged with implementation of the ESA for all marine mammals in American Samoa, and shares responsibility with the USFWS for sea turtles. USFWS is responsible for the protection of ESA-listed seabirds. The ESA defines endangered species as "any species which is in danger of extinction throughout all or a significant portion of its range" and threatened species as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." Of the 72 listed threatened and endangered marine species managed by NOAA, the range of 10 overlaps with the American Samoa EEZ. These include five endangered

[14] Craig (2009) provides details on flying fox ecology.

whale species (blue, fin, humpback, sei, and sperm) and three endangered turtle species (hawksbill, leatherback, and olive ridley) and two threatened species (green and loggerhead). The Newell's shearwater (*Puffinus auricularis newelli*) has been identified as a "seabird visitor" to Tutuila by the NPS. Its primary distribution is well north of the archipelago (Birdlife International 2011). The bristle-thighed curlew (*Numenius tahitiensis*) is a migratory species that breeds in Alaska and is known to winter on Rose Atoll (WPFMC 2009a)[15]. In addition to these species, the bumphead parrotfish (*Bolbometapon muricatum*) and 62 coral species (see coral section above) are candidate species whose range also overlaps the American Samoa EEZ. The ESA defines a candidate species as "any species being considered by the Secretary for listing as an endangered or threatened species, but not yet the subject of a proposed rule." Of the endangered and threatened species, only the humpback and sperm whales, and green and hawksbill turtles are known to regularly occur in American Samoa waters (see details in sea turtles and marine mammals sections).

All marine mammals are protected under the MMPA administered by NOAA Fisheries and the USFWS. NOAA Fisheries issues commercial fishery exemptions to the MMPA for incidental take, which are described at the end of the subsection on fisheries. In addition to the five ESA-listed marine mammal species listed above, the following fourteen species of marine mammals may occur within the American Samoa EEZ and are protected under the MMPA:

- Blainsville beaked whale *Mesoplodon densirostris*
- Bottlenose dolphin *Tursiops truncates*
- Bryde's whale *Balaenoptera edeni*
- Cuvier's beaked whale *Ziphius cavirostris*
- Fraser's dolphin *Lagenodelphis hosei*
- Longman's beaked whale *Indopacetus pacificus*
- Melon-headed whale *Peponocephala electra*
- Pygmy sperm whale *Kogia breviceps*
- Risso's dolphin *Grampus griseus*
- Rough-toothed dolphin *Steno bredanensis*
- Short-finned pilot whale *Globicephala macrorhynchus*
- Spinner dolphin *Stenella longirostris*
- Pantropical spotted dolphin *Stenella attenuata*
- Striped dolphin *Stenella coeruleoalba*

[15] Bird Checklist for American Samoa found at: http://www.nps.gov/archive/npsa/5Atlas/partzj.htm.

3.1.3 Human Setting

This section describes the history, culture, maritime heritage resources of American Samoa, as well as human uses of the marine environment there. Local history is relevant to understanding proposed sanctuary actions because it explains the foundation of Samoan culture, the origins of local maritime heritage resources, and the relationship between the two branches of government that administer the sanctuary (the U.S. federal government and the ASG). As noted in Chapter 1, sanctuary management occurs within the context of *fa'a-Samoa*, and Samoan cultural traditions and practices. It would be difficult to fully understand how sanctuary staff will implement many of the activities described in this document without an introduction to local cultural traditions and practices. Since sanctuary regulations include protections for maritime heritage resources, an explanation these resources also is warranted. Next, understanding the history of the relationship between the U.S. Federal Government and the ASG provides useful context for section *3.1.5 Institutional Setting*. Finally, describing human uses of the local marine environment provides context for understanding potential human impacts on that environment, as well as potential impacts of sanctuary regulations on those uses.

3.1.3.1 History[16]

Human history in American Samoa dates back about 3,000 years (Craig 2009, Linnekin *et al.* 2006). Three particular sites have yielded archaeological evidence dating to that time: Mulifanua (offshore west of Upolu in Samoa), the ʻAoa Valley (eastern Tutuila), and Toʻaga (Ofu; Craig 2009). The evidence includes pottery from an early Polynesian culture known as "Lapita," as well as "Polynesian plainware" ceramics produced across the inhabited islands of the Samoas from 1,500 to 3,000 years ago (Craig 2009; Linnekin *et al.* 2006).

Archaeological sites dating to the subsequent 800 years are difficult to find and identify because of the lack of pottery. Since this period is prior to any major surface construction, it is known as the "Samoan Dark Ages" (Craig 2009). This period is believed to be important to the development of the Samoan culture, including the *matai* system (Craig 2009). Evidence for inland settlements dates to the latter part of the Polynesian plainware period, and substantial settlements were present on Upolu by 1250 A.D.; however, later abandonment of large settlements appears to be a theme in much of the Samoan archipelago (Linnekin *et al.* 2006). The large settlements often included *tia seu lupe* or "star mounds," large, often star-shaped, raised platforms 2 to 15 feet (0.6 to 4.5 m) high, built primarily in the last 500 years (Craig 2009),associated with the activities of higher ranking individuals (Linnekin *et al.* 2006) to snare and catch pigeons.

Island subsidence and sea level rise yield the potential for coastal zones (including offshore areas) to hold buried deposits of cultural material, some dating back 3,000 years. Early cultural deposits such as those found at Mulifanua on Upolu might be found at Tutuila if island

[16] The treaties, cessions and federal laws relevant to the political history of American Samoa are available online via the American Samoa Bar Association at http://www.asbar.org/Newcode/treaties.htm. For additional details on the history of American Samoa, see Linnekin *et al.* (2006).

subsidence occurred as rapidly as that on Upolu. Further work is needed to assess this possibility as well as to investigate marine archaeological evidence of fishing. Regarding the latter, little work has been done to date in the South Pacific (Linnekin *et al.* 2006).

With the exception of Ta'u, the Samoan islands were under Tongan conquest from 1200 to 1400 A.D. (Linnekin *et al.* 2006). The first European contacts came in 1722 and 1768 when Dutch explorer Jacob Roggeveen and French explorer Louis-Antoine de Bouganville traded with islanders in the Manu'a group (Linnekin *et al.* 2006; Davidson 1969). The subsequent wave of outside visitors included European explorers and Christian missionaries. Several accounts of whaling ships were also documented in the archipelago in the 1830s (Linnekin *et al.* 2006; Davidson 1969). A period of rapid population decline and a settlement shift from inland to coastal locations occurred before 1830, likely as a result of the introduction of European diseases (Linnekin *et al.* 2006).

From the 1850s on, a steadily increasing number of European and American traders were operating on Tutuila, while Manu'a remained relatively isolated. By the 1880s, Britain and Germany had laid claims to the islands. In March 1889, German, English, and American warships stood ready to go to war over possession of the islands, but the impending battle never ensued because of a hurricane. In 1899 (though not effective until February 16, 1900), Germany, England, and the U.S. (note the absence of Samoan representation) signed a tri-partite agreement that granted control of Upolu and Savai'i to Germany and control of Tutuila, Aunu'u, and Manu'a to the U.S. That year, the U.S. Department of the Navy assumed administration of "Tutuila Station" (Enright *et al.* 1997).

The principal interest of the U.S. in the area was Pago Pago Harbor, where the U.S. had already established a coaling station (Linnekin *et al.* 2006). The *matais* of Tutuila and Aunu'u ceded these islands to the U.S. on April 17, 1900. The king and *matai* of Manu'a did not sign a deed of cession for Ta'u, Ofu, Olosega, and Rose Atoll to the U.S. until 1904. Several years after, the Navy began to refer to the region as "American Samoa" (Linnekin *et al.* 2006). Although American Samoa remained largely insulated from World War I, in 1914 New Zealand seized control of Western Samoa from Germany (Enright *et al.* 1997). In 1925, the U.S. Congress established authority over Swains Island per 48 U.S.C. sec. 1662. In 1930, amidst fears of rebellion against the U.S., a congressionally appointed fact finding commission recommended development of an organic act defining the relationship between American Samoa and the U.S. (Linnekin *et al.* 2006). During World War II, the American Samoa Defense Group (headquartered at Naval Station Tutuila) was the largest defense group in the Pacific and experienced Japanese scout overflights and submarine fire (Enright *et al.* 1997). In 1951, per Executive Order 10264, administration of American Samoa transferred from the Department of the Navy to the Department of the Interior.

Today American Samoa is an unincorporated, unorganized, and self-governing territory of the U.S. and remains administered by the Office of Insular Affairs, U.S. Department of the Interior. It is "unincorporated" because not all provisions of the U.S. Constitution apply to the territory (Future Political Status Study Commission 2007). It is an "unorganized" territory because Congress has not provided it with an organic act, which would organize the government, much

like a constitution would. Instead, Congress gave plenary authority over the territory to the President of the U.S., who then delegated that authority to the Department of the Interior. The Secretary of the Interior enabled American Samoans to draft a constitution under which the American Samoa Government functions (Office of Insular Affairs 2010; U.S. Department of Labor 2010).

American Samoans are classified as U.S. nationals rather than as full citizens. Consequently, they cannot vote in national elections, but have freedom of entry into the United States. American Samoa has had an elected, nonvoting Member of Congress in the U.S. House of Representatives since 1981 (U.S. Department of Labor 2010).

3.1.3.2 Culture

A detailed discussion of Samoan culture is provided in Appendix C of the original Fagatele Bay National Marine Sanctuary management plan (U.S. Department of Commerce 1984) and details about culture and population are in Levine and Allen (2009). The information in these documents is incorporated by reference. A brief introduction to Samoan culture is provided below.

Despite outside influences and their status as U.S. nationals, American Samoans hold on to ancient traditions more tightly than other Pacific Islanders (U.S. Department of Labor 2010). While it holds on to these traditions, Samoan culture has inherent flexibility, allowing ceremonial and traditional customs to be modified to suit the current situation (U.S. Department of Commerce 1984). One key factor in the integrity of Samoan culture is the endurance of the Samoan language. As of the 2000 census, about 90 percent of the population in American Samoa speak Samoan at home and 78 percent speak another language more frequently than English at home (data from U.S. Census Bureau 2003). Samoan is also spoken in the work place, including in the offices of the sanctuary and the American Samoa Department of Commerce. Another key to the fortitude of Samoan culture is the commitment to maintaining *fa'a-Samoa*, the Samoan way of life, which is protected by Article 3 of the Bill of Rights in the American Samoa Revised Constitution:

> "It shall be the policy of the Government of American Samoa to protect persons of Samoan ancestry against alienation of their lands and the destruction of the Samoan way of life and language…."

The ASCA also codifies preservation of *fa'a-Samoa*. ASCA Title 1, sec. 1.0202, maintains that Samoan customs (not in conflict with the laws of American Samoa and the U.S.) shall be preserved, and furthermore it provides for the continuation of village, county, and district councils of hereditary chiefs and talking chiefs (orators) according to their own Samoan customs.

Fa'a-Samoa places great importance on the dignity and achievements of the group rather than on individual achievements. It also emphasizes reciprocity rather than individual accumulation, and similarly, prestige is gained through generous distribution (not accumulation) of wealth (Levine and Allen 2009). The group that is the basic unit of Samoan society is the *aiga potopoto*, or the

group of extended family members who acknowledge a common allegiance to a particular *matai*, or chief (U.S. Department of Commerce 1984). Leading *matais* (*Sa'o*) manage the communal economy, regulate the activities of *aiga* members, and are responsible for their welfare, protect and distribute family lands, and represent the family in councils (U.S. Department of Commerce 1984). *Fa'amatai* is the traditional chiefly system that includes the protocols of the *saofa'iga ale nuu* (village council meeting) (Brainard *et al.* 2008). The *fa'amatai* and the *saofa'iga ale nuu* are relevant at all levels of Samoan political organization: the *aiga* (family), the village, the region, and in national matters (Brainard *et al.* 2008). Sanctuary staff must be familiar with *fa'amatai* since cultural protocol dictates that they consult with that community's *matai* when they want to work with a given community.

Matais are divided into two functional groups: *ali'i* (high chiefs) and *tulafale* (talking chiefs or orators). At the *aiga* level, the *ali'i* and *tulafale* have the same responsibilities, although they have different but complementary roles in public and in the *saofa'iga ale nuu*. *Ali'i* are ultimate authorities, while *tulafale* act as executive agents for the *ali'i*; for example, making speeches on behalf of the *ali'i* or the village, or serving as the master of ceremonies when a chief's title is being bestowed. While the differences in function between *ali'i* and *tulafale* are a constant, their relative influence depends on factors such as their genealogy, the given time and circumstances, and their personalities. Similarly, the rank of one *matai* relative to that of another depends on genealogy and the particular set of circumstances at hand (U.S. Department of Commerce 1984)

ASCA Title 1, Chapter 4 provides the series of qualifications one must meet to succeed to a *matai* title, such as being of at least one-half Samoan blood, born on American soil, chosen for the title by mutual agreement of one's *aiga potopoto*, and serving the family and community (known as *Tautua*). Chapter 4 also codifies the legal process through which a person may succeed to a given *matai* title and be removed from a *matai* title. There are numerous different *matai* titles, a given title may only be held by one person at a time, and one person may not register more than one *matai* title at a time.

Photo 10: Reaching Fagatele Bay from Futiga requires advance permission from the local matai and that the site warden unlocks the gate at the entrance to the Fagatele Bay Trail, which traverses private land. Photo: Sarah Kinsfather.

Land ownership traditions in American Samoa have important implications for the sanctuary, since most people would access the proposed sanctuary unitsfrom land. As mentioned above, one of the roles of the *Sa'o* is protecting and distributing family lands. Land is one of the most important tangible assets in American Samoa and is important to family organization and identity (U.S. Department of Labor 2010). There are three types of land holding in American Samoa: communal land, individually owned land, and freehold land (U.S. Department of Commerce 1984). Communal land ownership is at the core of the Samoan way of life (Future Political Status Study Commission 2007). Existing land tenure law prohibits the transfer of land ownership, except freehold land, to any person whose blood is less than one-half Samoan (U.S. Department of Labor 2010). Freehold land is mostly located in the Pago Pago Bay area, the Tafuna Plain, and the Village of Leone (U.S. Department of Labor 2010). About 90 percent of the land is communally owned by *aiga*, and about 2 percent is freehold land (Office of Insular Affairs 2010). In 2006, the American Samoa Government's Future Political Status Study Commission recommended that the Governor and Legislature review current laws to cease individualization and alienation of communal lands (Future Political Status Study Commission 2007). Sanctuary management must work with *matais* on sanctuary accessibility issues and on issues pertaining to land use adjacent to sanctuary units.

Customary Marine Tenure

Several aspects of traditional culture are directly relevant to the management of marine resources, especially Customary Marine Tenure (CMT). CMT is a model of governance, common in Pacific cultures, that provides a legal and cultural base for controlling inshore marine resource access (Cinner 2005). Decision-making varies based on culture, geography, and status within a community and restriction to access is often based on lineage. CMT structures vary by geography and culture and can be simple community-owned area or complex. In American Samoa, traditionally the village *tautai* (master fisherman) is a key decision maker in fishing matters, in which this *matai* is awarded higher status than other *matai* who might otherwise outrank him. Villages control nearshore marine resource usage rights and may establish their own *tapu* (restrictions) on fishing and access for the entire community. The DMWR Community Fisheries Management Program formalizes some community-specific marine resource use restrictions. All areas also have an informal *tapu* against fishing on Sundays. Additional traditional marine resource management techniques include village-based regulations, banning various types of fishing techniques, as well as banning outsiders from fishing in village areas (Levine and Allen 2009).

3.1.3.3 Maritime Heritage Resources

American Samoa contains maritime heritage resources representing more than 3,000 years of human history. Maritime heritage resources consist of cultural, archeological, and historical properties associated with coastal and marine areas and seafaring activities and traditions. Maritime heritage resources in American Samoa reflect five different aspects of Samoan history.

Historic Shipwrecks Lost in American Samoa

There are 10 known historic shipwrecks in American Samoa dating from 1828 to 1949. They include brigs, schooners, whalers, barkentines, destroyers, steamers, and tankers. They were lost at sea, in Pago Pago and Leone Bays, and offshore from Tutuila and Rose Atoll. They represent British colonization efforts, whaling heritage, and World War II. The tanker U.S.S. *Chehalis* in Pago Pago Harbor is the only historic shipwreck located to date.

World War II Naval Aircraft Lost in American Samoa

Aircraft wrecks include military aircraft associated with World War II patrols and training activities, and commercial craft. Between 1942 and 1944, 43 naval aircraft are reported as having ditched or crashed into American Samoan waters, principally in the vicinity of Tutuila. None has been located, though local divers report possible plane debris near Pola Island, Tutuila.

World War II Fortifications, Gun Emplacements, and Coastal Pillboxes

At least 81 coastal fortifications from the World War II era are a testament to the important role of the islands during a pivotal period in Pacific history. World War II era fortifications include remnants of numerous concrete pillboxes along the shoreline, gun emplacements, bunkers, air bases, the naval hospital, radar and radio stations, and foundations. The 6-inch guns at Blunts Point, along with their emplacements and ammunition lockers, have been designated as National Historic Landmarks. These pillbox sites, some built before the American declaration of war in December 1941, are associated with the U.S. Marines and with the local *fitafita* (Samoan soldiers). The Samoan Marines were the first ethnic brigade to be incorporated into the Marine Corps Reserves (Kennedy *et al.* 2005).

Archaeological Sites Associated with the Ancient Past in American Samoa

Of the wide variety of archaeological artifacts and sites in American Samoa, only a few occur repeatedly in the marine and coastal context: whet stones (stones used to sharpen knives and other cutting tools), petroglyphs, grinding holes and bait cups, and certain coastal villages. While some sites have been the subject of archaeological investigation and excavation, in many instances artifacts and features have simply been informally described and briefly included in previous inventory summaries.

Marine and Coastal Natural Resources Associated with the Legends, Folklore, and Culture of American Samoa

Landscape and seascape features serve as visible touchstones of oral history and parts of the heritage record. There are at least 20 known coastal sites, including *tupua* (legendary, sacred stones, rocks or formations that represent ancient humans), other natural features and specific locations, which represent stories and legends in American Samoa. Of all the archaeological and historic sites the Historic Preservation Office works to protect in American Samoa, these sites are viewed as the most significant to local residents and in need of further inventorying (Volk *et al.* 1992). Aside from inventorying these sites, challenges lie ahead in assessing the significance of and preserving these locations given the gap between definitions of property under federal preservation mandates and these less tangible properties and locations of cultural importance.

Other aspects of maritime heritage in American Samoa include significant historical sites, artifacts, and modern-day efforts to preserve maritime heritage traditions. Massacre Bay on the northwest coast of Tutuila is the spot where 12 members of French explorer Jean-François de la Pérouse's crew and 39 Samoans met an unfortunate end when a fight broke out among them. The site is on the National Register of Historic Places. Satala Naval Cemetery inters enlisted men dating back to the 19th century, along with Korean fishermen who died while overseas. Modern-day efforts to preserve maritime heritage traditions include efforts surrounding *fautasi* and the *'Alia*. *Fautasi* (traditional long boats typically rowed by 50 people) are expertly raced in an inter-village competition every Flag Day (Van Tilburg 2007). The *'Alia* is a replica double-hulled voyaging canoe launched by the Aiga Tautai o Samoa Association (the Voyaging Society of Samoa). The *'Alia* was designed to serve as a platform for preserving sailing skills and knowledge for American Samoan youth and has potential to play a greater role toward these ends.

Photo 11: Fautasi *long boat races remain an important component of American Samoa's maritime heritage traditions. Photo: Doug Fenner.*

3.1.3.4 Human Uses of the Marine Environment

People have been using the marine environment in American Samoa for various purposes since the first Polynesians settled the area roughly 3,000 years ago. The range of human uses of the marine environment in American Samoa includes fishing, transportation, shipping, recreation and tourism, research, and Department of Defense activities. Human behavior and activity on land and at sea can dramatically alter coastal marine ecosystems and associated species diversity. In addition, sanctuary regulations prohibit certain activities and may have impacts on others.

Fisheries[17]

Fishing has been important throughout Samoan history and up through the present day, although targeted fish stocks are generally considered underutilized and fishing effort has been decreasing with the introduction of a market economy (Zeller *et al.* 2006; Sabater and Tofaeono 2007; Sabater 2010). Zeller *et al.* (2006) estimated a steady decline in total non-pelagic species catch from 752 tons in 1950 to 155 tons in 2002, an 80 percent decline over the past 50 years. Contemporary fisheries include artisanal, subsistence, recreational, and commercial fisheries, though none of the domestic fisheries fits strictly in one category (Craig *et al.* 1993). It is common for fishermen to eat a portion of their catch, give another portion to family and friends, and sell the remainder. Small-scale fisheries consist of shore-based and boat-based sectors (Zeller *et al.* 2006), with little monitoring or reporting of shore-based sector (Zeller *et al.* 2007). In addition to harvesting fish and invertebrates for food, two species of marine algae (*limu*) are commonly eaten in American Samoa (Skelton 2003).

Cultural Harvest

The strong relationship between the Samoan people and the marine environment is steeped in traditional folklore, subsistence resource use, and CMT. These relationships can be seen in traditional practices, celebrations, and *fa'alavelave*. *Fa'alavelave* preserves the Samoan Way and gathers communities and extended families for events such as weddings, funerals, and other important events where traditions are observed and ritual exchanging of gifts takes place.

The Palolo Festival takes place in October or November and is centered around the annual rising of the Palolo sea worms. Palolo are about 12 inches long and live on the outer reef buried in columns dug in the coral pavement. They surface to spawn only in October and November based on the lunar cycle. Attracted by the moonlight, the worms rise to the surface, where community members wade in shallow waters or take boats farther out to gather them using handmade nets or cloth. The following day is marked by a traditional feast where the worms are cooked and communities gather.

Between October to April, *i'asina* (juvenile goatfish) appear by the thousands along sandy shorelines. Several communities participate in communal fish drives, particularly in the Manu'a

[17] Fisheries are characterized in detail by WPFMC (2009), Craig *et al.* (1993) and Craig (2009).

Islands, where they wade in shallow waters to catch *i'asina.* Hand-woven funnel trap called *enu* are baited and buried half way in shallow water along sandy shorelines (Levine and Allen 2009).

Giant clams are traditional and culturally important aspect of the *fa'a-Samoa*, and as a result of their accessibility, overfishing remains a concern. These clams are a favorite food of the Samoan people and are increasing in popularity for the ornamental trade. *Fa'alavelave* events often call for contributions of giant clams if available. Harvest of giant clams most commonly takes place in areas with easy accessibility and involves the breaking up the substrate (coral and coralline algae) where the clam is buried or wedged.

Ornamental Fisheries

Many Pacific Island governments are concerned about artisanal fisheries for shells used to make buttons and furniture inlays (Adams and Dalzell 1994; Dalzell *et al.* 1996). These fisheries target mother-of pearl shell from Trochus (*Trochus niloticus*), black-lip pearl oyster (*Pinctada margaritifera*), and green snail (*Turbo marmoratus*; Adams and Dalzell 1994). Collection of shells for ornamentation is not as widespread in American Samoa as it is in the independent nation of Samoa, though some small-scale, locally based collection does occur. There are plans to raise giant clams in local aquaculture facilities for the marine ornamental industry (see *Marine Aquaculture* below).

Live Fish Fisheries

Unlike in other parts of the South Pacific, there is currently no trade in coral and live reef species (*e.g.*, for aquaria; Fenner *et al.* 2008b).

Artisanal, Subsistence and Small-scale Commercial Fisheries

Artisanal fisheries are small-scale fisheries that generally use small boats and traditional fishing techniques, and are critical to food security and livelihoods of developing nations (Center for Marine Biodiversity Conservation, Scripps Institution of Oceanography 2010). Most of the catch is consumed by the family or community, with the excess sold in local markets (Adams and Dalzell 1994). A recent survey indicates that only 10 percent of the people that fish in the nearshore coral reef habitat usually sell their catch (Spurgeon *et al.* 2004). Artisanal fishing is the primary fishery that occurs in the coastal zone of the tropical Pacific, with virtually all catch retained for use (Adams and Dalzell 1994; Dalzell *et al.* 1996). Contemporary artisanal fisheries in American Samoa began in earnest in 1972, largely the result of a DMWR dory boat subsidy project (Craig *et al.* 1993; Itano 1996). Today, American

Photo 12: American Samoa's artisanal and subsistence fisheries target a wide variety of reef species. Photo: Doug Fenner.

Samoa's artisanal fisheries include an offshore fishery for pelagic and bottomfish species and a nearshore fishery for lobsters and reef fish. Species composition or the magnitude of the subsistence, recreational, and commercial catches for crustacean fishery resources are largely unknown at this time (WPFMC 2009a).

The nearshore artisanal fishery occurs from the reeftop, adjacent shallow waters, and the shoreline, and is dominated by spear fishing and gillnetting (Sabater 2010). Fishermen target a wide variety of reef fish, as well as lobsters and other invertebrates. As many as 78 different species have been reported, with bigeye scad (*atule*) accounting for as much as one-third of the overall catch (Adams and Dalzell 1994). Other commonly caught reef species include red squirrelfish (*malau*), sea urchin (*tuitui*), jacks (*lupotā*), octopus (*fe'e*), and spiny lobster. The spiny lobster (*Panulirus penicillatus*) is speared at night by free divers (DMWR prohibited scuba-assisted spearfishing in 2001) near the outer slope while diving for finfish (Couture 2003a). In the past, lobsters were provided at the village and family level, while today they are mainly purchased at markets (WPFMC 2009a). Average annual commercial landings are 1,271 pounds (Couture 2003a).

Subsistence fishing has declined over the last 30 years with the shift toward a cash-based economy, though many American Samoans still consider fishing an important part of their culture and today participate in more of a recreational manner (Fenner *et al.* 2008b). Principal gear types reported for the shoreline subsistence fishery on Tutuila in 1991 were rod and reel (which accounted for 37 percent of the annual catch), handline (25 percent), free diving (14 percent), gill netting (9 percent), gleaning (the collection of fish and invertebrates at low tide, 8 percent), and throw netting (5 percent; Craig *et al.* 1993). Virtually all animals are retained, with 86 percent being fishes (Craig *et al.* 1993). The majority of reef resident species harvested were Carangidae (jacks, 10 percent of catch composition), Acanthuridae (surgeonfishes, 9 percent), Mugilidae (mullets, 6 percent), and octopus (5 percent), but the coastal migratory bigeye scad (atule, 46 percent) dominated the harvest (Craig *et al.* 1993). Craig *et al.* (1993) further note that the average size of fishes taken was "surprisingly small," and some favored species such as giant clams (*Tridacna* spp.) were generally absent in reef catches in 1991 as a result of overharvesting. DMWR began monitoring reef fisheries at 22 villages around Tutuila Island in 1990 (PIFSC 2006b).

Photo 13: Reef catch such as these surgeonfishes that are not consumed by the fishermen or shared within the community are sold at market, or in this case on the roadside. Photo: Doug Fenner.

Historically, the majority of vessels in the offshore pelagic and bottomfish fleet have been small (less than 30 feet) catamarans called *alias* (Itano 1996; WPFMC 2009b). Fishing is typically conducted during single-day trips less than 25 miles offshore (Craig *et al.* 1993), limited by a lack of ice on board (WPFMC 2009b). However, in recent years a growing number of fishermen have acquired larger (greater than 35 feet) vessels with the capability to chill or freeze fish, thus increasing their fishing range (WPFMC 2009b). In 1991, there were 30 boats in the pelagic fishery and 20 boats in the bottomfish fishery (Craig *et al.* 1993), which has been reduced to a total of 18 permitted jig and trolling/bottomfish vessels.[18] The cause of the decline in participation over the past 15 years is a result of (1) some vessels switching to more profitable longlining (PIFSC 2006a, 2006c), (2) the end of government-funded projects to boost bottomfish catch (Craig *et al.* 1993; WPFMC 2009b), and (3) a series of hurricanes that struck the territory between 1987 and 2005, damaging both vessels and habitat (WPFMC 2009a). The pelagic artisanal fisheries catch consists largely of skipjack tuna (55 percent) and yellowfin tuna (28 percent; Craig *et al.* 1993). Bottomfish landings consist mainly of emperors and snappers (WPFMC 2009a). Commercial landings of bottomfish account for almost all of the total bottomfish catch, as landings for recreational or subsistence purposes are very small (WPFMC 2009a). The average annual commercial landings from 1986 to 2008 were 27,593 pounds. In 2008, the value of the commercial bottomfishery was $133,417 (Sabater 2010).

Small-scale commercial fisheries for coral reef fishes and invertebrates use various gear types, including hook and line, spear gun, and gillnets (WPFMC 2009a). The composition of the reef fish catch in American Samoa is dominated by six families: Acanthuridae (surgeonfish, 28 percent), Serranidae (groupers, 13 percent), Holocentridae (soldier and squirrelfish, 12 percent), Lutjanidae (snappers, 7 percent), Mugilidae (mullets, 7 percent), and Scaridae (parrotfish, 6 percent; Dalzell *et al.* 1996). Commercial reef fish catch in American Samoa averaged 14.75 U.S. tons from 1982 to 2005 (WPFMC 2009a), though is estimated to be below 10 U.S. tons since 2001 (Brookins 2007). A decline in reef fish catch has occurred since it peaked in 1997, possibly a result of factors such as increasing enforcement of commercial license requirements in the territory and the 2001 prohibition on the use of scuba gear in fisheries (WPFMC 2009a). The value of the coral reef fishery in 2008 was $54,191 (WPacFin 2010).

A number of authors point to declines in reef catch in American Samoa and postulate several factors that may explain the decline: a decline in available resources, a decline in fishing effort, or competition from non-fishery resources or other fisheries. Zeller *et al.* (2006)[19] estimate a 79 percent decline in coral reef subsistence and artisanal fishery resources (including bottomfish and reef-associated pelagics) from 1952 to 2000. The 79 percent decline is based on a total estimate of coral reef fishery resources (excluding large pelagic species such as tuna and billfishes) extracted from 1952 to 2000, compared with the United Nations Food and Agriculture Organization statistics for American Samoa. Fenner *et al.* (2008) also note that there is concern

[18] Source: http://www.pifsc.noaa.gov/wpacfin/as/Pages/as_vssl_3.php. Last accessed March 23, 2011.

[19] Zeller *et al.* (2006) acknowledge limitations of their study in terms of data available that can be used to base their estimates, but point out that lack of catch statistics is what originally led them to the exercise.

regarding overall fish biomass levels and biomass of large and medium-sized fish in American Samoa since these values are significantly lower than at neighboring island groups. Nevertheless, they indicate that reef fish populations have remained relatively stable over the past 30 years and conclude that declines in catch are attributable to declines in fishing effort rather than to limited or declining reef resources. Declines in fishing effort have been caused by stochastic events and long-term trends, including the hurricanes and preference for longline fishing mentioned above (WPFMC 2009a; Fenner *et al.* 2008b; Craig *et al.* 1993), which generally led to declines in pelagic and bottomfish catch (WPFMC 2009a; Craig *et al.* 1993). Declines in fishing effort have also been caused by the shift from a subsistence-based to a cash-based economy over the last 30 years (Fenner *et al.* 2008b; Sabater 2010). Competition for supply includes imports of fresh fish from Samoa and Tonga (WPFMC 2009a), which are cheaper to buy than local reef fish (Adams and Dalzell 1994). Frozen non-target fish from canneries, longline, and purse seine vessels also increase the availability of inexpensive fish. Conversely, Zeller *et al.* (2006) concluded that the decline in catch, small fish size, and an increase in imports, support the argument of an insufficient local supply caused by overfishing.

While WPFMC (2009) indicates that coral reef fishery resources have not been determined to be overfished or subject to overfishing, several issues make assessing the status of fishery resources difficult. One such issue is a lack of baseline data (Fenner *et al.* 2008b). The variety of natural and anthropogenic factors affecting fish populations further complicates assessments, as well as assessments of the extent any one given factor contributes to population variability (Fenner *et al.* 2008b). Other issues arise with limitations of fisheries-dependent data. Data on the subsistence portion of artisanal fisheries catch are not recorded (Zeller *et al.* 2006). In addition, there are no long-time series of fisheries-dependent data. For example, DMWR began monitoring reef fisheries at 22 villages around Tutuila Island in 1990 (PIFSC 2006b), approximately at the onset of the above-mentioned regulatory and socioeconomic changes that have led to a decline on fishing effort.

Recreational and Sport Fisheries

Another type of fishery in American Samoa is the recreational tournament fishery, described in detail by Craig *et al.* (1993). The tournaments, which have occurred since 1974, target pelagic fishes, consisting primarily of yellowfin tuna, blue marlin, and skipjack tuna. There have been as many as five tournaments per year, attracting up to 70 fishermen on 14 local boats. In 1991, tournament fishing was an important sector in American Samoa, contributing 3 percent of the total domestic landings during 16 days of fishing, with catch nearly equal to the annual artisanal bottomfish harvest and 19 percent of the artisanal pelagic harvest. After 1991, participation dramatically declined, with only 3 participants in 1997 (Tulafono 2001), possibly a result of shift in the commercial fishery from trolling to longlining. Switching gear for a weekend tournament may be too time-consuming, which may be the reason for low participation since the development of the commercial longline fishery. More recently, the annual tournament has been scheduled to follow one week after a tournament in neighboring Samoa, and vessels from New Zealand and Samoa have increased the field to more than 20 participants (Wearing 2011).

In addition to the tournament fishery, sport fishing is an available tourist activity. Sport fishing in the waters around American Samoa is considered by some among the best in the world and would provide a competitive destination for fishing vacations (Resort Consulting Associates 2010). The Pago Pago Yacht Club hosts the annual Sport Fishing Tournament and Festival. While sport fishing is not expected "to become a large percent of the overall tourism mix in American Samoa," it takes advantage of the territory's natural marine resources and is a factor in the selection of tourism destinations (Resort Consulting Associates 2010). Sport fishing as a tourist attraction is an opportunity that requires little more than increased promotion because one company currently offers fishing charters and scuba diving tours. Other locally owned boats could be used if demand increases (Resort Consulting Associates 2010).

Commercial Fisheries

*Photo 14: Yellowfin tuna (*Thunnus albacares*) are among the most commonly harvested pelagic fish in the Western Pacific, where current fishing levels are close to the sustainable limit. Yellowfin is often marketed as ahi. Photo: William L. High, NOAA Fisheries.*

Commercial longline and purse seine fisheries in American Samoa target pelagic species.[20] The commercial longline fishery is divided into small- and large-scale components. The small-scale fishery is conducted on locally built *alias* that are about 30 feet long, engage in single-day trips, and hold up to 10 miles (16 km) of monofilament main line (PIFSC 2006d). The large-scale fishery is based on large monohull vessels (averaging 89 feet long) that engage in 3- to 4-week trips and hold 20 to 30 miles of monofilament mainline (PIFSC 2006d). Vessels larger than 50 feet are required by regulation to fish outside of the "large vessel prohibited areas," which encompass all waters extending from shore to 50 nm around Tutuila, Swains Island, Rose Atoll, and the Manua Islands (WPFMC 2009b).

Small-scale longlining began in American Samoa in 1995 with five *alias* in the fleet (PIFSC 2006d; WPFMC 2009b), providing albacore tuna to the StarKist tuna cannery in Pago Pago (the Chicken of the Sea tuna cannery closed in 2009). Yellowfin and blue marlin represent the next most abundant components of the catch, with these species sold to the cannery, local stores and restaurants, or donated for family functions (PIFSC 2006d; WPFMC 2009b). While 37 vessels smaller than 38 feet long had federal permits as of May 2006, only seven were active in 2005, likely due to high fuel costs and other factors (WPFMC 2009b). The large-scale longline fishery began in 1997 with the introduction of the large monohull longliner (PIFSC 2006d; WPFMC 2009b). Coincident with large vessels joining the fleet, wahoo, mahi-mahi, and bigeye became prominent components of the longline fleet catch (PIFSC 2006d). By 2001, the large vessels accounted for 88 percent of the nearly 4,000 U.S. tons of longline catch (PIFSC 2006d). In 2002,

[20] For a complete description of the commercial pelagic fisheries, see WPFMC 2009.

there were 60 active large longliners in American Samoa, which fell to 29 active vessels out of 38 federally-permitted[21] in 2005 (WPFMC 2009b).
The distant water purse seine fishery is composed of U.S. vessels 200 to 250 feet long that fish beyond American Samoa's EEZ in the central and western Pacific Ocean (WPFMC 2009b). They employ large nets to capture skipjack, yellowfin, albacore (Craig 1993; PIFSC 2006e), and bigeye tuna (WPFMC 2009b) near the ocean surface. This fleet provides the majority of tuna to the cannery, followed by longliners and trollers (Craig 1993; PIFSC 2006e).

NOAA Fisheries administers the List of Fisheries, which classifies U.S. commercial fisheries into one of three categories according to their level of incidental mortality or serious injury of marine mammals:

- *Category I*: Frequent incidental mortality or serious injury of marine mammals;
- *Category II*: Occasional incidental mortality or serious injury of marine mammals; and
- *Category III*: Remote likelihood of/no known incidental mortality or serious injury of marine mammals (NOAA Fisheries 2010a).

The owner of a vessel or non-vessel gear participating in a Category I or II fishery must obtain authorization from NOAA Fisheries to lawfully, incidentally take a marine mammal in a commercial fishery, while those participating in Category III fisheries may incidentally take marine mammals without registering for or receiving an authorization (NOAA Fisheries 2010). For those species under NOAA Fisheries' jurisdiction, permits may be issued for the incidental, but not intentional, taking of marine mammals listed as threatened and endangered under the ESA. American Samoa fisheries List of Fisheries categories are shown in Table 3-2.

Table 3-2: American Samoa Final 2011 List of Fisheries Categorizations.

Fishery Description	Estimated # of Vessels	Marine Mammal Stocks Incidentally Killed/ Injured
Proposed Category II		
Longline/Set Line Fisheries:		
American Samoa longline*	60	• False killer whale, American Samoa stock • Rough-toothed dolphin, American Samoa stock
Proposed Category III		
Troll Fisheries:		
American Samoa tuna troll	< 50	None documented
Handline and Jig Fisheries:		
American Samoa bottomfish	< 50	None documented

* Fishery classified by analogy. Adapted from 75 FR 68468 (NOAA Fisheries 2010)

[21] Source: http://www.pifsc.noaa.gov/wpacfin/as/Pages Last accessed March 23, 2011.

Marine Aquaculture

Aquaculture efforts in American Samoa are aided by the U.S. Department of Agriculture (USDA) Land Grant Program and the NOAA Sea Grant Program. The ASCC is a USDA National Institute of Food and Agriculture Land-Grant college. Through the Land Grant program, ASCC obtains federal funding for research, education, and outreach related to public food and agriculture related needs. The University of Hawai'i Sea Grant College Program maintains a marine extension agent at ASCC and promotes and develops education and outreach activities in marine science and aquaculture in the territory. With help from Land Grant, Sea Grant, and other partners, ASCC has been operating the aquaculture research and demonstration facility *Center for Sustainable Integrated Agriculture and Aquaculture* since August 2009, with additional planned expansion of tanks and other equipment to improve training capabilities (Temple 2010). This facility will address the main obstacles to aquaculture development in American Samoa: (1) affordable feeds (*e.g.*, for freshwater tilapia farming), and (2) implementation of aquaculture management techniques (Temple 2008). ASCC's Extension and Research Plan of Work for the period 2010 to 2014[22] includes a new aquaculture program focusing on production of tilapia and marine species including giant clams, Pacific threadfin, and mangrove crabs. With regards to giant clams (*Tridacna* sp.), current aquaculture efforts focus on completing a hatchery in Tutuila and initiating grow-out facilities in Aunu'u and the Manu'a islands (Fenner *et al.* 2008b). These facilities are targeting three markets: (1) the marine ornamental industry; (2) local markets and restaurants; and (3) stock enhancement efforts (Fenner *et al.* 2008b).

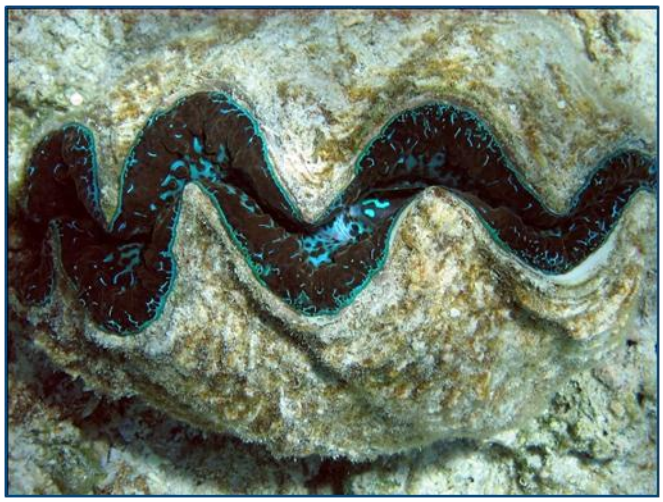

Photo 15: Giant clams, such as this wild specimen at Rose Atoll, are the subject of current and planned aquaculture operations in American Samoa. NOAA CRED Photo.

In addition to the aforementioned species, sponges and corals are also potential candidates for marine aquaculture in American Samoa (Fenner *et al.* 2008b). The USDA Natural Resources Conservation Service, Pacific Islands Area, engages in voluntary partnerships with conservation districts and others to provide technical and cost-share assistance to private landowners toward the goal of protecting, enhancing and preserving soil, water, air, plants, and animals using sound science and expertise (USDA 2010). In 2006, the American Samoa Resource Conservation & Development Executive Board approved a Coral Farming for Village Industry and Coral Reef Rehabilitation project funded by the National Fish and Wildlife Foundation. This project helps

[22] See http://www.reeis.usda.gov/web/areera/plans/2010-2014/2010-American-Samoa-Community-College-Combined-Research-and-Extension-Plan-of-Work.pdf.

local villages in American Samoa grow hard coral fragments for restoration and sale to the aquarium trade (USDA 2008). To date, three coral farms have been developed in the villages of Amouli, Alofau and Nu'uuli Oceanside lagoon, although the latter two were damaged during the 2009 tsunami and are being rebuilt. The Amouli farm is growing more than 45 different species of coral but supplying them only for scientific studies (M. King 2010).

Vessel Traffic and Harbors

Photo 16: The American Samoa Department of Port Administration maintains a small port at Aunu'u Island, from which alia *provide ferry service to and from Tutuila. Photo: Claire Fackler, NOAA National Marine Sanctuaries.*

American Samoa experiences a range of vessel traffic at Pago Pago and a number of smaller harbors. Pago Pago Harbor is the deepest and most sheltered embayment in the South Pacific, and therefore also one of the region's best natural harbors. It offers good facilities to fishing vessels, cruise ships, pleasure craft, and cargo ships that move more than 1,000 containers of cargo through the harbor each month (Stein and Turner 2007). In addition, it has access to excellent roads, reliable power, and water and waste treatment systems (Burk 2005). The port's master plan proposes extending the container dock more than 12 m (40 feet) into the harbor, extending the main dock 400 to 500 feet toward the market place, creating a separate cruise ship terminal, connecting the fuel dock and container dock, and extending the port area to the point of the inland boundary (Burk 2005). The port's proximity to Pago Pago International Airport also means that American Samoa is capable of becoming a shipping and airfreight center for the South Pacific (Stein and Turner 2007).

The smaller harbor facilities include those at Au'asi (on Tutuila), Aunu'u, Faleasao (on Ta'u), and Ofu (Burk 2005). Both Faleasao and Ta'u harbors on Ta'u can be challenging to access during rough seas. Faleasao harbor has been dredged and can accommodate deeper vessels than Ta'u harbor. A daily ferry between Tutuila and Aunu'u is the primary means for Aunu'u residents to travel between these two islands, including daily crossings of primary school students from Aunu'u. Because of the shallow harbor, only *alia* can enter (C. King 2010). Its operation is subject to weather, which on occasion has suspended service for multiple days. Regularly scheduled ferry transportation between the islands could be more reliable, comfortable, and frequent. Currently there is a supply and passenger boat from Pago Pago to Ta'u and Ofu islands, and reportedly the ferry can be quite rough and not comfortable. Private *alia* boats offer transportation between Ta'u and Ofu, with the schedule subject to weather conditions and opportunistic pricing. These boats may not be equipped with proper safety equipment and require constant bailing during rough crossings.

The steel-hulled merchant vessel (M/V) *Sili* (158-foot long) obtained U.S. Coast Guard certification in 2010 to carry passengers and cargo and operates as a weekly ferry to the Manu'a Islands, transporting passenger and cargo, including bulk fuel. At peak times, the M/V *Sili* travels to the Manu'a Islands two to three times a week. (C. King 2010). The new ASG boat, the M/V *Fo'isia*, currently is only certified to carry six passengers and no cargo. Although it could offer a shuttle service between Ofu and Ta'u; as reported in the *Samoa News*, it is intended for distinguished guests and not for regularly scheduled runs. Given the dire need for improved access on Ofu, this type of use for the M/V *Fo'isia* should be considered, at least on a temporary basis. (Resort Consulting Associates 2010). As a contingency plan when the M/V *Sili* is not available, ASG charters a steel-hull, 128-foot, military-style landing craft utility vessel from neighboring Samoa (C. King 2010).

The M/V *Sili* is the only vessel in American Samoa that has the capability to reach remote sanctuary units, including Rose Atoll and Swains Island. The DMWR charters the M/V *Sili* at least once per year to transport local and off-island scientists to Rose Atoll for about 10 days. The ASG charters the M/V *Sili* to Swains Island four times per year to deliver cargo and pick-up and drop-off five to 12 people who live on the island (C. King 2010). The M/V *Sili* does not have the capabilities to carry out scientific, enforcement, or emergency response.

Pago Pago is the only port of call in the territory for cruise lines and the point of entry for all vessels entering American Samoa (Burk 2005). However, the commercial nature of the port and the large cargo and fuel containers diminish the appeal from a tourist standpoint (Resort Consulting Associates 2010). Since Pago Pago is a U.S. port of entry, all vessels calling there are subject to U.S. Coast Guard Rules involving safety, security, life saving, and ensuring that an English-speaking person is on the bridge (Burk 2005). Furthermore, all vessels entering Pago Pago Harbor engaged in inter-island or coastwise shipping or carrying goods or people to or from American Samoa are also subject to period inspection for compliance with safety standards established by Title 20 of the ASCA.

The Port Administration tracks information on various categories of vessels calling on Pago Pago Harbor: merchant, passenger and government, naval and coast guard, fishing, workboat, and pleasure craft. For the first three quarters of fiscal year 2010, 85 container ships, 24 tankers, 7 cruise ships, and 19 international cruising yachts called there. On average, seven to 12 cruise ships visit Pago Pago each year. Burk (2005) noted that yachts commonly visit smaller harbors after they clear Pago Pago. However, according to Port officials, this number is not usually the case, though for the first time in 15 years the Port recently had two vessels request anchoring outside Fagasa. Visiting other coastal areas requires requesting permission from local *matai*, and yachts typically stop in American Samoa to resupply and acquire maintenance rather than to vacation (King 2010b, unless otherwise noted).

Nonconsumptive Recreation and Tourism

The territory had a vibrant tourism sector in the 1960s when it was a stop-over location for trans-Pacific flights. Once those flight patterns changed, tourism levels were not sustained and today there is virtually no tourism infrastructure or organization in place. American Samoa is currently

revitalizing tourism, namely through the Fono's 2009 legislation authorizing the creation of the American Samoa Visitors Bureau, and through development of a new Tourism Master Plan.[23] Goals include increasing air and cruise ship passengers to the territory, increasing available lodging, developing attractions and experiences, and ensuring that necessary infrastructure to support increased tourism is in place (Resort Consulting Associates 2010). The staff of the new American Samoa Visitors Bureau is actively pursuing numerous opportunities to increase interest in tourism to the territory (Vaeafe 2010).

The limited current extent of tourism is underscored by several factors. Between 2005 and 2009, total recreation visits to the NPAS ranged from a high of 6,774 in 2007 to a low of 1,239 in 2006 (NPS 2010a). Roughly half of the tourists visiting the park use its marine areas for swimming, snorkeling, or scuba diving (Craig *et al.* 2005). Since January of 2011, only one flight per week operates between the U.S. (via Honolulu) and Pago Pago for most of the year. Previously there were two weekly flights between the U.S. and Pago Pago. Additionally, there are several daily flights between American and Independent Samoa, and there is limited service to a few other destinations (Fenner *et al.* 2008b). Approximately 6,470 tourists visited American Samoa in 2009 (Resort Consulting Associates 2010).

Examples of nonconsumptive recreation and tourism activities include snorkeling and diving, boating (including motor boating and sailing), personal watercraft use, kayaking, and wildlife viewing. As of 2005, there were only about 30 pleasure craft berthed in Pago Pago Harbor, with none anchored anywhere else in the territory (Craig *et al.* 2005). It is unknown if any were damaged by the 2009 tsunami.

Whale watching is limited in American Samoa but is being considered for expansion. "One of the most frequented spots for humpback whales is at protected Fagatele Bay on the island of Tutuila in American Samoa" (South Pacific Whale Watching Guide 2010). The American Samoan government is currently conducting surveys and may consider a whale watching venture. With the downsizing of the tuna industry, the territory is looking at other economic activities, such as tourism (Radio New Zealand 2010).

According to the Tourism Master Plan, snorkeling, scuba, and marine life excursions at Fagatele Bay could be compelling reasons for potential visitors to choose American Samoa as their vacation destination. However, current land-based access conditions are unreliable and difficult and therefore, limit tourist opportunities. (Resort Consulting Associates 2010). "One of the biggest potential tourist attractions on Tutuila is Fagatele Bay and Larson's [sic] Bay; but there is very little signage for the road turn-off, no signage to identify the parking area, instructions for gaining access through the gate to Fagatele are not provided, and the trail to Larson's Bay is not easily identifiable" (Resort Consulting Associates 2010).

[23] Because of the remote location and access issues of both Rose Atoll and Swain's Island, these locations were not included in the Tourism Master Plan assessment (Resort Consulting Associates 2010).

Recreational diving is limited in American Samoa, as there are only a handful of currently certified divers (Van Tilburg 2007). There are no dive shops on the islands, so divers must have their own equipment, and safety is a concern as there are currently no decompression chambers on the island. However, expansion of scuba diving is a feasible goal. In terms of scuba opportunities, several locations have been identified as prime dive sites, including the reefs of Aunu'u, the deep sea pinnacles off of Aunu'u, and the Giant Coral and Valley of the Giants on Ta'u (Resort Consulting Associates 2010). Visitors may cause direct impacts to coral reefs including fishing, collecting corals and other invertebrates, boat anchor damage, and damage caused by walking on reef flats (NMSP 2007).

Photo 17: The thousands of tourists who arrive with cruise ships present vendors with an opportunity to sell their wares at stands in Pago Pago Harbor, as well as potential opportunities for outreach about the territory's cultural and natural treasures. Photo: Doug Fenner.

Recreational opportunities at Rose Atoll are limited by the remote location and access. Although the nearshore waters of the Rose Atoll ecosystem contain an abundance of diverse marine and terrestrial species that could attract ecotourism opportunities, permission to enter the National Wildlife Refuge must be granted by the USFWS, which currently allows access only for research (ASVB 2011). Public scoping comments indicated that tourism opportunities should include public visitation of Rose Atoll, but the proposed sanctuary unit does not overlay the refuge. As such, public access to the refuge is beyond the scope of this action.

The 7 to 12 cruise ships that typically visit American Samoa annually spend 1 day in the territory, arriving at first light and leaving by sundown (King 2010b). In 2011, Pago Pago Harbor will host twelve cruise ship visits (ASVB 2011). The cruise ships typically carry about 2,000 passengers (Vaeafe 2010).

Research and Education

The sanctuary is an important partner in marine science research and education efforts in the territory. It currently operates one vessel that supports research, monitoring, and education. Research related to anthropogenic stressors of the coral reef ecosystem are ongoing and include coral survival rates under elevated temperatures, nitrification and algal blooms on reef flats, impacts on fish species abundance, distribution and assemblages because of fishing pressure, as well as monitoring the crown-of-thorns starfish and conducting stock assessments for other species (Fenner *et al.* 2008b). Benthic habitat mapping, fish and invertebrate surveys, and oceanographic studies are being conducted by NOAA's CRED, with a comprehensive review of available survey data conducted by NCCOS. Fenner *et al.* (2008) summarize biological and oceanographic monitoring in American Samoa.

Departments of Defense & Homeland Security

American Samoa, though administered by the U.S. Department of the Navy until 1951, no longer maintains an active duty military presence in the territory. The closest U.S. active duty military presence is maintained on Guam. American Samoa, however, is home to the only infantry division of the U.S. Army Reserves, the 100th battalion of the 442nd Infantry Regiment (Anderson 2010). American Samoa has two companies of the battalion, with about 500 total reserve soldiers (Anderson 2010). In addition, the USCG maintains a Marine Safety Detachment office in Pago Pago.

3.1.3.5 Environmental and Anthropogenic Stressors

A variety of natural and anthropogenic stressors can alter the coral reef ecosystems in American Samoa, often with more severe damage when multiple stressors act on the ecosystem at a given time. The Fagatele Bay National Marine Sanctuary Condition Report 2007 (NMSP 2007) identifies a number of territory-wide threats: tropical cyclones and elevated ocean temperature, fishing, crown-of-thorns starfish outbreak, diseases, agriculture and coastal development, and visitation. Introduced species, marine pollution, and vessel groundings are also issues concerning coral reef health. An understanding of past and present stressors and potential future threats provides a backdrop for identifying priority management needs and informing an ecosystem-based management approach.

Climate Change

Recent decades have brought increased awareness of the changing global environment and the implications this change may have on ecological processes. The increase in average global temperatures, sea level rise, and change in chemical compositions of the world's oceans are typically cited as the results of global climate change. More specifically, the U.S. EPA (2007a) provides a concise summary of direct and indirect effects of climate variability and change as including effects on "sea surface temperatures, ocean carbonate concentrations, sea level, storm surges, precipitation patterns, stream flows to the coast, salinity, and pollution loads…." Changes in the global climate are being brought about by three factors: increasing concentrations of carbon dioxide and other gasses in the atmosphere; alterations in the biogeochemistry of the global nitrogen cycle; and ongoing change in land use and land cover. Changes in land use associated with industrialization are causing atmospheric concentrations of carbon dioxide to rise and are considered the most important component of global change (Vitousek 1994, Kleypas *et al.* 2006). Although there is some debate regarding the extent of the impact these changes will have on the Earth's environment, several trends have been well documented.

According to the findings of the Intergovernmental Panel on Climate Change (IPCC), warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level. The international scientific consensus of the IPCC is that most of the recent warming observed has been caused by human activities and that it is "very likely" caused by increased concentrations in anthropogenic greenhouse gases (IPCC 2007).

Coral reef ecosystems are especially susceptible to climate change (U.S. EPA 2007a), as are human populations living in Pacific nations and territories on high islands or low atolls (Nunn 2009). Increased sea surface temperatures can stress corals. Historically, coral reef environments have maintained a high level of temperature stability, with temperatures in tropical oceans fluctuating less than 2°C over the past 18,000 years (Thunell *et al.* 1994; Oliver and Palumbi 2009). Having adapted to these conditions, corals can become stressed with increases in water temperature of 1 to 2 °C above average summer maximum temperatures, resulting in bleaching, which can retard growth and sexual reproduction, and under severe conditions cause large-scale die-off of coral colonies (Hoegh-Guldberg 1999; Brown 1997; Fenner *et al.* 2008b). Mass bleaching events occurred in American Samoa in 1994, 2002 and 2003 (Fenner *et al.* 2008b), years when there were unusually high sea surface temperatures in summer months (U.S. EPA 2007a). Researchers have found that scattered coral colonies, specific coral communities, or whole reef sections may survive after bleaching events. Understanding why certain corals survive and others do not may have important implications for potential impacts of climate change. Barshis *et al.* (2010) review research to date on coral tolerance and resilience to thermal stress. They conclude that among populations of the reef building coral *Porites lobata* on Ofu and Olosega Islands, there are minor genetic differences and physiological responses to thermal fluctuation between cnidarian host animals located in environments with a history of thermal fluctuation (*i.e.*, back reef areas) and host animals located in more thermally stable environments (*i.e.*, forereef areas; Barshis *et al.* 2010).

Photo 18: This coral off of Tutuila is exhibiting coral bleaching, which can result from water temperature increases of only 1 to 2 °C above average summer maximums. NOAA CRED Photo.

Climate change is also predicted to lead to an increase in tropical cyclones, overall increases in precipitation, and geographic and temporal changes in precipitation (*e.g.*, greater extremes in localized, intense downpours; U.S. EPA 2007a). Cyclones cause direct disturbance to reefs and benthic habitat, though healthy reef systems are generally able to recover from these events (U.S. EPA 2007a). Increased precipitation can lead to greater transport of land-based sediments, nutrients, and contaminants and extend low-salinity plumes associated with streams and rivers (U.S. EPA 2007a).

Increases in atmospheric carbon dioxide can lead to ocean acidification, as carbon dioxide dissolves in the ocean and shifts the relative concentrations of carbonate and bicarbonate ions. Reef building organisms use calcium and carbonate ions to build their calcium carbonate skeletal structures. Calcium is abundant in seawater and is not affected by climate change; however, even minimal decreases in seawater pH caused by increasing atmospheric carbon dioxide will

substantially decrease the carbonate concentration and thereby reduce the calcification rates of reef building organisms, including corals and calcareous algae (Buddemeier *et al.* 2004). Decreased calcification leads to slower growth or skeletons that are less dense, causing greater susceptibility to physical breakdown and bioerosion (Buddemeir *et al.* 2004). Calcification rates in American Samoa may have decreased 10 percent since the industrial revolution (1880; Buddemeir *et al.* 2004), and may decrease an additional 10 to 20 percent by the year 2100 (Kleypas *et al.* 1999).

Climate change models for the Pacific indicate gradual warming of air and water temperatures and an eastward shift in precipitation, similar to El Niño conditions (Carter *et al.* 2001). Many island species are strongly influenced by the climate to which they are adapted, making them particularly vulnerable to climate change; or, in the case of highly migratory species such as tuna, changing their location (Carter *et al.* 2001). These conditions in Pacific Islands are often associated with drought and increased risk of tropical storms. Drought can impair the supply of quality fresh water and have socioeconomic implications for the population at large, tourism development, and industry such as the tuna cannery. Increased ocean temperatures and potential changes in ocean circulation patterns will affect coastal ecosystems such as mangrove forests and coral reefs, as well as marine fisheries (Carter *et al.* 2001). Severe storms increase can lead to increased risk of some water-borne diseases (*e.g.*, *leptospirosis*; Carter *et al.* 2001). Mangrove forests have capacity to adapt to sea level rise, but it is limited by human interference with their regeneration (Carter *et al.* 2001). Coral bleaching may be exacerbated by increased ocean temperatures. Sea level rise is of varying concern in Pacific Islands because of island subsidence (which compounds the problem) or geologic uplift (which can to some extent negate the problem). In general, sea level rise poses the greatest threat to low-lying coral atolls (Carter *et al.* 2001).

According to U.S. EPA (2007a), all of the direct and indirect effects of climate variability and change "must be considered for the design of effective strategies for management of coral reefs and their ecosystem services." A recent project in Samoa, the Samoa Infrastructure and Asset Management project, may offer insights and serve as a model for means to effectively address the impacts of climate change in small Pacific island communities, such as American Samoa, through integrated disaster management and land use planning (Daly *et al.* 2010). A number of local initiatives to address climate change in the territory are currently under way as well.

In 2007, Governor Togiola Tulafono issued Executive Order No. 010A, outlining the ASG's steps to reduce greenhouse gas emissions and reduce energy consumption to combat the threats to American Samoa posed by climate change, including (but not limited to):

- A loss of landmass and shoreline from an increase in sea level;
- Coral reef loss caused by increases in water temperature and depth; and
- An increase in mortality and economic losses from an increase in the number and strength of tropical storms and lack of reef protection.

Climate change is one of four local action strategies (LAS) adopted by the American Samoa Coral Reef Advisory Group24. The climate change LAS outlines a series of planned actions, the lead agency responsible for implementing each, the funding source for each, and the timeline when each action is to be taken. The actions are collectively designed to achieve a series of five goals:

1. Solicit and support research and monitoring to implement and support management strategies for reducing climate change and its impacts.
2. Establish adaptive management strategies to maximize resilience of coral reef ecosystems.
3. Foster adaptation and resilience of communities and economic systems to respond to climate change impacts.
4. Reduce American Samoa's carbon footprint to provide a regional and international model of progress toward a low carbon sustainable economy.

Create a populace who is informed about climate change and taking steps to reduce climate change causes and impacts.

Coastal Development

High and increasing population density and associated construction along Tutuila's coast result in a great strain on shoreline resources (Fenner *et al.* 2008b). Merely one-third (19 square miles [5,000 ha]) of Tutuila contains land suitable for development (*i.e.*, with a slope less than 30 percent; AS-EPA 2010a). Development and urban growth is causing loss and degradation of wetland habitat (AS-EPA 2010a). For example, mangrove forests have been filled in for construction of homes and businesses, as well as for agriculture (*e.g.*, a large portion of a small forest at Alofau was cleared for a taro plantation; Bardi and Mann 2004). Development also affects water quality in groundwater, streams, and coastal waters as well as coral reefs through associated factors such as poor land use permitting, overfishing, and increased production of solid waste and sewage, road construction, and sedimentation (AS-EPA 2010a).

Photo 19: Road construction is an example of coastal development that can lead to anthropogenic stress on the territory's coral reef and shoreline resources. Photo: Irene Kelly, NOAA Fisheries.

[24] http://crag.as/?nav=LAS-Climate_Change&cont=Global_Climate_Change

Sand and coral rubble mining in the forereef environment for use as building materials has been ongoing over the past several decades, with an estimated removal of 100 cubic yards per week (Volk *et al.* 1992). This activity is prohibited under territorial regulation, but the expense of substitute material and lack of enforcement factor into its ongoing occurrence. This mining has led to a devaluation of corals in American Samoa as well as potential additional costs to the American Samoa economy of between US$ 0.5 to 2.3 million per year (Spurgeon *et al.* 2004). Sand mining leads directly to a loss of reef flat substrate and a loss of recreational beaches. These factors led to a recommendation that "enforcement of sand and coral rubble mining must become a top priority (Spurgeon *et al.* 2004)."

Another aspect of coastal development is that for agriculture. The most recent census of agriculture in American Samoa was conducted in 2007; however, the 2003 census provides the most recent available data. Per that census, 75 percent of households in American Samoa meet the census definition of farms: "any place that raised or produced any agricultural products for sale or home consumption" (USDA 2005). Approximately 40 percent of total territory land area is used for farms, with just under 23 percent being commercial farms and more than 17 percent in noncommercial farms (USDA 2005). Agriculture in American Samoa is still largely a subsistence sector with mostly traditional staple food crops, chickens, and pigs.

Photo 20: Taro plants (foreground) and papaya trees (background, left) cultivated on the ridgeline above Fagatele Bay. Photo: Sarah Kinsfather.

With an increasing population and a fragile economy, American Samoa is likely to experience an increase in agricultural development. This development may threaten water quality, habitat integrity, and biological health of fringing coral reefs if adjacent soil and sediment runoff is not controlled. Given that two-thirds of American Samoa's land area has slopes greater than 30 percent and a rainfall of up to 5 meters per year, soil erosion is a constant threat (Hirata 1999). Clearing land for agriculture within watersheds often decreases the ability of soils to absorb rainfall. Without proper land management, streams carry eroded soils, fertilizers, and pesticides into nearshore waters. The developed watersheds around Tutuila generally discharge higher sediment loads than undeveloped areas. The steep topography of Fagatele Bay's watershed is particularly vulnerable to erosion when surrounding land is cleared.

Taro, a perennial plant with an edible tuber, is one of the most important traditional, staple crops in American Samoa, and a prime example of how traditional agriculture can help reduce environmental impacts. These traditional practices include leaving trees to reduce erosion,

cutting weeds to use as mulch, and using a planting stick (*'oso*) rather than tilling the soil (Hirata 1999). Unfortunately, these practices are often replaced by the removal of all vegetation and leaving fields to sit fallow after cultivation. Without careful stewardship, forest re-growth in cleared areas may be inhibited by the rapid invasion of vines and other plant species. These introduced plants replace the native trees and ground cover with vegetation that cannot efficiently hold soil in place. For example, choking of the native forest by vines and other invasive species can be seen in parts of Fagatele Bay's watershed. In recent years, landowners have cleared new areas of the slopes above Fagatele Bay for taro cultivation. Clearing creates significant concern for the integrity of the forest ecosystem, its soil, and the bay's water quality.

Introduced Species

Although preliminary indications are that introduced species compose a small percentage of locally found taxa, a description of potential vectors, impacts, and the current state of local knowledge and management of this issue is merited given their potentially devastating effects, as well as obstacles to managing them in the Pacific Islands region.

A native species is essentially a species that lives within its natural and historical range and zone of dispersal, evolving by adapting to its local habitats. Introduced species fall into two categories. A non-native (also known as exotic or introduced) species is defined (15 CFR 922.71) as a species (including any of its biological matter capable of propagation) that is not native to the ecosystem where it occurs (*i.e.*, a species transported beyond its natural range to places it could not reach either by itself or through natural dispersal, such as by wind, tides, or currents). A genetically modified species is any organism into which altered genetic matter, or genetic matter from another species, has been transferred so that the host organism acquires the genetic traits of the transferred genes. Exotic species can be introduced to the marine ecosystem via a variety of mechanisms. These mechanisms include via vessel hulls, rudders, propellers, live-well tanks or sea chests, intake screens, ballast pumps, ballast water, and seawater piping systems. As many as 3,000 alien species are transported by ships around the world (MITSG 2004). Similarly, they may be transported by dredging and drilling equipment, dry docks, buoys, seaplanes, canals, marine debris, and recreational equipment (Carlton 2001). They may also be introduced through:

- Attachment to an intended introduced species, such as giant clams for harvesting;
- Intended introduction for commercial and sport fishery, mariculture, or biocontrol efforts;
- Release of unwanted organisms by aquarists or bait fishermen;
- Intentional or accidental release during transport for research, restoration, education and aquarium activities; and
- Natural spread from original point of introduction.

Exotic species can have a number of impacts on native coastal marine species:

- Replacement of a functionally similar native species through competition;

- Reduction in abundance or elimination of an entire population of a native species, which can affect native species richness;
- Inhibition of normal growth or increased mortality of the host and associated species;
- Increased intra- or interspecies competition with native species;
- Creation or alteration of original substrate and habitat;
- Hybridization with native species;
- Other genetic effects;
- Transfer of new parasites and diseases; and
- Direct or indirect toxicity (*e.g.*, toxic diatoms).

Exotic species have adversely affected more than 45 percent of listed threatened or endangered species in the United States. After habitat modification and loss, invasive species are responsible for more species extinctions than any other cause (U.S. General Accounting Office 2002; Kimball 2001; Wilcove *et al.* 1998), with the rate of extinctions higher on islands than anywhere else in the world (South Pacific Regional Environment Programme, or SPREP, 2000). On coral reefs, introduced predatory species can decimate juvenile populations of native species and out-compete adults for resources and habitat (Albins and Hixon 2008).

In 1986, in an effort to develop and enhance local resources, DMWR imported giant clams of the species *Tridacna derasa* from Palau for a small-scale mariculture test project; 4 months after they were introduced at the Alofau nursery site, the predatory snail *Cymatium muricinum* (which preys on bivalves such as giant clams) appeared (Itano and Buckley 1988b). *T. derasa* along with *T. gigas* from Palau were also brought to American Samoa for their commercial potential in 1991 (Eldredge 1994). Additional unintentional introductions are not surprising given that Pago Pago is a major regional harbor in the central South Pacific where marine species may be introduced and from which they may spread (Coles *et al.* 2003). Once exotic species are established at ports and harbors, intraregional travel can expedite spread of the species.

During a 2002 survey of sites at Pago Pago Harbor, Fagatele Bay, Vatia, and Fagasa, Coles *et al.* (2003) deemed 28 (or 2.2 percent) of the 1,256 taxa they identified as being either introduced or of uncertain origin with indications of being introduced (for simplicity referred to as "introduced"). These taxa included two alga, one sponge, six hydroids, one polychaete, two barnacles, four amphipods, one isopod, two bivalves, six bryozoans, one ophiuroid, and two tunicates. Of the 28 species, 23 were found only in Pago Pago Harbor, and none was common on coral reef sites either inside or out of the harbor. Although approximately 10 percent of established introduced species become invasive (National Invasive Species Council 2001), introduced species around Tutuila do not appear invasive (*i.e.*, spreading or competing with local endemic or indigenous species), and none has been reported as invasive in other areas where they occur (Coles *et al.* 2003).

Given that eradication of an invasive species is likely only if the introduction is caught early on, Coles *et al.* (2003) recommend vigilant monitoring of introduced species and of the prospect of new introductions, as well as inspection of barges and slow-moving vessels that transit from Pago Pago Harbor to other areas in the territory. SPREP (2000) identifies a number of obstacles

to introduced species management in the Pacific island region, including limited and inaccessible scientific information on basic biology for risk assessment and management, lack of awareness of invasive species impacts on biodiversity, insufficient mechanisms for information dissemination to relevant decision-makers, lack of well-developed regional coordination, and a shortage of technically trained personnel and necessary facilities, as well as insufficient funding to support the above. SPREP (2000) provides a regional strategy for addressing introduced species, but it focuses on terrestrial and freshwater species.

Marine Pollution

Marine pollution can be defined as the introduction by humans, whether directly or indirectly, of substances or energy to the marine environment, resulting in deleterious effects such as hazards to the health of marine life and humans, hindrance of marine activities, and impaired water quality. Marine pollution may originate from land-based or sea-based human activities in the form of point source discharges, nonpoint source runoff, or marine debris.

Marine pollution can affect marine resources in a number of ways. Toxic effluents can lead to:

- Metabolic impairment or cellular damage;
- Physiological damage or behavioral changes at the organism level;
- Changes in mortality or biomass at the population level; and
- Changes in species distribution or altered trophic interactions at the community level (Klee 1999).

Re-suspended sediments may affect benthic marine life by interfering with filter feeding and respiratory functions and causing a loss of food sources and habitats. Organic contaminants in the marine environment may lower photosynthesis and oxygen levels. High nutrient concentrations can lead to excess algal growth and oxygen depletion (eutrophication). Some point source discharges have the potential to introduce non-native species into the environment. Effluents may introduce disease-causing microorganisms (pathogens), such as bacteria, protozoans, and viruses, into the marine environment. Marine debris can lead to injury or mortality of marine mammals, sea turtles, and seabirds through ingestion and entanglement.

Photo 21: Runoff after a spring rain shower forms a temporary stream as it moves down the hillside toward Larsen Bay. Photo: Sarah Kinsfather.

Nonpoint Source Pollution

Nonpoint source pollution does not originate from individual, identifiable sources such as industrial facilities, or municipal sewage treatment plants. Instead, it results from many diffuse sources, which generally include land runoff, precipitation, atmospheric deposition, drainage,

seepage or hydrologic modification, and more specifically can include:

- Excess fertilizers, herbicides, and insecticides from agricultural lands and residential areas;
- Oil, grease, and toxic chemicals from urban runoff and energy production;
- Sediment from improperly managed construction sites, crop and forest lands, and eroding stream banks;
- Salt from irrigation practices and acid drainage from abandoned mines;
- Bacteria and nutrients from livestock, pet wastes, and faulty septic systems; and
- Atmospheric deposition and hydromodification (U.S. EPA 2010a).

As runoff moves over the land or through the ground, it picks up and carries away these natural and human-made pollutants and eventually deposits them into lakes, rivers, wetlands, coastal waters, and ground waters (U.S. EPA 2010a). These pollutants result in harmful effects on drinking water supplies, recreation, fisheries, and wildlife, and are reported by states to be the leading remaining cause of water quality problems (U.S. EPA 2010a).

American Samoa has concluded that all of its threatened or impaired designated water uses are caused by nonpoint sources, with pollution from poorly constructed human and pig waste disposal systems and increased turbidity and nutrients from soil erosion posing the greatest threats to nearshore water quality (AS-EPA 2010a). Problems with polluted runoff reaching the coast on Tutuila are compounded by a number of factors: development has increased impervious surfaces along the narrow strip of coastal land; cesspools and improperly constructed septic systems serve most households; and most piggeries are located immediately adjacent to stream banks or coastal shorelines (DiDonato and Paselio 2006). The impacts of runoff on water quality have direct implications for American Samoa's coral reefs, including reduced species richness for both corals and fish (Houk and Musburger 2008).

The majority of American Samoa's mangroves are subject to constant pollution from piggeries, with 37 piggeries (ranging from four abandoned sites to 16 "large" piggeries with more than 10 pigs) bordering the mangrove forests on Tutuila and Aunu'u (Bardi and Mann 2004). These piggeries have caused soil and water pollution, making swimming and fishing near mangroves unsafe (Biosystems Analysis, Inc. 1992). Piggery waste discharged into waters includes pathogens such as *Salmonella* and *Leptospira* (Bardi and Mann 2004). A number of Tutuila village beaches have posted signs warning of *Leptospirosis* in the water. From 2007 to 2010, the AS-EPA reduced the number of pigs kept in illegal piggeries by 20 percent. This reduction, down from 8,373 in 2006 to 6,674 in 2010, has yielded significant reductions in pig waste washed down streams and onto the territory's beaches (AS-EPA 2010a).

Point Source Pollution

Under the Clean Water Act, 33 U.S.C. 1362(14), "point source" means:

> "any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural stormwater discharges and return flows from irrigated agriculture."

The U.S. EPA regulates point source discharges of pollutants through National Pollutant Discharge Elimination System (NPDES) permits. AS-EPA (2010) identified seven point sources in the territory with individual NPDES permits, of which only the following four have active operations: the StarKist tuna cannery, Utulei Wastewater Treatment Facility, Tafuna Wastewater Treatment Facility, and BP South West Pacific Ltd. (now Pacific Energy South West Pacific Ltd.; AS-EPA 2010a). The AS-EPA (2010a) found that these facilities meet the NPDES permit requirements and have negligible impacts on water quality.

The U.S. EPA has also issued general NPDES permits for stormwater discharges in the territory, including a construction general permit and a multi-sector general permit (U.S. EPA 2009a). Permittees are required to generate storm water pollution prevention plans and implement best management practices that minimize pollutants in storm water discharges (U.S. EPA 2003). In addition, U.S. EPA has issued an NPDES vessel general permit for discharges incidental to the normal operations of vessels. The permit covers a variety of discharges and establishes effluent limits for pollutants that may be grouped in the following categories: aquatic nuisance species (introduced species), nutrients, pathogens (including *E. coli* and fecal coliform), oil and grease, metals, most conventional pollutants (*e.g.*, biochemical oxygen demand, pH, and total suspended solids), and other toxic and non-conventional pollutants with toxic effects (U.S. EPA 2008).

Graywater is considered a "discharge incidental to the normal operation of a vessel," and consists of galley, bath, and shower water (CWA sec. 312). Graywater can contain a variety of substances including (but not limited to) detergents, oil and grease, pesticides, and food wastes (Eley 2000). Very little research has been done on the impacts of graywater on the marine environment, but many of the chemicals commonly found in graywater are known to be toxic (Casanova *et al.* 2001). These chemicals have been implicated in the occurrence of cancerous growths in bottom-dwelling fish (Mix 1986). High levels of fecal coliform and total suspended solids have been observed in some graywater sources, which led the Alaska Department of Environmental Conservation (2001) to conclude that "graywater is similar to blackwater [sewage] in number of fecal coliform bacteria and total suspended solids, and that graywater should be treated prior to discharge." Graywater is by far the largest source of liquid waste on a cruise ship (Sweeting and Wayne 2003).

Sewage from vessels is not covered under the NPDES vessel general permit, but instead is regulated under CWA sec. 312. Sewage from vessels is generally more concentrated than sewage from land-based sources, as it is diluted with less water when flushed (3 quarts versus 3 to 5 gallons).Vessel sewage discharges may introduce disease-causing microorganisms (pathogens), such as bacteria, protozoans, and viruses, into the marine environment (U.S. EPA 2007b). Untreated or under treated sewage from vessels can cause bacterial and viral contamination in commercial and recreational shellfish beds, posing risks to public health (Herz and Davis 2002).

High concentrations of nutrients in sewage, namely nitrogen and phosphorous, can lead to eutrophication, causing excessive growth and decomposition of oxygen-depleting plant life, and resulting in injury or death to other organisms. In addition, marine sanitation device (MSD) treatment and deodorant chemicals such as chlorine, ammonia, and formaldehyde can present a threat to marine organisms (California Department of Boating and Waterways 2007). The environmental effects of dumping raw or under-treated sewage in smaller, closed ecosystems such as lakes are better understood than the effects on large-scale ocean processes, which remain poorly characterized (Davenport and Davenport 2006).

Marine Debris

Photo 22: Marine debris such as plastic slippers, bags, water bottles, and fishing buoys mix with coral rubble and driftwood along the Larsen Bay shore. Photo: Sarah Kinsfather.

Marine debris, such as derelict fishing gear and discarded plastics, is a global problem. The increase in reliance on plastic materials that float and are persistent in the environment, as well as improper disposal, has led to an abundance of these materials in the oceans. Marine debris degrades the aesthetic value of the coastal environment, creates navigational hazards, and has negative ecological impacts. For example, marine debris can injure or kill marine mammals, seabirds, and sea turtles through ingestion and entanglement.

Most marine debris in American Samoa originates from land-based activities, though a limited amount washes in from offshore (Fenner *et al.* 2008b). Improperly disposed of trash pollutes open coastal waters and embayments (AS-EPA 2010a). In a survey focused on trash sites bordering mangroves, Bardi and Mann (2004) found that 94 percent of the trash consisted of household (40 percent) and scrap metal (54 percent) waste, both of which could be addressed through existing laws prohibiting trash dumping and through existing trash disposal programs. Constant trash dumping on mangroves prevents seedling recruitment and colonization, and the presence of large-size trash can alter hydrology and consequently affect a much larger area than it occupies (Bardi and Mann 2004).

Vessel Grounding and Shipwrecks

The nature and degree of the impacts and subsequent recovery of vessels grounded on coral reefs are not well understood (Schroeder *et al.* 2008). They can break and crush reef structure, reduce habitat complexity, kill corals and other benthic organisms, provide bare surfaces for colonization (Precht *et al.* 2001), and can lead to discharge of oil, debris, and other point source pollutants (U.S. Department of Commerce 2008). Benthic and associated fish assemblages may take years to decades to recover (Schroeder *et al.* 2008). Groundings at archaeological sites can destroy or bury historical and cultural artifacts under tons of steel and debris. Vessel fuel can

smother and damage resources, as well as impair radiocarbon dating research efforts due to petroleum contamination (U.S. Department of Commerce 2008). Legal and policy gaps render addressing these impacts difficult for resource managers (NOAA and Pacific Basin Development Council 2002).

Several longliner wrecks are located along Tutuila's south shore, and eight fishing vessels were blown onto the reef in Pago Pago Harbor during a 1991 hurricane (Van Tilburg 2007). In 1993, the Taiwanese longliner *Jin Shiang Fa* ran aground at Rose Atoll, spilling 100,000 gallons of diesel fuel and other contaminants onto the reef (Green *et al.* 1997), causing major injuries:

- Large grooves gouged in the atoll and broken reef rubble;
- Mortality of reef-boring sea urchins, giant clams, and corals;
- Mortality of crustose coralline algae, with subsequent blooms of opportunistic algal species over a large portion of the reef; and
- Changes in the distribution of herbivorous fishes and sea urchins, which were attracted to the wreckage and subsequent algal bloom (Green *et al.* 1997).

Surveys of Rose Atoll from 2002 to 2006 indicate increased numbers of herbivorous fish at the wreck site versus other reef-slope survey sites, associated with significantly greater algal cover (Schroeder *et al.* 2008). Brainard *et al.* (2008) indicate that iron enrichment from the *Jin Shiang Fa* shipwreck may be related to the prevalence of coral disease at the site.

In 2000, the U.S. Coral Reef Task Force (CRTF) issued Resolution 5-1, recommending several actions: requiring bonds from fishing vessels that transact business at U.S. ports adjacent to coral reefs, developing legislation and a funding mechanism for vessel removal, establishing national legislation for coral reef damage assessment to serve as a guideline for fines and restoration costs, and developing federal assistance protocols for vessel damage assessment and removal (U.S. CRTF 2000b). NOAA initiated several actions in response to this resolution, including collaborating with the U.S. Department of Justice, the USCG and Pacific Island jurisdiction through a Grounded and Abandoned Vessel Working Group to review legal and financial mechanisms for vessel removal from coral reef ecosystems, conducting two workshops on vessel grounding issues in U.S. Flag Pacific Islands, developing a database of grounded and abandoned vessels in coral reef ecosystems, and consulting and coordinating with Pacific island jurisdictions to prioritize their possible removal (NOAA and Pacific Basin Development Council 2002).

Similar to impacts from grounding events, hazardous cargos, fuel, and possible unexploded ordnance inside metal hulls of slowly deteriorating shipwrecks may threaten marine resources (U.S. Department of Commerce 2008). Van Tilburg (2007) lists 39 reported shipwrecks (including groundings) in American Samoa, some of which have been removed. The ex-USS *Chehalis*, lost in Pago Pago Harbor in 1949, is an example of the environmental threats posed by shipwrecks. Up to 100,000 gallons of fuel leaked into the surrounding waters in recent years (AS-EPA 2007a). On April 6, 2010, USCG and the Naval Sea Systems Command's Supervisor of Salvage and Diving concluded collaborative efforts to remove more than 60,000 gallons of

petroleum products from the *Chehalis* (U.S. Navy 2010). Munitions remaining on the wreck were deemed not to be a threat and have not been removed (AS-EPA 2010b).

Crown-of-Thorns Starfish Outbreaks

The crown-of-thorns starfish (*Acanthaster planci*, known as *alamea* in Samoan) is a large (up to 15.7 inch [40 cm] diameter), 14 to 18 armed starfish, covered on the aboral surface with long, venomous spines. Crown-of-thorns starfish prey on coral and are usually a rare member of the reef community. Crown-of-thorns starfish outbreaks recur at irregular intervals and happen suddenly within a few months (Birkeland 1982). These outbreaks can kill large tracts of coral. A major outbreak in American Samoa between 1977 and 1979 devastated coral on Tutuila's reefs, including more than 90 percent of living coral in Fagatele Bay, and was one of the factors that led to the establishment of the sanctuary (FBNMS 2009a).

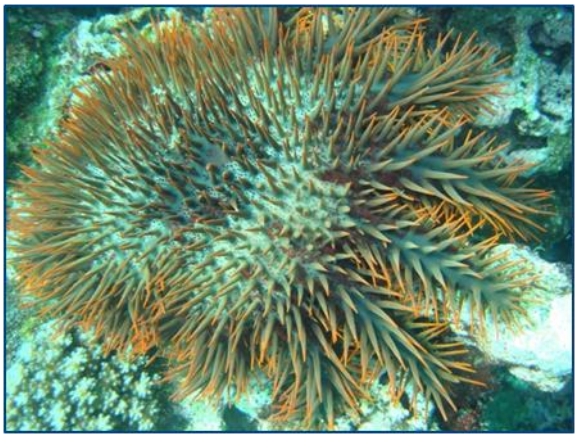

Photo 23: The crown-of-thorns starfish is a native coral predator in American Samoa that periodically exhibits population outbreaks, leading to massive coral mortality and cascading effects on reef ecosystems. Photo: NOAA CRED.

The sudden build up of Crown-of-thorns starfish is demonstrated by the following:

1. Crown-of-thorns starfish were rarely observed in the decades prior to 1977 despite extensive diving, fishing, and snorkeling around Tutuila.
2. In 1977, an aggregation of 83,000 was observed on Taema Banks.
3. By 1978, 486,933 were removed and buried on land, though they still remained abundant around Tutuila by 1979 (Birkeland and Randall 1979).

The cycle of the 1977-1979 crown-of-thorns starfish outbreak in American Samoa was observed to generally include, in summary:

- Sea star digestion of soft coral tissues leading to widespread coral mortality;
- Rapid algal colonization of remaining coral by endolithic, filamentous, calcareous and fleshy macro- algae;
- Subsequent extensive colonization by crustose coralline algae (within a few years of coral mortality); and
- Early stages of regeneration of remaining live coral patches and recruitment of new corals (within 7 to 10 years; Randall and Birkeland 2003).

In addition to direct tissue loss, coral impacts include a shift toward coral species not preferred by crown-of-thorns starfish as well as decreased coral reproduction (reviewed in Rotjan and Lewis 2008). As coralline algae colonize dead portions of a reef, they contribute to its recovery by cementing surfaces together and promoting settlement and growth by new coral colonies.

Given that coral is the foundation for coral reef ecosystems, it is not surprising that crown-of-thorns starfish outbreaks have been observed to subsequently affect more than the coral itself. Aside from the recruitment of algae described above, secondary effects on the reef include a decline in fish abundance (Wilson *et al.* 2006; Green 2003) and changes in abundance of reef invertebrates (Smith 2003).

The cause of a crown-of-thorns starfish outbreak is likely complex and location-specific (Zann 1992) and can be influenced by hydrography, hurricane disturbance, nutrient inputs, predator removal and ENSO cycles (Birkeland and Lucas 1990; Bradbury and Antonelli 1990; Ormond *et al.* 1990; Dulvy *et al.* 2004a, b; Zann 1992).Outbreaks may involve various interacting natural and anthropogenic factors leading to increased recruitment of crown-of-thorns starfish larvae (Engelhardt and Lassig 1997). On the Great Barrier Reef, fished reefs have a seven times greater frequency of crown-of-thorns starfish outbreaks than no-take protected reefs, possibly a result of trophic cascades favoring invertebrates that prey on juvenile starfish (rather than direct predation on starfish by exploited fish) (Sweatman 2008).

Diseases in Coral and Coralline Algae

> *"Disease is one of the most significant and growing biological threats to tropical coral reefs around the globe."*
>
> – U.S. Coral Reef Task Force, Coral Disease and Health Consortium Working Group (2009)

Bacteria, viruses, protozoa or fungi can cause infectious disease in coral, which is observed in the field as lesions or distinct bands of tissue loss (Harvell *et al.* 2007). Diseases can compromise coral structurally, reproductively, and energetically. Studying diseases in corals is especially challenging given the inherent complexity of corals and roles of coral tissue, zooxanthellae symbionts, and microbial communities living in coral surface mucopolysaccharide layers (Harvell *et al.* 2007). Two studies have been conducted specifically on the distribution and level of coral and crustose coralline algae diseases in American Samoa, results of which are reviewed in Fenner *et al.* (2008b) and are summarized briefly below.

Based on a study of Ofu Lagoon and seven sites around Tutuila, Aeby *et al.* (2005, 2006) documented a total of fifteen coral and two coralline algae diseases. Major findings include:

- Disease is widespread but overall prevalence is 0.143 percent, which is low compared with other Indo-Pacific areas;
- No patterns suggest a direct relationship between disease levels and anthropogenic watershed stress;
- Variation in the types and frequency of disease occurrence between austral winter 2004 and austral summer 2005, but no significant difference in overall disease level between these seasons;
- Variation in diseases, but no significant difference in the overall disease level between sites at Tutuila and Ofu Lagoon;
- Variation in prevalence of disease among coral genera, with highest disease prevalence among *Acropora*; and

- *Acropora* white syndrome, *Acropora* growth anomaly, and coralline lethal orange disease were the most common diseases on Tutuila reef sites.

Work *et al.* (2008a) further examined *Acropora* growth anomaly based on surveys conducted in 2004 at sites around French Frigate Shoals (Hawai‘i), Johnston Atoll, and Tutuila. They found the disease in all three regions, though Tutuila had the widest distribution, greatest variety, and number of morphological types (seven). Though the etiology of *Acropora* growth anomaly is unknown, the authors reviewed proposed causes such as ultraviolet radiation-caused cell damage and environmental stressors such as sedimentation, turbidity, and temperature extremes. Work *et al.* (2008a) proposed that the higher prevalence and variety of the disease at Tutuila relative to the other study regions may be a result of its status as a high island with high human populations, extensive watersheds (yielding runoff and siltation), and that it has a greater number of *Acropora* species (25 versus 10 or fewer at the other sites), potentially fostering a greater diversity of growth anomalies.
Brainard *et al.* (2008) report on the results of 2006 ASRAMP rapid ecological assessments of

coral and coralline algae disease at 62 survey sites around Tutuila, Ofu, Olosega, Ta’u, Swains, and Rose. They observed four coral disease states (prevalence shown as a percentage of all disease cases observed): “other lesions” (75.3 percent), growth anomalies (13.3 percent) bleaching (9.4 percent), and band disease (.003 percent). They found that 63 percent of the 62 sites surveyed exhibited some disease, and the mean disease prevalence for all sites combined was 0.34 percent. Based on the survey results, Brainard *et al.* (2008) concluded that the rank order of coral general propensity to disease (and predation) appears to be *Montipora*, *Pocillopora*, and *Porites*, followed by *Acropora*, *Astreopora*, and *Montastrea*. They also concluded that these trends suggest populations of infrequent or rare coral taxa may be subject to more severe ecological impacts of disease and predation than other taxa. Regarding coralline algae disease, Brainard *et al.* (2008) found that 92 percent of disease cases were coralline lethal orange disease, and 94 percent of cases of this disease occurred around Tutuila at both pristine and affected locations.

More research is needed across all aspects of coral disease, including work to identify the causes of outbreaks and to identify, characterize, assess, and monitor the various diseases. Theories as to causes of disease outbreaks implicate climate warming, pollution and anthropogenic stressors, plus synergistic effects of multiple stressors, on reduced coral resistance to disease as well as increased pathogen virulence (reviewed in Harvell *et al.* 2007). The U.S. CRTF's Coral Disease and Health Consortium Working Group developed Coral *Disease and Health: a National Research Plan*, and is the lead group in the U.S. serving to organize and coordinate scientific resources to address coral health and disease issues and connect them to coral reef management[25].

3.1.4 Socioeconomic, Demographic, and Environmental Justice Resources

Fagatele Bay and Larsen Bay on Tutuila Island, Aunu'u, Ta'u, Rose Atoll, and Swains Island were identified as the region of influence (ROI) for socioeconomic analysis, since the majority of direct and indirect social and economic effects from the proposed project would occur in these areas. Data for American Samoa are presented for comparison and to analyze the possible broader effects of the proposed actions.

This section also discusses local uses of the sanctuary that may be affected. These uses include cultural harvest, ornamental fisheries, live fish fisheries, artisanal subsistence and small-scale commercial fisheries, recreational and sport fisheries, commercial fisheries, marine aquaculture, vessel traffic and harbors, non-consumptive recreation and tourism, and research and education. This section discusses the significance and potential market effects of impacts on direct uses of the sanctuary.

Definition

The socioeconomic and demographic indicators used for this study include population size and change, along with employment, labor force, unemployment trends, and industrial earnings, to describe the economic health of the region. Income information is provided as annual median household income. The protection of children and environmental justice populations also are identified.

Population

The vast majority of the 57,291 residents live on the narrow coastal plain of southern Tutuila. The population is growing at a rapidly (at a rate of about 2.1 percent per year between 1990 and 2000) (U.S. Census Bureau 2003) and is expected to continue rising because of the high birth and immigration rates. Over recent decades, population expansion and a steady shift from a subsistence economy to a cash economy have led to major changes in land use, increased urbanization, and significant losses of coastal resource services and values. Table 3-3 presents population figures for the ROI, based on the 2000 Census of Population and Housing of the U.S. Department of Commerce. Futiga, the village associated with Fagatele Bay and Larsen Bay, and Vaitogi, the other village associated with Larsen Bay, had the highest population in the ROI with

[25] For more information, see http://coralreef.gov/cdhc/.

731 and 1,347 people. The third largest population was in Aunu'u, which is the only village on Aunu'u Island, with 476 people.

In American Samoa, the population density is about 829 people per square mile (320 per square km). The annual population growth rate is nearly 3 percent, and the population is projected to double in 24 years (SPC 2000). The immigration rate into American Samoa was estimated to be around 3.75 immigrants per thousand of the population in the year 2000 (CIA World Factbook 2000).

Table 3-3: 2000 Population Estimates.

2000 Population Estimates							
	Futiga	Vaitogi	Aunu'u	Si'ufaga	Leusoali'i	Swains Island	American Samoa
Total Population	731	1,347	476	92	181	37	57,291
Total Households	104	228	79	22	32	7	9,349
Average Household Size	7.03	5.91	6.03	4.18	5.66	5.29	6.05
High School Graduate or Higher	69.4%	56.6%	54.8%	70.5%	56.8%	68.8%	66.1%

Source: U.S. Census Bureau 2003

Employment

In 2000 the total labor force in American Samoa was approximately 16,718 people, of which 8,693 (about 52 percent) were employed. Of the six villages in the planning area, Futiga and Vaitogi had the largest labor forces, with 235 in Futiga and 346 people in Vaitogi. The unemployment rate in Futiga (3.6 percent) was greater than the average for American Samoa of 2.7 percent. However, the unemployment rate in Vaitogi (2.3 percent) was slightly lower than the national average.

Leusoali'i and Swains Island have the highest population percentages whose economic circumstances rely on subsistence activities. About 49.0 percent of the total labor force in Leusoali'i and 45.5 percent on Swains Island are employed by subsistence activity alone. These figures are much higher than the average for American Samoa, of 6.7 percent of the total labor force.

Table 3-4 provides a breakdown of occupation by industry in all six villages in the ROI for the year 2000. The major industrial sectors within the villages in the ROI are construction and educational, health, and social services. The next category with the largest number of jobs is public administration.

Table 3-4: Employment Status and Occupation by Industry.

Employment Status and Occupation by Industry							
	Futiga	Vaitogi	Aunu'u	Si'ufaga	Leusoali'i	Swains Island	American Samoa
Total Labor Force	235	346	97	24	48	6	16,718
Percent in labor force	56.8%	43.8%	35.6%	51.9%	47.1%	27.3%	46.7%
Percent unemployed	6.4%	5.2%	1.0%	14.3%	-	-	29.8%
Percent not in labor force	7.03%	5.91%	6.03%	4.18%	5.66%	33%	6.7%
Median Household Income	$22,250	$16,136	$14,531	$12,500	$15,625	$18,125	$18,219
Agriculture, forestry, fishing and hunting, mining	0.9%	0.6%	3.1%	-	4.2%	16.7%	3.1%
Construction	3.0%	6.1%	17.5%	37.5%	31.3%	-	6.4%
Manufacturing	38.7%	30.9%	16.5%	4.2%	-	-	35.3%
Wholesale trade	3.0%	1.4%	-	-	-	16.7%	2.2%
Retail trade	6.0%	9.5%	2.1%	-	-	16.7%	8.5%
Transportation and warehousing, and utilities	7.7%	9.2%	3.1%	4.2%	4.2%	16.7%	6.2%
Information	5.1%	1.7%	2.1%	-	-	-	1.9%
Finance, insurance, real estate and rental and leasing	0.9%	1.2%	1.0%	8.3%	-	-	1.9%
Professional, scientific, management, administrative and waste management services	1.7%	2.0%	-	-	-	-	1.4%
Educational, health, and social services	19.6%	19.1%	39.2%	29.2%	43.8%	16.7%	17.1%
Arts, entertainment, recreation, accommodation and food services	1.7%	4.3%	-	-	-	-	3.7%
Other services (except public administration)	2.1%	3.2%	1.0%	-	2.1%	-	3.0%
Public administration	9.8%	10.7%	14.4%	16.7	14.6%	16.7%	9.3%

Source: U.S. Census Bureau 2003

Income

American Samoa has a small developing economy, dependent mainly on two primary income sources: the ASG, which receives income and capital subsidies from the federal government, and the two fish canneries on Tutuila (BOH 1997). However, the Chicken of the Sea tuna cannery closed in 2009. The StarKist tuna cannery, located in Pago Pago, is still in operation. The fish canneries obtain fish from foreign vessels and the U.S. purse seine fleet, and 90 percent of the employment at these facilities was composed of foreign workers. The services sector is the third-largest income source within American Samoa. The latest year for which the ASG compiled detailed labor force and employment data was 1993, when it employed 4,355 people (32.2 percent of total employment). In that same year, the two fish canneries employed 3,977 people (29.4 percent), and the rest of the services economy employed 5,211 people (38.4 percent).

Statistics on household income indicate that 61 percent of American Samoans live at or below poverty level, according to U.S. income standards. American Samoa has the lowest gross domestic product and highest level of donor aid per capita among U.S. Pacific Islands (Adams *et al.* 1999). However, by regional measures, American Samoa is not a poor economy. Its estimated per capita income of $9,332 (for males) is almost twice the average for all Pacific island economies, although it is less than half of the per capita income in Guam, where proximity to Asia has led to development of a large tourism sector.

Economic Value of Coral Reefs in American Samoa

The coral reefs of American Samoa provide benefits to both the territory and the mainland. A breakdown of the estimated annual values by type and stakeholder group is given in Table 3-5. With the exception of current fishery product values, the benefit estimates are approximate and should be considered in terms of their relative order of value only. Total benefits of coral reefs to American Samoa residents and visitors are estimated to be worth around $3.6 million per year. When potential non-use benefits accruing to U.S. citizens are included, overall benefits of coral reefs could be at least $10 million per year. Overall nonuse values are around $8.8 million per year (87 percent of the total economic value). Around 8 percent of coral reef values relate to direct uses and 5 percent to indirect uses. With U.S. public non-use values included, around 50 percent of coral reef values accrue to residents of American Samoa, equivalent to $ 4.9 million per year. Around 75 to 80 percent of the resident values are non-use values, which partly capture traditional and social values (Spurgeon et al. 2004).

The use-value for coral reefs to American Samoa presented in Table 3-5 is relatively low, compared with American Samoa's annual Gross Domestic Product, because tourism and recreational access to corals are limited. Extensive man-made shoreline defenses, which have been constructed for beach sand and rubble mining, and the relatively poor and small population, have contributed to this low recreation and tourism value (Spurgeon *et al.* 2004). Excluding the U.S. public non-use values, the combined annual coral value is only around 1 percent of American Samoa's annual Gross Domestic Product.

Within American Samoa, residents' subsistence fishery catches were worth $0.6 million per year; and subsistence consumer surplus, which represents the benefit to residents, was estimated at $73,000 per year. The subsistence fishery catch has steadily decreased over the last 2 decades. This reduction is primarily associated with a steady shift toward a cash economy on the islands. Whereas once people tended to rely heavily on the fishery for food, lifestyles and diet are changing and they now increasingly buy alternative products from the local store. Few families continue to fish for a living, and fishing is becoming more of a leisure activity. Younger generations tend to work in salaried employment and go fishing on weekends and public holidays. This recreational value represents an important benefit and is captured as consumer surplus in Table 3-5. At 2004 market prices, the total direct value of the subsistence fishery was estimated to be $544,000 per year. Including additional indirect and induced expenditures generated within the economy as a result of subsistence fishing (the multiplier effect, assumed to be 1.25), this level equates to $572,000 per year. The total value of the subsistence fishery for the six villages within the ROI accounts for 53 percent of the total value of subsistence fisheries within American Samoa (Spurgeon et al. 2004), or $303,000.

Coral reef fish harvest for sale (the artisanal fishery) provides both direct benefits and indirect benefits. Direct benefits refer to nearshore catches of coral reef species that are traded in local markets. Indirect fishery benefits refer to catches of offshore bottomfish species, the majority of which are in some way "reef-associated" and thus an indirect reef benefit. The direct value of the artisanal fishery for American Samoa was estimated at $44,111 in 2004. The ROI accounts for approximately 53 percent of this production, or $23,378. The total value of subsistence and artisanal fisheries in the ROI totals $325,378. An analysis using data provided by the PIFSC's Estimated Total and Commercial Landings tables (1982-2010) determined the total value of American Samoa's nearshore fisheries at $250,000 in 2009, with a total economic value of $312,000, employing the multiplier.

Table 3-5: Coral Reef Annual Values ($ per year).

CORAL REEF ANNUAL VALUES ($ PER YEAR)						
	Tutuila South Shore[2]	Aunu'u	Ta'u	Rose Atoll	Swains Island	American Samoa
USE VALUES						
Subsistence fishery (personal consumption)						
Direct harvest of fishery[1]	202,970	5,412	92,837	-	6,595	571,607
Fishing consumer surplus (or personal satisfaction)[3]	25,850	689	11,824	-	840	72,800
Artisanal fishery (harvest for sale)						
Direct harvest of fishery[1]	15,846	422	7,248	-	-	44,111
Indirect fishery (or harvest of bottomfish from offshore) [1]	13,564	4,993	3,500	-	-	70,000
Snorkeling/diving consumer surplus	32,985	-	-	-	-	50,100
Snorkeling/diving expenditure added value[1]	5,770	-	-	-	-	23,281
Shoreline protection value	307,997	-	19,326	-	-	447,001
Total value use	**604,983**	**11,517**	**134,734**	**-**	**7,435**	**1,278,900**
NON-USE VALUES						
Resident non-use value	477,924	183,308	176,326	1,454,805	45,792	3,609,120
Visitor non-use value	28,653	10,990	10,571	87,220	2,745	216,378
U.S. general public non-use value	657,339	252,123	242,520	2,000,945	62,983	4,964,000
Total non-use value	**1,163,917**	**446,421**	**429,417**	**3,542,971**	**111,520**	**8,789,498**
TOTAL VALUE	**1,768,900**	**457,938**	**564,152**	**3,542,971**	**118,955**	**10,068,399**

1-With multiplier effect. A general expenditure multiplier effect of 1.25 has been assumed. This compares to one of 1.12 for Florida and 1.25 for the Hawaiian economy.
2-Includes Fagatele Bay and Larsen Bay
3- Consumer surplus is the benefit an individual receives from utilizing a resource over and above what they have to pay for it.

In 2005, a study titled "Public Knowledge and Perceptions of Coral Reefs: A Study of Tutuila American Samoa" was completed for the American Samoa Coral Reef Advisory Group. This study included interviews with 121 residents of 10 villages of American Samoa. According to the study, the most important stated value of coral reefs was of fish as a source of food, second was shelter, habitat, and food for fish, and third was shellfish, seaweed, and palolo for food. The top perceived threats to coral reefs was illegal or destructive fishing methods (45 percent) and local pollution (43 percent), with other stated threats of people stepping on coral, outsider fishing, and too much fishing. Ninety one percent (110 of 121 people) of surveyed residents

stated that coral reefs should be protected, with 70 percent stating that it is the responsibility of everyone in the village or on the island for this protection.

Recreation and Tourism

American Samoa has seen a precipitous drop in tourist arrivals since the 1970s, when 35,000 people visited the territory by plane and cruise ship. This drop is the result of several factors, such as the loss of international airline service, the decline of the main hotel (the Rainmaker), inadequate infrastructure, and intense competition from elsewhere in the Pacific. While the territory has many of the support services in place, such as car rental and restaurants, the infrastructure is woefully inadequate to support large-scale tourism. The number of guest rooms in 2000 was approximately 312 (ASPA 2003).

According to the latest Census (U.S. Census Bureau 2003), in 2000 there were 6,333 tourists, 10,099 business visitors, and 27,726 people visiting relatives. The main tourists are Americans (58 percent), Australians and New Zealanders (35 percent), and Europeans (4 percent). Tourists contributed to about 7 percent of economic activity in American Samoa. There are an increasing number of cruise ships visiting American Samoa. In 1999, there were 10,000 passengers and the same number of crew. They tend to come onto the island just for the day and are not included in the tourist number, but as transits.

It is unlikely that many visitors come specifically for the coral reefs (for snorkeling and diving), although the reefs may play a small role in tourism recruitment. However, there are many residents (permanent and expatriates) who gain important recreational benefits from coral reefs, particularly snorkeling and to a lesser extent diving.

Protection of Children from Environmental Health or Safety Risks

In April 1997, President Clinton signed Executive Order (EO) 13045, *Protection of Children from Environmental Health Risks and Safety Risks*. This EO requires federal agencies to identify, assess, and address disproportionate environmental health and safety risks to children from federal actions.

Environmental Justice

On February 11, 1994, President Clinton signed EO 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations. The purpose of this order is to require federal agencies to identify and avoid disproportionate impacts on minority or low-income communities. This section identifies minority or low-income communities that could be affected by the proposed project.

Table 3-6 provides 2000 race and ethnicity information for the six villages within the ROI. According to the 2000 census, the populations of each village, as well as of American Samoa as a whole, are between 88.3 and 99.4 percent Samoan and less than 5 percent from other ethnic origins. Swains Island is the only area with reported Tokelauan population, with 54.1 percent of

the total population on this island. Tokelauan are reported to be 0.1 percent the whole American Samoa population.

Table 3-6: Ethnic Origin.

2000 Ethnic Origin							
	Futiga	Vaitogi	Aunu'u	Si'ufaga	Leusoali'i	Swains Island	American Samoa
Total Population	731	1,347	476	92	181	37	57,291
Samoan	93.0%	88.3%	98.3%	91.3%	99.4%	35.1%	88.2%
Tokelauan	-	-	-	-	-	54.1%	0.1%
Tongan	0.3%	4.6%	-	2.2%	-	-	2.8%
Fijian	0.8%	0.1%	-	-	-	-	0.1%
Other Pacific Islander	-	-	-	-	-	10.8%	0.3%
Asian	2.2%	0.2%	-	2.2%	-	-	2.8%
White	0.5%	1.3%	-	-	-	-	1.1%
Two or more ethnic groups	4.2%	5.2%	1.7%	4.3%	0.6%	-	4.2%

Source: U.S. Census Bureau 2003

3.1.5 Institutional Setting

Marine and coastal resources in American Samoa are under the jurisdiction of the territorial government and federal government. This section provides a brief overview of relevant government agencies.

3.1.5.1 American Samoa Territorial Government Agencies

The right, title, and interest in American Samoa's submerged lands from the mean high tide line seaward to 3 geographical miles from the coastline are conveyed to the American Samoa Government under 48 U.S.C. 1705, with a list of exceptions. The relevant exceptions include (but are not limited to) those areas designated as national parks, reserves, or monuments per U.S.C. Title 16, Chapter 1, Section 2, including submerged lands adjacent to Rose Atoll. The federal Outer Continental Shelf Lands Act of 1953 confirmed federal jurisdiction over the resources beyond 3 miles and created a legal framework to manage those resources. In general, territorial jurisdiction extends 3 miles offshore, while federal jurisdiction extends from 3 to 200 miles offshore (the outer boundary of the U.S. EEZ). A number of American Samoa territorial government agencies are relevant to marine and coastal resource management. These agencies are described briefly below.

Office of Samoan Affairs

The ASG operates at the local level through a network of 75 villages, 14 counties, and three districts. The system is administered by the Office of Samoan Affairs. The officials representing the local units have limited authority but are delegated tasks and serve as liaisons between the territorial government and local residents.

The *fa'amatai*, which as noted earlier in this Chapter is the traditional chiefly system that includes the protocols of the *saofa'iga ale nuu*, is the core of local governance. The *matai*, selected by each *aiga potopoto*, manage the communal economy, protect and distribute family lands, are responsible for the welfare of all in the *aiga*, and represent the family in councils. Traditionally, the *matai* consults the *aiga* before exercising his or her authority. The *saofa'iga ale nuu* is made up of the *matai* of the village and is responsible for the general government of the village community. (U.S. Department of Commerce 1984)

American Samoa Department of Commerce (AS DOC)

The AS DOC is responsible for management of economic development and environmental protection for the Territory of American Samoa. The department is composed of six divisions: Research and Statistics, Planning, Economic Development, Resource Management, Administration, and Special Projects. The Resource Management Division administers the American Samoa Coastal Management Program (described below), the Governor's Coral Reef Initiative Program, and the AS DOC partnership with the American Samoa sanctuary. The AS Coastal Management Program holds the AS DOC's one voting member seat on the sanctuary advisory council.

American Samoa Coastal Zone Management Program (ASCMP)

The Coastal Zone Management Act of 1972 calls for the establishment of federally approved (by NOAA) state and territorial coastal zone management programs. NOAA approved the American Samoa coastal program in 1980. Its jurisdiction includes all lands within the territory and extends seaward to a distance of 3 miles. In 1990, the American Samoa Fono gave the program a legislative mandate by enacting Public Law 21-35, the Coastal Management Act. The program's mission is to "provide effective resource management by protecting, maintaining, restoring, and enhancing the resources of the coastal zone" (OCRM 2006). This program encompasses the following divisions and programs: Project Notification and Review System, Water Quality/Non-Point Source Pollution Program, Cumulative and Secondary Impacts, Community Based Management Wetlands Program, Geographical Information Systems, Public Awareness Campaign, and Ocean Resource Management Program. The review of environmental activities and likely impacts on coastal resources are guided by ASCMP Administrative Rules (ASCA Title 26).

American Samoa Department of Marine and Wildlife Resources (DMWR)

As provided in the ASCA (sec. 24.0304(a)), the mandate of the DMWR is to manage, protect, preserve, and perpetuate the marine and wildlife resources in the territory. The DMWR administers the CFMP, a 20 percent no-take marine protected area initiative detailed in the Marine Protected Area Program Master Plan (Oram 2008), general fisheries regulations, and regulations that help implement the territory's sea turtle and marine mammal sanctuary. These programs are the main focus of the DMWR-sanctuary relationship, which is facilitated by DMWR's one voting member on the sanctuary advisory council. In addition, DMWR and sanctuary staff collaborate in environmental education initiatives through *Le Tausagi*.

To pursue a CFMP MPA, villages sign a cooperative agreement with DMWR to develop a fisheries management plan and by-laws and establish a village monitoring and enforcement committee (members of which are then trained by DMWR). MPAs must be designated within the designating village's boundaries. DMWR had established 11 CFMP MPAs at sites in Aoa, Fagamalo, Poloa, Amanave, Matu'u, Auto & Amaua, Alofau, Aua, Sailele, Masausi, and Vatia. Biological reconnaissance surveys have been conducted at 15 sites in Tutuila (A'asu, Airport Lagoon, Alofau, Amalau, Amanave, Aunu'u, Auto & Amaua, Fagaitua, Fagatele Bay, Larsen Bay, Leone Bay, Nafanua Banks, Poloa, Taema Banks, and Vatia), four sites in Manu'a (Afuli Cove, Ofu Lagoon, Sili, and South Ta'u Drop-off) and at Rose Atoll.

Current nearshore fishing regulations, administered by DMWR in American Samoa (ASCA sec. 24.0902-24.0945) include gear restrictions and species-specific restrictions. All commercial fishing operators must obtain a fishing license. The subsistence portion of Pacific island artisanal fisheries is effectively unregulated (Adams and Dalzell 1994), and their catches in American Samoa are not recorded (Zeller *et al.* 2006).

American Samoa Environmental Protection Agency (AS-EPA)

The mission of the AS-EPA is to protect human health and to safeguard the natural environment – air, water, and land – on which life depends. The AS-EPA carries out its mission through the activities of five program offices: Administration, Air and Land Program, Education and Awareness Program, Technical Services Program, and Water Program. It also enforces a series of regulations in the ASAC, including Title 24 chapters 1-2, 5-8, 12, and Title 25 chapters 4, 16, and 20. (AS-EPA 2010c) The AS-EPA is a voting member on the sanctuary advisory council and centers primarily around two AS-EPA programs. The Education and Awareness Program promotes watershed protection and conservation through environmental education and awareness programs and disseminates environmental information to the public. The Water Program's Water Quality Branch works to prevent the degradation of water resources and protect human health by identifying sources of contamination to streams, wetlands, and coastal waters and reducing polluted runoff to these sources (AS-EPA 2010a).

American Samoa Community College ASCC/NOAA Sea Grant College Program

ASCC is a post-secondary, accredited academic institution that provides residents of American Samoa with education opportunities in liberal arts, teacher training, vocational-technical education, and general education (ASCC 2010). In 2002, ASCC became a NOAA Sea Grant College. Sea Grant encourages the wise stewardship of marine resources through research, education, outreach, and technology transfer. The ASCC Sea Grant Program focuses on developing aquaculture, as well as offering marine science courses. This local program is supported by a University of Hawai'i Sea Grant College Program aquaculture agent stationed at ASCC. ASCC/Sea Grant holds one voting member on the sanctuary advisory council.

American Samoa Historic Preservation Office (ASHPO)

Established in response to the National Historic Preservation Act of 1966 (16 U.S.C. 470 *et seq.*), the ASHPO identifies, evaluates, registers, interprets and protects American Samoa's historic and cultural properties, from star mounds to shipwrecked vessels. The ASHPO provides communities and preservation organizations with a variety of services and maintains an inventory of historic properties. It also reviews nominations to the National Register of Historic Places and oversees sites on that register. Under Section 106 of the National Historic Preservation Act, the ASHPO reviews all federal undertakings for impacts on historic properties.

American Samoa's strong indigenous culture and traditional system of communal land ownership impose special conditions of cultural sensitivity on such an endeavor. A primary concern of the ASHPO is to fulfill its responsibilities in a manner that recognizes and honors these inherent cultural conditions. The ASHPO works in partnership with federal and territorial agencies, village and district councils, private organizations, and individuals to assist in compliance with applicable federal and territorial historic preservation laws and to raise the community's consciousness about historic preservation and its role in cultural maintenance. The ASHPO helps provide information on maritime resources in or near sanctuary units and ensure their protection.

Governor's Coral Reef Initiative & Coral Reef Advisory Group (CRAG)

The CRAG is a working body of the Coral Reef Initiative and represents a collaboration of five different agencies: the AS DOC (the lead, with AS Coastal Management Program and the sanctuary serving as advisors), DMWR, AS-EPA, ASCC, and the NPAS. This group was established in 1994 "to protect and conserve coral reefs for the benefit of the people of American Samoa, the U.S. and world" (CRAG 2010). The member agencies that make up the advisory group work together by mutual consensus to manage coral reefs in American Samoa by planning achievable programs, identifying and collaborating with other partners, obtain funding for projects, tracking project compliance, promoting public awareness, and developing local capacity for eventual self-sustainability (CRAG 2010).

American Samoa Marine Protected Area Network Strategy

In 2000, former Territorial Governor Tauese Sunia issued a statement establishing a goal to protect 20 percent of American Samoa's coral reefs as no-take MPAs by 2010 and requested that a plan be developed to meet this goal (Sunia 2000). This statement was in response to the Coral Reef National Action Plan, adopted by the U.S. CRTF in 2000, which set a goal of protecting 20 percent of all U.S. coral reefs as no-take MPAs (U.S. CRTF 2000). Former Governor Sunia tasked the Coral Reef Advisory Group with developing the plan. The group issued the plan, titled "American Samoa Marine Protected Area Network Strategy" (Chromis LLC 2007) in August 2007. The text below summarizes and quotes information contained in the strategy.

The stated goal of the MPA Network Strategy is to "effectively coordinate existing and future MPAs to ensure the long-term health and sustainable use of the Territory's coral reef resources." The strategy is designed to integrate American Samoa's existing MPA agencies, programs and authorities to increase their collective efficiency and effectiveness in protecting, managing and conserving coral reef ecosystems and marine resources. The strategy will also "facilitate, support and enhance the designation and management of no-take MPAs that will protect 20% of the Territory's coral reef ecosystems." It uses NOAA's definition of MPAs (from the Draft Framework for Developing the National System of MPAs, June 2006):

> "Any area of the marine environment that has been reserved by Federal, State, territorial, tribal or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein."

The strategy contains five action plans: governance and administration, MPA development and support, education and outreach, research and monitoring, and enforcement. It is implemented by primary and secondary agencies. Primary agencies are engaged at a higher level in implementing action plan activities and tasks. Secondary agencies are engaged at a lower level in direct implementation, but also provide advice and review.

3.1.5.2 U.S. Government Agencies

A number of federal government agencies are relevant to marine and coastal resource management. These agencies are described briefly below.

NOAA Fisheries

NOAA Fisheries is mandated, under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), to manage fisheries in federal waters using an ecosystem-based approach. NOAA Fisheries also shares responsibility with the USFWS for implementation of the MMPA and the ESA, both of which prevent the taking of any endangered, threatened, or otherwise depleted species. As part of the MMPA mandate, NOAA Fisheries Office of Protected Resources works in collaboration with the Protected Resources Divisions of the NOAA Fisheries Regional Offices and Science Centers to develop and implement a variety of programs for the

protection, conservation, and recovery of marine mammals. NOAA Fisheries and USFWS share joint responsibility for managing sea turtles.

The NOAA OLE is authorized to enforce sanctuary regulations. In addition, through a joint enforcement agreement, OLE contracts sanctuary enforcement assistance to a third party (the American Samoa DMWR). The joint enforcement agreement provides that the contracted agency is to engage in both sanctuary enforcement (including at night) and education and outreach. Enforcement includes monitoring and investigating illegal takes and violations involving marine life within the sanctuary. Education and outreach include distributing information and regulations to the public via pamphlets or other educational materials. The DMWR submits monthly reports of all activities (relevant to the agreement) and promptly reports any citation, arrest, or violation of federal laws to the NOAA Special Agent or Enforcement Officer in the region.

In conjunction with territorial resource agencies (such as the American Samoa DMWR), NOAA Fisheries approves and enforces Fishery Management Plans (FMPs) prepared by regional fishery management councils. The WPFMC is the regional fishery management council responsible for federally authorized fisheries in American Samoa. The regulation of fishery resources in national marine sanctuaries is a collaborative process where sanctuary superintendents work with other fishery managers, including the WPFMC, to ensure fishery resources are protected. The WPFMC has made efforts, in recent years, to move from species-based fishery management plans to place-based fishery ecosystem plans (FEPs). WPFMC released the FEPs for Pacific Pelagic Fisheries of the Western Pacific Region and also for the American Samoa Archipelago in 2008 and 2009. The Pacific Pelagic Fisheries FEP addresses management of tunas, sharks, billfishes, and other pelagic species. The American Samoa Archipelago FEP addresses management of bottomfish, crustaceans, precious corals, and coral reef ecosystem species. These FEPs establish a framework for initiating an ecosystem-based approach to fisheries management (WPFMC 2008, 2009).

National Park Service (NPS)

The NPS under the U.S. Department of the Interior conserves scenery, national and historic objects, and wildlife and provides for the enjoyment of those resources in a manner that will leave them unimpaired for future generations. The NPAS is the only national park where the land is not owned by the U.S. government. The NPAS consists of three units, with one unit per each of the following islands, all of which have boundaries that extend offshore: Tutuila, Ofu, and Ta'u. The park boundary is described at 16 U.S.C. 410(qq), with additional information regarding the seaward boundary in the lease agreement between the NPS and the ASG. The lease agreement states, "The seaward boundary of the National Park of American Samoa shall begin at American Samoa Government's jurisdiction at the mean high tide line and extend seaward to the 60 feet depth contour interval or one quarter (1/4) mile offshore, whichever is farthest." Based on NPS marine surveys and NOAA data, the boundary is always 1/4 mile from shore as the 60' depth occurs closer to shore. NPS general regulations are at 36 CFR Part 2, and the NPAS does not have a subset of site-specific regulations. The NPS has one non-voting member seat on the sanctuary advisory council. ONMS and NPS are committed to working closely together on the

protection and management of shared marine resources across the country. In American Samoa, the park is an active and integral sanctuary partner on projects ranging from education and outreach to research and monitoring.

U.S. Fish and Wildlife Service (USFWS)

The USFWS under the U.S. Department of the Interior is mandated to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. Two program offices of USFWS — Endangered Species and the National Wildlife Refuge System — have statutory authority to protect marine resources. The Rose Atoll NWR is part of the Pacific Reefs NWR complex, and consists of 20 acres of emergent coral atoll and 1,600 acres of lagoon. USFWS shares responsibility with NOAA Fisheries for implementing the MMPA and ESA. In American Samoa, the USFWS has conservation oversight for all terrestrial species, including seabirds. It also administers coastal conservation and conservation partnership programs through its habitat conservation division and provides assistance with invasive species issues and emergency response throughout the Pacific islands.

On January 6, 2009, President George W. Bush established the Rose Atoll Marine National Monument under the authority of the Antiquities Act of 1906. The monument incorporates approximately 13,448 square miles within its boundaries, which extend 50 nm from the mean low water lines of Rose Atoll. The proclamation stipulates that the Secretary of the Interior will have management responsibility for the monument, including Rose Atoll NWR, in consultation with the Secretary of Commerce. It also stipulates that the Secretary of Commerce, through NOAA, will have the primary management responsibility for management of the marine areas of the monument seaward of mean low water with respect to fisheries-related activities regulated pursuant to the Magnuson-Stevens Fishery Conservation and Management Act. The proclamation also states that "the Secretary of Commerce shall initiate the process to add the marine areas of the monument to the Fagatele Bay National Marine Sanctuary in accordance with the NMSA." The proclamation clarifies that, in developing and implementing management plans, management rules, and regulations the Secretary of Commerce should consult with the Secretary of the Interior, and:

> "shall designate and involve as cooperating agencies the agencies with jurisdiction or special expertise, including the Department of State, the Department of Defense, and other agencies through scoping in accordance with the National Environmental Policy Act (42 U.S.C. 4321 *et seq.*), its implementing regulations and with Executive Order 13352 of August 26, 2004, Facilitation of Cooperative Conservation, and shall treat as a cooperating agency the Government of American Samoa, consistent with these authorities."

This management plan/EIS, which proposes and evaluates the addition of the marine areas of the monument to the sanctuary, is an important step in implementing the mandates established in the proclamation.

Finally, the Proclamation stipulates that the Secretary of the Interior will continue to manage the Rose Atoll NWR and will comply with the NEPA and consult with the Department of Commerce in developing management plans, rules, and regulations for the refuge. On January 16, 2009, the Secretary of the Interior delegated his management responsibilities for the monument to the USFWS through Secretary's Order 3284.[26]

3.1.6 Operational Setting

3.1.6.1 Human Resources

Sanctuary Superintendent

The sanctuary superintendent serves as a liaison between the ASG (via consultation with the American Samoa AS DOC) and ONMS in sanctuary management. The superintendent oversees site-specific management functions, including revising and implementing the management plan. The superintendent designates responsibility for implementing specific programs or projects, establishes the administrative framework to ensure all resource management activities are coordinated, and maintains and manages an appropriate infrastructure to adequately support site operations. The superintendent reports to the Regional Superintendent for the Pacific Islands Region of ONMS. General responsibilities of the sanctuary superintendent include:

- Submitting an annual operating plan that recommends priorities to ONMS for annual allocation of funds for site operations and resource protection;
- Formulating and directing research, education, marine resource management, cultural liaison programs and partnerships locally, nationally, and internationally;
- Determining staffing needs and requirements;
- Coordinating with ONMS in evaluating, processing, and issuing permits and conducting inter-agency consultations;
- Coordinating on-site efforts of all parties involved in sanctuary activities including territory, federal, regional, and local agencies;
- Working closely with constituents and the community; and
- Evaluating progress made toward achieving sanctuary goals and objectives.

Sanctuary Staff

Basic staffing supports program activities in eight functional areas:

- Management Planning;
- Resource Protection;
- Research and Monitoring;
- Education and Outreach;
- Cultural Affairs;
- Sanctuary Advisory Council Coordination;
- Site, Facility & Vessel Operations; and
- Office Administration.

[26] Regardless of any sanctuary designation, Monument designation would remain per Proclamation 8337.

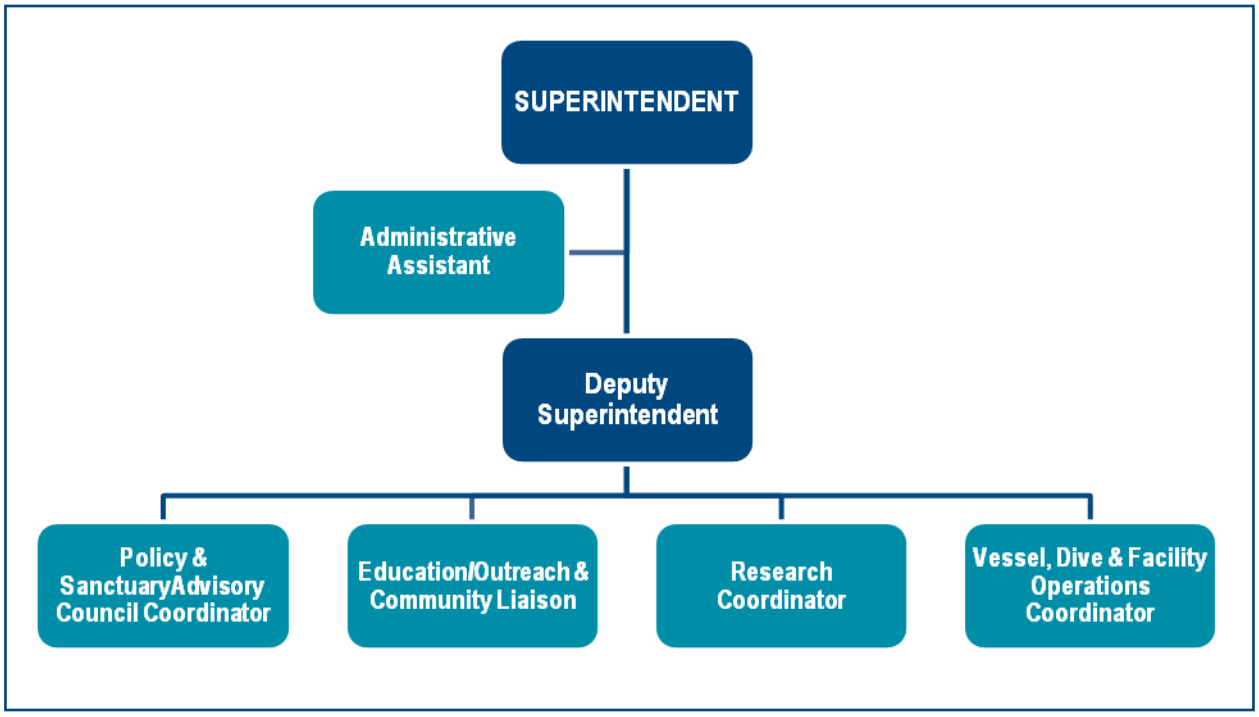

Figure 3-5: Sanctuary Staff Organization Chart.

Sanctuary staff have knowledge and expertise in policy, marine resource management, education and outreach, scientific research and monitoring program development, and office administration. The existing organizational structure is shown in Figure 3-5. There are currently seven full-time staff, one of whom is a federal employee and five are contract employees.

Staff from the ONMS Pacific Islands Region and the AS DOC also help support the sanctuary on an as needed and as available basis with scientific expertise, office administration, GIS, and information technology.

3.1.6.2 Infrastructure

Offices

The facilities of the American Samoa sanctuary are located in the Village of Utulei on Tutuila Island. Office space is provided by the AS DOC. Historically, sanctuary offices were housed in a waterfront building in Pago Pago Harbor. During its renovation of the waterfront building, the AS DOC provided sanctuary office space within the Executive Office Building in Utulei, a few blocks from the waterfront building. When they were completed, the renovated waterfront facilities will consist of an administrative office, visitor center, meeting rooms, and an ocean discovery hall. These facilities will occupy a 22,713 -square-foot, one-story building. The sanctuary offices reside at this one site; there are no plans in the next 5 years to develop a satellite office.

Vessels & Vehicles

The sanctuary currently operates one vessel in support of research and monitoring, education and emergency response. The R/V *Manumā* is the sanctuary's new rigid-hull inflatable. The R/V *Manumā* is a multi-purpose research vessel designed primarily to support sanctuary science and education missions. Its length overall is 33 feet, and its beam is 10.5 feet. It has twin 200 horsepower outboard engines. It has a fuel capacity of 200 gallons and a range of 65 to 80 nm. It carries a crew of two to three and a science party of five to seven for single-day trips. Since it was acquired in 2009, the vessel has served as a platform for research and monitoring from diving operations to benthic habitat mapping, and for regional damage assessments and recovery efforts following the September 2009 tsunami.

Photo 25: The R/V Manumā, at work collecting marine debris following the 2009 tsunami, is a critical part of sanctuary infrastructure. NOAA Photo: By Jake Asher.

3.2 SITE-SPECIFIC AFFECTED ENVIRONMENT

3.2.1 Fagatele Bay

3.2.1.1 Description of Site Setting and Major Attributes

Fagatele Bay covers about 0.25 square miles on the southwest shore of Tutuila, where the Fagatele volcanic crater was breached and flooded thousands of years ago. Seumalo Ridge rises more than 400 feet (120 m) along the western and northern sides of the bay, and Matautuloa Ridge flanks the eastern side of the bay at more than 200 feet (60 m) high. These steep slopes comprise some of America's rare paleo-tropical rainforest (U.S. Department of Commerce 1984). Although foot trails from the mountain ridges to the shore exist, the steep, difficult trails are not much used. The landward boundary of the sanctuary is the mean high high water line between Fagatele Point and Steps Point. The seaward boundary is defined by a straight line between Fagatele Point and Steps Point (Figure 3-6).

Fagatele Bay is within the 1.23-square-mile Fagatele-Larsen watershed, classified by the AS-EPA as watershed 29. The AS-EPA categorizes this watershed as pristine, with an ocean shoreline fully supporting aquatic life and assigned to assessment Category 2 by CALM. The 5.7 miles of shoreline in the watershed meets one of its designated uses (*i.e.*, supporting aquatic life), but insufficient data inhibit evaluation of other designated uses (*i.e.*, swimming and fish consumption) (AS-EPA 2010a). Water quality within the bay is considered good, with low nutrient levels and good water clarity. Concerns have been raised based on an increasing number of warm-water events that could lead to coral bleaching (NMSP 2007). Fagatele Bay is in the highly agricultural Tualatai County, where about 82 percent of the county is farmland. Slightly

more than half of the 1,822 acres of farmland is categorized as commercial (USDA 2005). Piggeries may exist within the Fagatele-Larsen watershed (AS-EPA 2006). Any potential data on reduction in illegal piggeries in recent years for this watershed are not currently available (Wiles 2010).[27] Because of the steep slopes, only 40 percent of the land within the Fagatele-Larsen watershed can be farmed, and only 5 percent of this land is currently being planted with permanent crops such as coconut and breadfruit trees. Many of the taro fields have been abandoned (especially on the ridges), and those that are active are well covered with trees, bushes, and shrubs. No crops are being cultivated within 300 feet (100 yards) of surface waters. Fertilizers are typically applied only to vegetables and Cavendish banana plants, which are grown mainly on flat lands, minimizing the threat of nutrient runoff into surface waters (Tuionoula 2010). Based on this information, agricultural runoff and erosion do not appear to threaten water quality within the Fagatele-Larsen watershed.

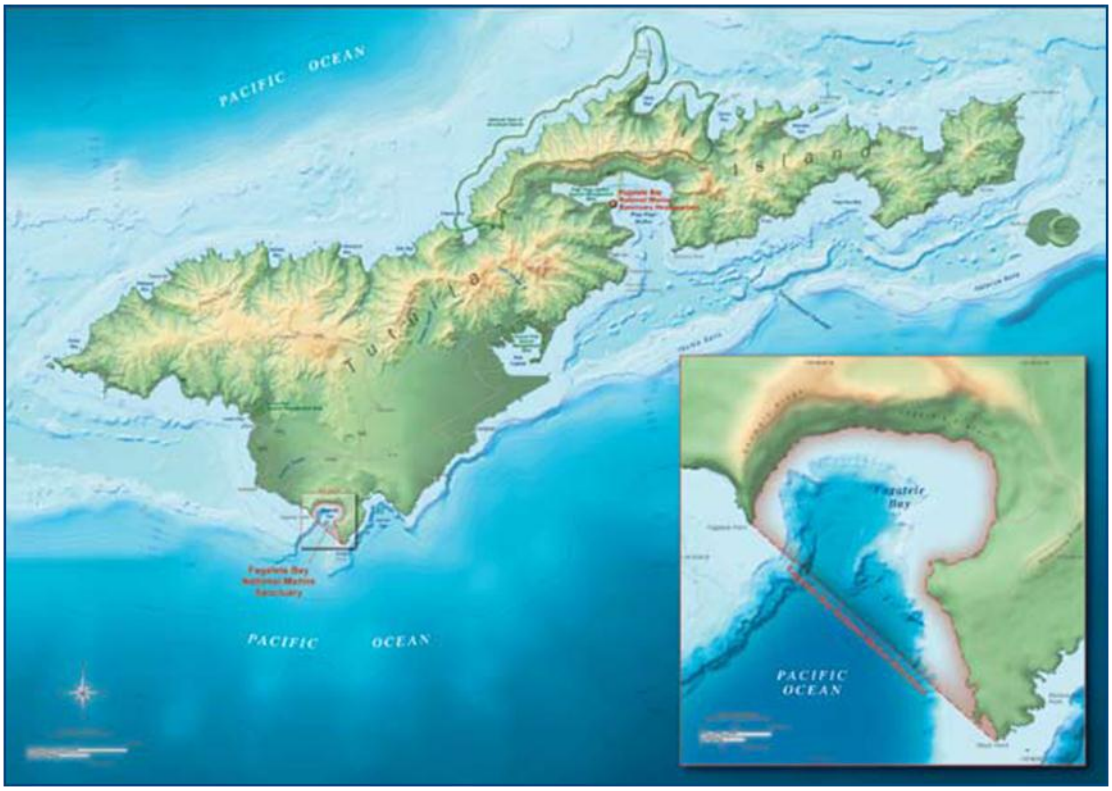

Figure 3-6: Fagatele Bay.
Source NMSP Condition Report

[27] The AS-EPA piggery compliance program is currently updating its data, which should be available in late 2010.

Habitats (reef zones, pelagic, deep waters)

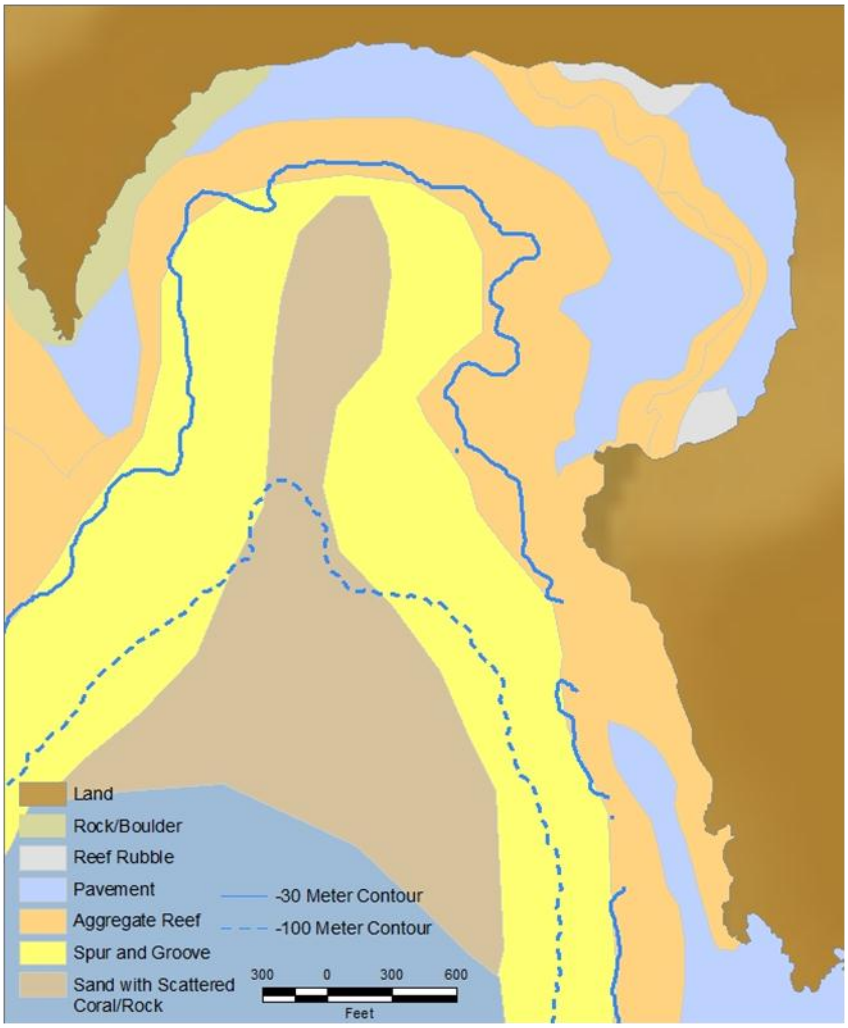

Figure 3-7: Fagatele Bay Benthic Habitats.

A mosaic of habitats supports marine life in Fagatele Bay (Figure 3-7). Calcareous sand beaches extend from above the mean high tide line to the deep reef platform 16 to 33 feet (5 to 10 m) offshore (Figure 3-7). The reef platform, or nearshore inner reef flat, continues for another 197 feet (60 m) offshore before it descends into a reef slope in deeper offshore waters (Birkeland *et al.* 1987). Midway between the flat and the slope, the reef crests in extremely shallow water, becoming exposed during the lowest tides. Beyond the reef slope, water depth increases from 560 feet (170 m) to 4,000 feet in the southwest (1,200 m; NMSP 2007). Coralline algae dominate the reef flat, while coral predominates on the bank (Figure 3-8). There is an estimated 0.45 square km of reef habitat, about 0.6 percent of the entire reef area for American Samoa (Kendall and Poti in prep.). Due to the well-protected reef and clean offshore waters, the coral community thrives at depths of more than 90 feet (30m; NMSP 2007).

Biological Significance

Fagatele Bay was designated a sanctuary to protect its extensive coral reef ecosystem. Although most productivity occurs in the upper 33 feet (10 m) of the sea, the reef provides that framework for a complex community of organisms that range throughout the bay, from the intertidal to the limit of the photic zone at around 98 feet (30 m) deep. Fagatele Bay is thought to support the greatest diversity of marine life in the National Marine Sanctuary System.

The bay scores high on typical indicators of a healthy coral ecosystem, including coral abundance, density, percent live coral cover, and size distribution of coral colonies. At least 168

species of coral have been documented in Fagatele Bay, including four discovered as recently as 2008 during surveys of monitoring sites (Fenner *et al.* 2008a). One recent study suggests that Fagatele Bay has among the highest live coral cover for the island of Tutuila (mean value of 57.5 percent, Brainard *et al.* 2008). Fagatele Bay is part of a distinct biogeographic region along with Larsen Bay that is a hotspot from coral cover, coral richness, and fish richness (Kendall and Poti in prep.). The reefs in Fagatele Bay appear to be at temporary equilibrium, based on relative abundance of various coral taxa and population density of corals along depth gradients (Fenner *et al.* 2008a).

The 168 species of corals in Fagatele Bay are thought to be the centerpiece of a community of more than 1,400 species of algae and other invertebrates and 271 species of fish, based on surveys of Tutuila's coral reefs (Fenner *et al.* 2008a). Large schools of damselfish, surgeonfish, butterflyfish, and parrotfish occur within the bay, although declines in grouper and snapper populations have been observed (NMSP 2007). Fagatele Bay has the highest macroalgal species diversity around Tutuila (Brainard *et al.* 2008). The high primary production and localized secondary production create a rich source of energy that is transferred to shorebirds, seabirds, sea turtles, and marine mammals that visit the bay, including hawksbill and green sea turtles, dolphins (Johnston *et al.* 2008), and humpback whales (Robbins and Mattila 2006).

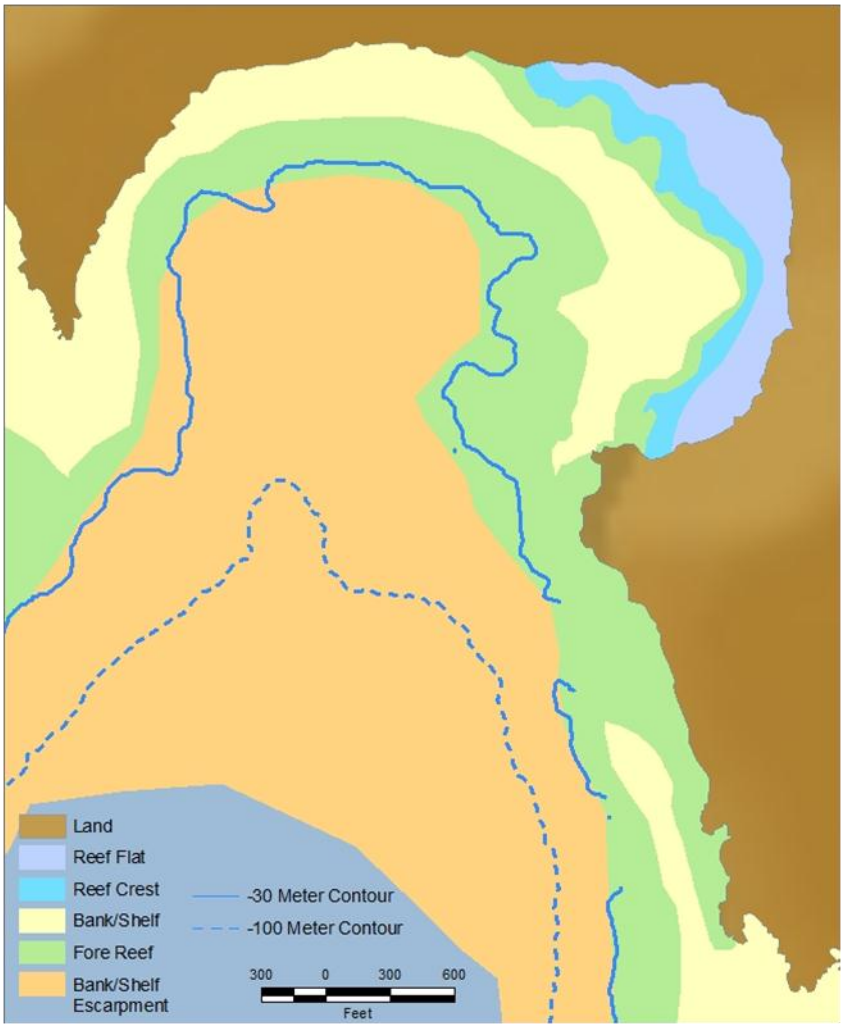

Figure 3-8: Fagatele Bay Benthic Zones.

The value of Fagatele Bay's rich foraging grounds to seabirds and shorebirds is increased by the relatively undisturbed nesting and roosting habitats of the surrounding rocky cliffs and forested ridges. The forests in the watershed surrounding Fagatele Bay protect the bay from excessive sedimentation, while also providing habitat for terrestrial species. Large colonies of fruit bats,

which are rare in more developed parts of Tutuila, roost in the forests that surround Fagatele Bay.

Cultural Significance

The cultural significance of Fagatele Bay lies in its connection with a historic coastal village that occupied its shores from prehistoric times through the 1950s (NMSP 2007). The site has not been excavated, but foundations of structures and pathways remain beneath the overgrown vegetation. The village apparently provided residential and fishing accommodations and "presents the potential to diachronically gauge man's interaction with the natural environment." (Gould *et al.* 1985). Fagatele Bay contains one of the few marine archaeological records in the territory: grinding holes or bait cups carved by Ancient Samoans into the shoreline along the reef edge (Van Tilburg 2007).

3.2.1.2 Current Human Uses

Fishing

Fagatele Bay is relatively inaccessible by land, and fishermen have historically reached the area by boat. Although protected areas like Fagatele Bay are important fishing areas (NMSP 2007), a low amount of boat-based fishing has occurred within the outer zone of the bay. Fishing is prohibited in the nearshore areas of the sanctuary. Based on territory-wide survey, the subsistence and artisanal coral reef fishery for Fagatele Bay is categorized as medium effort (Spurgeon *et al.* 2004).

Non-consumptive Recreation and Tourism

Fagatele Bay National Marine Sanctuary is difficult for people to visit because it is remote and surrounded by steep cliffs on privately held land. Near the sanctuary's welcome sign off of Futiga Road, the Futiga site warden controls access to a gate that secures the area. Rather than enter through the gate, visitors can take the 5-km Fagatele Bay trail, developed in 2008 by a collaborative effort of the sanctuary, AS DOC, the people of Taputimu, Futiga and Vaitogi villages, the NPAS, the American Samoa Resource Conservation and Development Council, and AmeriCorps. The trail, which runs from Taputimu Road to Fagatele Bay, does not require passage through the Futiga gate. A third access route is to take the road from Vaitogi to the east, then west to where it connects with the Fagatele Bay trail. Official patrols and visits by sanctuary staff over the past 20 years indicate few visitors make the trek to Fagatele Bay.

Access to the sanctuary by water is also rare. Very few residents own pleasure boats. No commercial scuba diving operators do business in the territory, although Fagatele Bay and other American Samoan coral reefs would offer high-quality diving experiences. Yachts visit Pago Pago Harbor to seek shelter and buy provisions during the cyclone season, but rarely anchor in other bays of the territory.

Research

The University of Guam Marine Laboratory began documenting and mapping biological resources in the bay in 1985, as the ASG began to implement the sanctuary's 1984 management plan (Green *et al.* 1999; Birkeland *et al.* 1987). Permanent reference markers for six research transects were installed, a detailed long-term survey methodology was established, and baseline data on habitats and biota were collected (Birkeland *et al.* 1987). Many of the research projects conducted within the bay since sanctuary designation are described in Chapter 1 under *Sanctuary Accomplishments*.

3.2.1.3 Current Management Regimes

Fagatele Bay is co-administered as a marine protected area by the AS DOC and by ONMS. Territory-wide coastal resource management measures (described in section 3.1.5.1), such as those administered through the Coastal Management Program, the AS-EPA, and the DMWR, are also in effect. The current sanctuary zoning regulations are briefly described below.

The Fagatele unit of the sanctuary is divided into two subzones where different fishing regulations apply. Zone A includes the area from the high water mark of the inner bay to a line between Fagatele Point and Matautuloa Point. Zone B covers the area between the boundary of Zone A and a line between Fagatele Point and Steps Point (see Figure 2-2). Sanctuary regulations address fishing regulations; natural and cultural resource protection; vessel and dive operations; discharges; sea bottom disturbance; use and possession of explosives, poisons or weapons; damage to sanctuary signs; and permits for otherwise prohibited activities.

Enforcement

All territory-wide management measures applicable in Fagatele Bay are subject to enforcement by territorial agencies. However, the territory has limited ability to conduct marine enforcement. NOAA's OLE officers can enforce sanctuary regulations directly and also contracts with the American Samoa DMWR for enforcement assistance. Most enforcement effort is focused on federal fisheries rules, the MMPA, and the ESA. See *NOAA Fisheries* under section 3.1.5.2 for additional discussion of enforcement. Although enforcement of fishing regulations can be difficult because of the remote location and difficult access from land (NMSP 2007), illegal fishermen were apprehended by law enforcement in the sanctuary in 2005.

3.2.1.4 Current Threats to Resources

The impacts of human activity on the coral reefs of Fagatele Bay are much greater than are predicted by the number of visitors to the sanctuary. People have degraded the reef by:

- Using destructive fishing practices, including dynamiting and discarded fishing lines;
- Collecting corals and other invertebrates;
- Anchoring and walking on the reef flat; and
- Discarding trash in or near the bay.

The absence of several large fish species that are characteristic of unfished reefs in the Indo-Pacific may indicate that Fagatele Bay suffers from overfishing (Fenner *et al.* 2008a), although differences in habitat availability for these species have yet to be considered (Sabater 2011).

Additional threats to the water quality of Fagatele Bay include:

- Agricultural developments in the steep forests around the bay, leading to erosion and sedimentation;
- Leaching from upland landfills; and
- Urbanization and population growth.

The level of coralline algae disease is particularly high in Fagatele Bay, with more than twice the prevalence than any other surveyed site on Tutuila, although no evidence of coral disease has been found (Brainard *et al.* 2008). Brainard *et al.* (2008) suggest that, based on current flow, this high level of coralline algal disease may be caused by contaminants discharged from Pago Pago Harbor.

The Futiga landfill (about one-half mile upland from the Fagatele Bay shoreline) has been identified as a potential land-based source of pollution, with leachate containment, sediment, and nutrients possibly impairing water quality and fish in the bay. According to the AS-EPA (Mease 2010), the landfill holds mostly household waste, but also includes medical waste and industrial byproducts (from fish cannery operations). It is suspected that asbestos may have been deposited in the landfill as well. The landfill is uncharacterized and unlined. No soil or water sampling has been conducted to evaluate whether contaminated leachate is approaching or entering Fagatele Bay. The landfill is leased by the American Samoa Government from a private landowner, and the American Samoa Power Authority operates the landfill (Mease 2010).

Invasion by nonindigenous species does not appear to be a cause for concern. Of 449 taxa identified in Fagatele Bay in 2002, only three were not clearly native to American Samoa. One nonindigenous bryozoan and two cryptogenic algae were observed; cryptogenic species are those that are suspected of being, but not yet confirmed to be, introduced (Coles *et al.* 2003).

3.2.2 Larsen Bay

3.2.2.1 Description of Site Setting and Major Attributes

Larsen Bay encompasses approximately 0.46 square miles (1.2 square km) of area on the southwest shore of Tutuila, just east of Fagatele Bay, from Steps Point across to Sail Rock. Fagalua and Fogama'a coves make up the inner, western portion of Larsen Bay. Like Fagatele Bay, Larsen Bay was formed from a flooded volcanic crater and is surrounded by steep, forested cliffs. During the original sanctuary designation process, the ASG Office of Marine Resources (now DMWR) forwarded to NOAA a recommendation to include this area in the original sanctuary boundary. The original proposal to include Larsen Bay is briefly described within Option 3 of the 1984 Final EIS, which notes several main differences from Fagatele Bay: a larger beach area that could be used for recreation and education, more extensive representation of deep

sea habitat, less protection from swells generated by southeasterly trade winds, and shelter from winds and swell out of the west (U.S. Department of Commerce 1984).

Like Fagatele Bay, Larsen Bay fronts the pristine, steep sloped 1.2 square mile (3.2 square km) Fagatele-Larsen watershed. Human impacts within the watershed are minimal and runoff from the highly erosive soils is not associated with significant nutrient loads (Pedersen 2000). For additional information, see the discussion of the Fagatele Bay watershed assessment, including agricultural characteristics and piggery information (section 3.2.1.1).

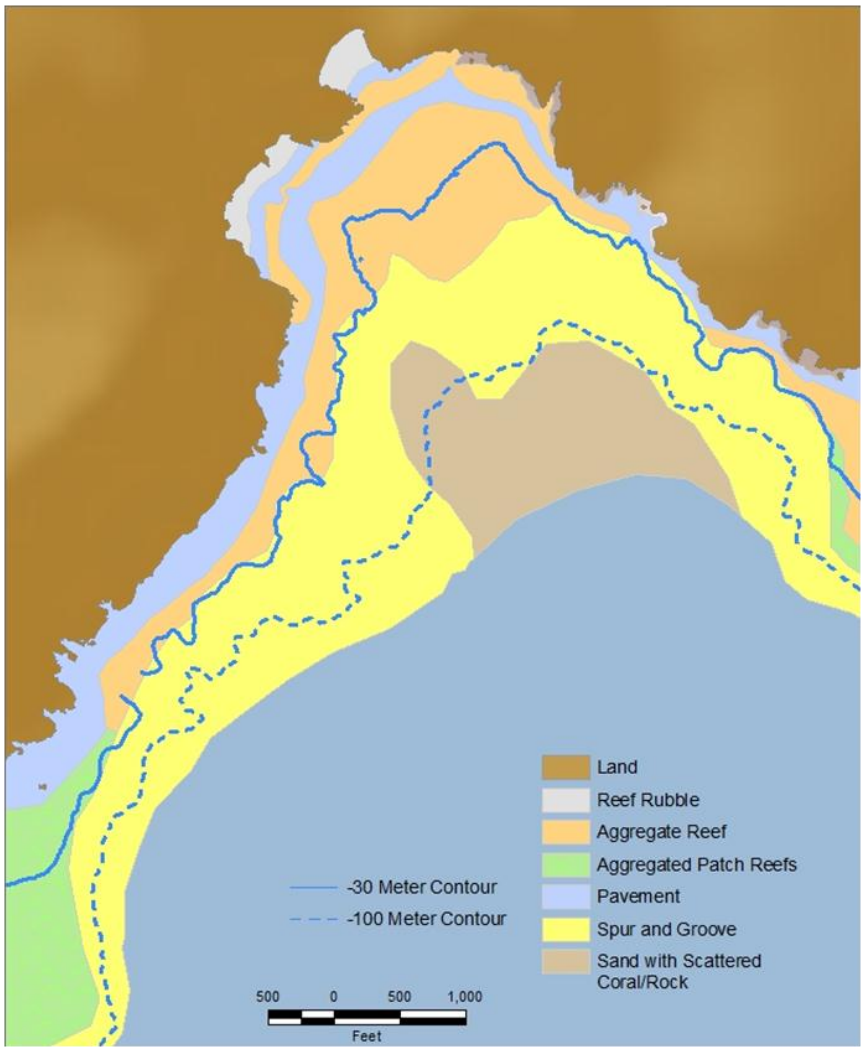

Figure 3-9: Larsen Bay Benthic Habitats.

Habitats

Larsen Bay is dominated by coral reef and hard bottom formations. Coral reef structures comprise approximately 63% of the benthic habitat in the bay and include aggregate reef and spur and groove. In comparison, these two structure types comprise only 11% of the mapped benthic habitat around American Samoa (Figure 3-9; Kendall and Poti in prep.). Similar to Fagatele Bay, coralline algae occurs primarily within the reef flat, while coral occurs on the reef bank (Figure 3-10).

The habitats and marine communities of Larsen Bay are not as well characterized as Fagatele Bay. However, benthic habitat maps indicate that the relative proportions and inshore/offshore zonation of these reef and hard bottom features replicate those found in adjacent Fagatele Bay (Kendall and Poti in prep.). Further, these two bays comprise a distinct bioregion based on archipelago-wide analysis of fish and coral data. A narrow peninsula of steep-sided cliffs separates the two bays into almost mirror images of each other, with similar environmental features but somewhat different wave and wind exposure.

Biological Significance

The ecological importance of Larsen Bay is comparable to Fagatele Bay, with both bays constituting a regional hotspot for coral cover, as well as coral and fish species richness. Compared to other locations across American Samoa, fish biomass values are lower in Larsen Bay (Kendall and Poti in prep.). Because of the physical and biological similarity, Larsen Bay provides a replicate habitat for increased protection, scientific research and overall increased resilience of coral reef ecosystems.

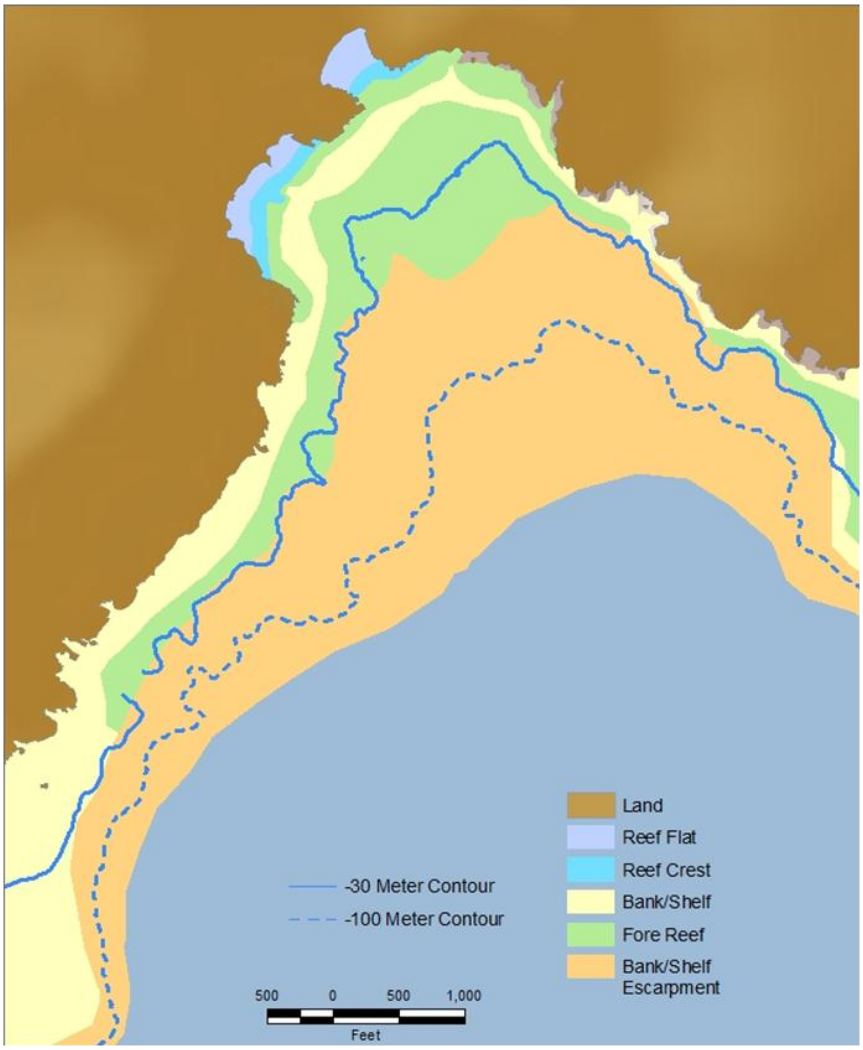

Figure 3-10: Larsen Bay Benthic Zones.

Cultural Significance

Within Larsen Bay, Fagalua Bay is the site of two turtle images carved in a boulder and prehistoric *fale* foundations and may contain buried archeological deposits. Larsen Bay has a historic feature and potentially old trails above the bay; it may also hold prehistoric archeological deposits, but this hypothesis has not been tested or confirmed (Herdrich 2010).

3.2.2.2 Current Human Uses

Fishing

Subsistence and recreational fishing activities occur in this unit. This consists of primarily pole-and-line fishing, but may also include gill net fishing and free diving spearfishing. No site-specific fishery data are available for Larsen Bay, but results from a territory-wide survey indicate a medium effort for coral reef fisheries in Larsen Bay (Spurgeon *et al.* 2004).

Non-consumptive Recreation and Tourism

Larsen Bay is accessible via overland routes from Taputimu, Futiga, or Vaitogi, and access is subject to the same difficulties described for Fagatele Bay. An alternative land route from the west is to take the Fagatele Bay trail past Fagatele and continue on to Fagalua or Fogama'a Coves. The Turtle & Shark Lodge located on the Vaitogi cliffs above the bay offers access to hiking and fishing at Fogama'a Cove. While no visitor records are available, the bay is considered a medium use for recreational snorkeling (Spurgeon *et al.* 2004).

Research

A thorough review of the existing marine research and resource assessment surveys for the entire archipelago (Kendall and Poti in prep.) indicates a total of six surveys within Larsen Bay, concentrated in the northwest spur and groove and pavement areas. While coral cover and species richness are high relative to other locations across American Samoa, more widely spread surveys are needed to more fully characterize the bay.

3.2.2.3 Current Management Regimes

Larsen Bay is subject to territory-wide ASG coastal resource management measures, such as those administered through the Coastal Management Program, the AS-EPA, and the DMWR, described in section 3.1.5.1.

Enforcement

The information provided for Fagatele Bay applies to Larsen Bay.

3.2.2.4 Current Threats to Resources

The information on land-based activities and marine resource use provided for Fagatele Bay applies to Larsen Bay.

3.2.3 Aunu'u Island

3.2.3.1 Description of Site Setting and Major Attributes

Aunu'u is a small, volcanic island approximately 2 km southeast of Tutuila with a land area of 1.5 square km. Major features of the island include Aunu'u Crater, Pala Lake (a unique area of red quicksand), and Faimulivai Marsh, the largest freshwater wetland in American Samoa.

Photo 26: Aunu'u is a small island with two offshore areas proposed for sanctuary protection. NOAA CRED Photo.

The Aunu'u Sisifo watershed drains the western half of the island, and Aunu'u Sasae its eastern half. The western side of the island has supported development for many generations, and the watershed has been extensively impacted (Pederson 2000), but coastal waters still fully support swimming. The area is designated CALM Category 2 based on insufficient data to evaluate other designated uses such as aquatic life and fish consumption. The eastern side of the island is pristine and consists of an uninhabited volcanic crater; CALM Category 3 signifies insufficient data to evaluate any designated uses. Wetlands in both watersheds are also assigned a CALM Category of 3 (AS-EPA 2010a).

Aunu'u is part of Sa'ole County, which includes southeastern Tutuila east of Pago Pago Harbor to the village of Utumea East. About half of the county (755 acres) is farm land, and about 72 percent of farm land is commercial (USDA 2005). Numerous piggeries occur along the western coast of Aunu'u (AS-EPA 2006). Any data on potential reduction in illegal piggeries for this watershed are not currently available (Wiles 2010). Aunu'u is the only place in American Samoa where taro is cultivated in paddy fields, which occupies about 5 percent of the land. The remaining land is mostly wet and unsuitable for cultivation and is primarily covered by non-edible trees, bushes, shrubs and weeds. Agricultural runoff and erosion do not appear to threaten nearshore water quality, as these flow into Pala Lake and the wetlands areas (Pedersen 2000; Tuionoula 2010). Aunu'u is said to produce the best taro in American Samoa (Best 1992).

Habitats

Bardi and Mann (2004) report on 15 acres of mangrove habitat at four sites on Aunu'u: Fou Elementary School Swamp, the School Swamp puzzlenut area, and two sites at Pala Lake. Aunu'u is one of two places in the territory where the puzzlenut tree (*Xylocarpus moluccensis*) occurs. All four Aunu'u mangrove sites are unique in that they occur inland, rather than along the coast, likely receiving salt water from underground percolation. Hence, mangrove habitat is near but not within the boundaries of this unit.

The benthic habitats surrounding Aunu'u Island are very diverse and comprised mostly of coral reef and hardbottom formations. To the south and west of the island lies the Nafanua Bank, which consists of pavement and pavement with patch reefs as well as spur and groove along the deepest edge of the bank (Figure 3-11). A narrow ring of aggregate reef surrounds the western half of the island, while rock and boulder formations occupy the nearshore waters to the east of the island. A number of reef pinnacle formations are found in the basin to the west of the island. To the east of the island extends a coral bank with extensive aggregate patch reef on its western edge, descending into deeper waters that support mesophotic reefs. Turf algae dominate much of the bank habitat near the island, forming extensive algal plains (Figure 3-12). Together, these features create a diversity of habitat unique in American Samoa.

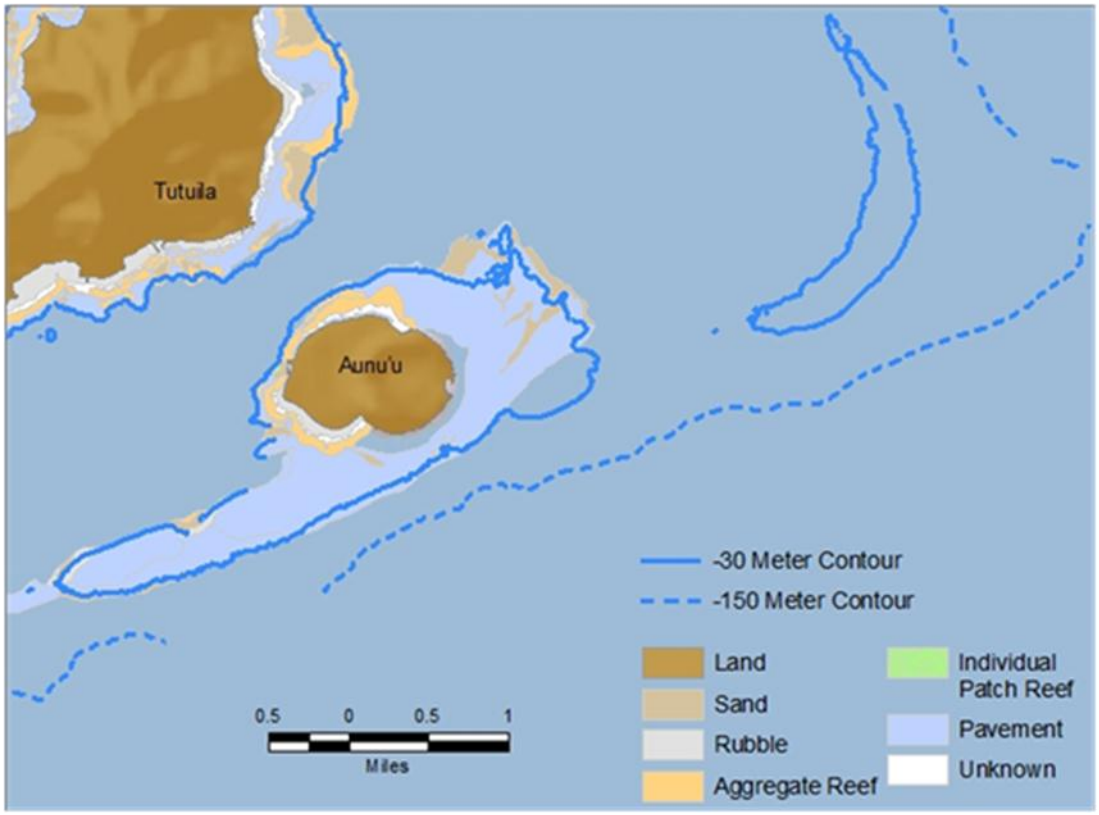

Figure 3-11: Aunu'u Benthic Habitats.

Biological Significance

Based on limited survey data, there is moderate coral cover and species richness compared to all of American Samoa (Figure 3-12). The area surrounding Aunu'u Island overlaps with four distinct biogeographic regions, making it a highly diverse marine area that includes hot spots for coral cover, fish biomass, and fish richness (Kendall and Poti in prep.). Survey sites to the south and west of the island in the pavement areas of Nafanua Bank generally have lower coral cover and fish biomass, although the one site in the spur and groove habitat along the edge of Nafanua Bank had high values for coral cover and fish biomass and species richness (Kendall and Poti in

prep.). These data and towed camera surveys highlight the value of the habitat at the edge of the bank. Survey sites to the east indicate higher values for coral cover, fish species richness and fish biomass. The region has a unique fish community, while its coral community has some similarities to coral communities around Fagatele and Larsen Bays. While the sanctuary designation would apply to the marine habitats, it would also highlight the unique inland habitats on Aunu'u Island. Fresh water caught by the crater pools in the interior of the island forms the largest freshwater swamp in the territory.

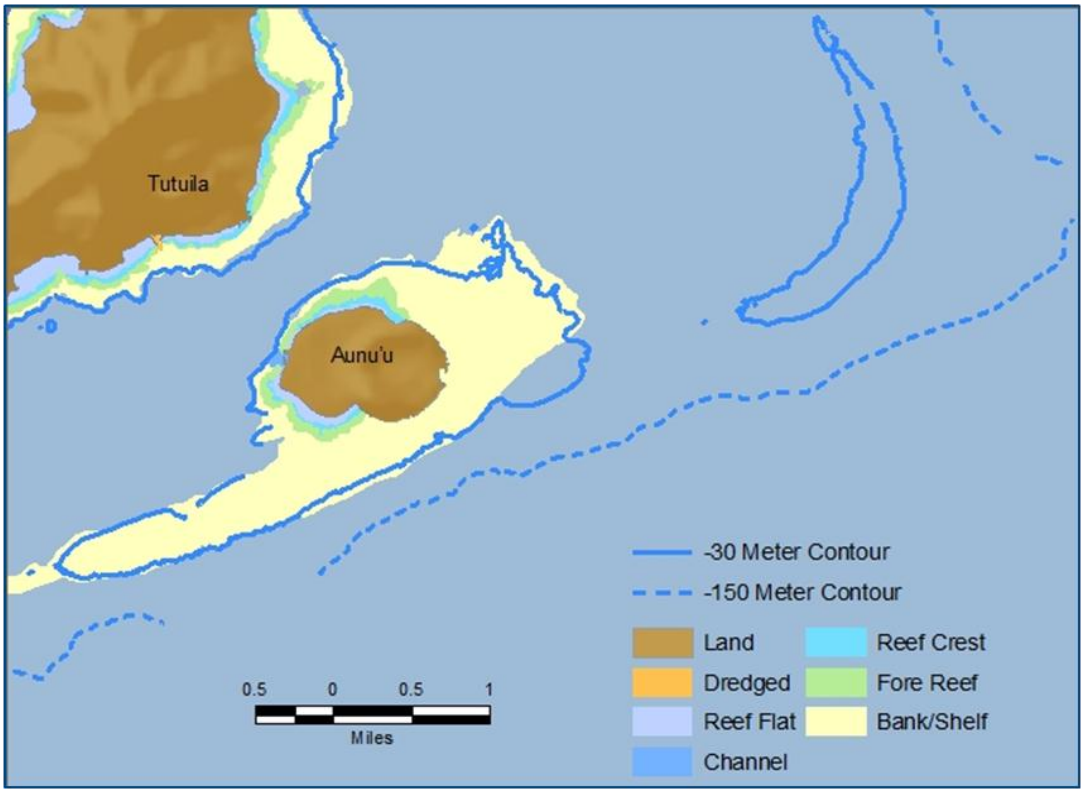

Figure 3-12: Aunu'u Benthic Zones.

Cultural Significance

Ceramics and potsherds indicate that people were on the island as long as 2000 years ago (Best 1992), although not much is known about the settlements at that time. Aunu'u is the site of a two maritime heritage resources dating to the 1800s, though a comprehensive survey of the island has not been conducted (Herdrich 2010). In 1835, a whaling vessel set out from Aunu'u for the Manua Islands and was lost at sea with all of its crew in the vicinity of Aunu'u (Van Tilburg 2007). Pa Taua, on the west coast of the village of Aunu'u, is the site of ruins that were once towers used to hold the four cannons from the *Kaimiloa*, a Hawaiian Kingdom steamer that was sent on an 1887 voyage in a display of power (Van Tilburg 2007). The cannons were used by the people of Aunu'u to repel a canoe fleet invasion and are now on display at the Jean B. Haydon Museum in Pago Pago. There are several sites associated with legends, buried archeological deposits, wetland taro fields likely of prehistoric age, and remains of an old light beacon (Herdrich 2010).

3.2.3.2 Current Human Uses

Fishing (subsistence, recreational, commercial)

Fish and shellfish are regularly harvested from the island's reefs and shorelines (AS-EPA 2007b). The coral reef fishery value for the lee side of the island (northwestern quadrant) is categorized as medium effort with high complexity, while the rest of reef flat around the island is categorized as medium effort with medium or low complexity. Beyond the island's reef flat, the coral reef is categorized as zero effort (Spurgeon *et al.* 2004), which stretches across about 6 miles (10 km) offshore of southwestern Tutuila and Aunu'u Island, is a popular area for both recreational and artisanal bottomfishermen (Wearing 2011), who target these species along the nearshore banks in 40 to 300 m deep waters (Spurgeon *et al.* 2004). While effort on the bank is not available, there are generally fewer than 12 vessels that bottomfish these nearshore banks (Wearing 2011).

Non-consumptive Recreation and Tourism

Boats providing ferry service to and from Aunu'u may be hired at the boat dock at Au'asi on Tutuila. The American Samoa Department of Port Administration maintains facilities at Au'asi and Aunu'u but does not track vessel arrival or departure data in either location (King 2010b). Aunu'u is popular for hiking and school tours. The coral reef surrounding Aunu'u is considered low use for recreational snorkeling (Spurgeon *et al.* 2004).

Research

A thorough review of the existing marine research and resource assessment surveys for the entire archipelago (Kendall and Poti in prep.) indicates a total of twenty surveys have been conducted in the waters around Aunu'u Island that offer comparable data to regions elsewhere in the Archipelago. These surveys occurred in the nearshore aggregate reef and pavement on the northwest side of the island as well as in pavement areas along the Nafanua Bank and to the east of the island. Towed diver and video transects of the area have also been conducted in recent years. Additional, more widely spread surveys are needed to more fully characterize the reef areas and other features within the Aunu'u boundaries.

3.2.3.3 Current Management Regimes

Aunu'u Island is a National Natural Landmark through a program administered by the National Park Service, which does not provide special protections or regulations. The management programs described for Fagatele Bay apply to Aunu'u Island.

Enforcement

Enforcement protocols described for Fagatele Bay apply to Aunu'u Island.

3.2.3.4 Current Threats to Resources

As of 2000, 476 people live in Aunu'u Village. The population uses an estimated 44,600 gallons of well water per day for domestic use (As-EPA 2007). The wastewater collection system consists of a wet well with a grinder pump, which is discharged as untreated sewage through ocean outfall in shallow water on a fringing coral reef. In 2007, the AS-EPA and U.S. EPA developed a wastewater facilities plan for the village and island of Aunu'u due to "chronic, ongoing, long-term bacterial contamination" on some southeastern beaches. Currents and waves also transport contaminated water to the island's southern and western recreational beaches and to the small Aunu'u harbor. The approach selected for wastewater treatment was to use wetlands as principal treatment facilities and discharge locations and to reserve the existing ocean outfall for emergencies only (AS-EPA 2007b).

The Aunu'u sewage outfall continues to operate without an NPDES permit. The proposed small community wastewater facilities have not yet been fully designed and thus not constructed as a result of lack of funding and prioritization of other projects (Tuitele 2010; Peshut 2010). While listed in 2008, the AS-EPA removed the Aunu'u Sasae watershed from the current 2010 CWA 303(d) impaired water body list as recent data had shown that the overall surface waters were meeting the water quality standard for *Enterococcus* (AS-EPA 2010a).

The mangrove sites at Pala Lake and Aunu'u Fou Elementary School Swamp were classified as in good health, but the School Swamp puzzlenut was considered severely impaired, based on a wetland rapid assessment (Bardi and Mann 2004). While the mangroves on Aunu'u occur inland, and would not be directly managed as part of the designation of sanctuary waters, their importance as part of the Aunu'u Island ecosystem may be considered for any sanctuary management and educational activities.

Ship grounding and derelict vessels also pose threats to resources at this unit.

3.2.4 Ta'u Island

3.2.4.1 Description of Site Setting and Major Attributes

Ta'u Island, part of the Manu'a Island group, is located approximately 150 km northeast of Tutuila Island and about 20 km east of Olosega Island. This extremely steep, 44 square km volcanic island is ringed by sea cliffs, some nearly 600 m high, and has limited low-altitude, level land areas. The island's bathymetry mirrors its topography, with a steeply dropping seafloor. Ta'u has a south-facing embayment, the result of collapse and landslides off the remnants of a southern caldera similar to the Fagatele Bay formation (Brainard *et al.* 2008).

Photo 27: Remnants of a caldera on Ta'u's steep southern shore. Photo: Doug Fenner.

The island of Ta'u drains into two watersheds: Ta'u Matu to the north, and Ta'u Saute to the south of the crescent-shaped collapsed caldera that divides the island between Si'ufa'alele Point and Tufu Point. Ta'u Matu is 14.3 square miles, draining the northern two-thirds of the island, which is incised by several streams. Sea cliffs made of basalt line a large portion of the northern coastline, which is mostly undeveloped (Pederson 2000), although numerous piggeries occur along the northwestern and northeaster areas of the island (AS-EPA 2006). Ta'u Saute is uninhabited and smaller (about 3.3 square miles), with two small streams. Both watersheds are considered pristine, and both fully support swimming in nearshore oceanic waters. Although there are no human impacts to the nearshore waters, there is a moderate to severe potential for sediment runoffs because of the steep inlands slopes and erosive soils (Pedersen 2000). The CALM designations (Category 2 and 3) reflect lack of information on other designated uses and do not indicate any degradation (AS-EPA 2010a).

Photo 28: Turbinaria reniformis *is one form of low-profile coral typical of Ta'u reefs. NOAA CRED Photo.*

The island spans parts of two counties. The western coast and half the southern coast of Ta'u are in Ta'u County; the rest is in Fitiuta County. Less than 5 percent of the land in either county is considered farm land (211 and 122 acres) (USDA 2005). This acreage equates to approximately 4 percent and 3 percent of each county's total land area. About 52 percent of farm land in Ta'u County and 26 percent in Fitiuta County is categorized as commercial (USDA 2005). About 40 percent of the island of Ta'u can be farmed, of which about 2 percent is actively cultivated for subsistence farming, with 3 percent being occupied with breadfruit and coconut trees (Tuionoula 2010). Taro and other crops are also grown (USDA 2005). Based on this information, agricultural runoff and erosion do not appear to threaten water quality in the nearshore waters around Ta'u (Tuionoula 2010).

Habitats

Most of Ta'u Island is surrounded by fringing reefs (Pederson 2000), characterized by a healthy and diverse coral community. The mapped benthic habitat encompasses only these fringing reefs in the nearshore areas within 0.25 miles of the shoreline. The southern and western nearshore waters are dominated by coral reefs, mostly spur and groove, which covers nearly 50% of the mapped area (Kendall and Poti in prep.). Beyond the fringing reefs are waters that are too deep for satellite mapping. Little is known about these deep water habitats apart from bathymetry.

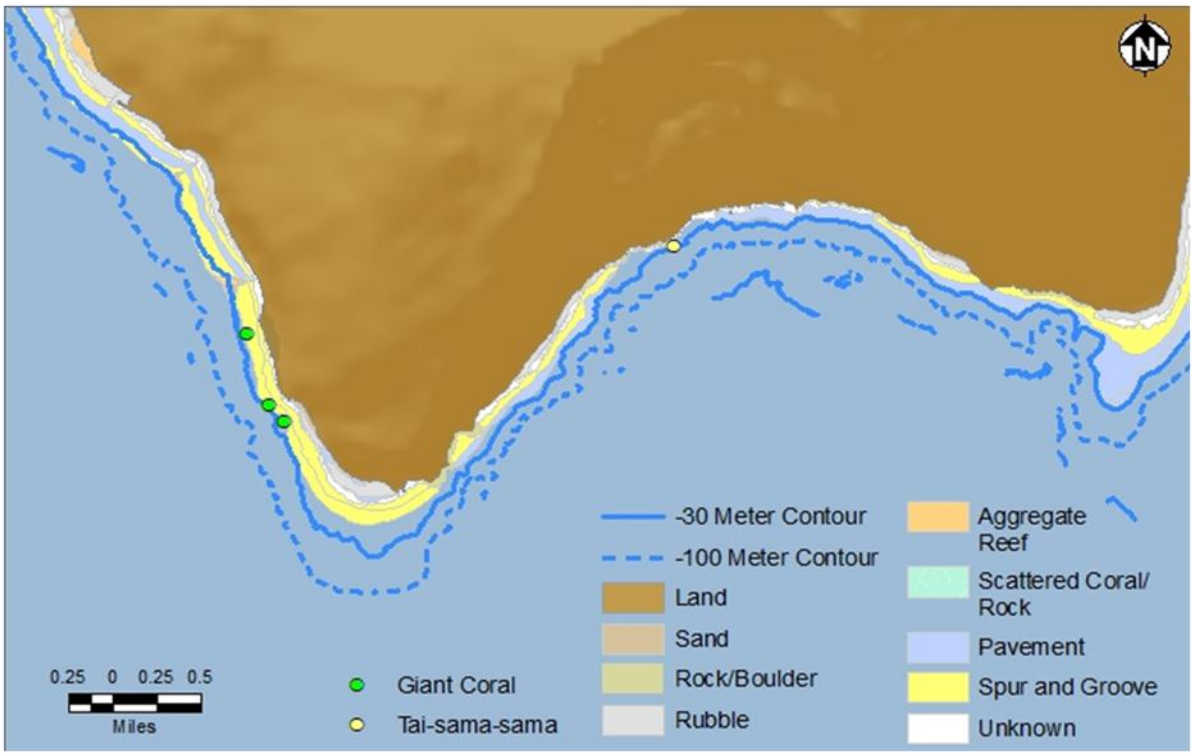

Figure 3-13: Ta'u Benthic Zones.

Turf and coralline algae are much less prevalent here than at other sites in the archipelago. On the east coast, the reef extends up to 152 m (500 feet) wide (Figure 3-13). On the northwest coast, it is up to 650 feet wide (198 m), whereas south of Ta'u Harbor, the reef is only about 300 feet (91 m) wide (Pederson 2000). At high exposure sites, such as Faga, low-profile massive and encrusting coral forms are prevalent (Fisk and Birkehead 2002).

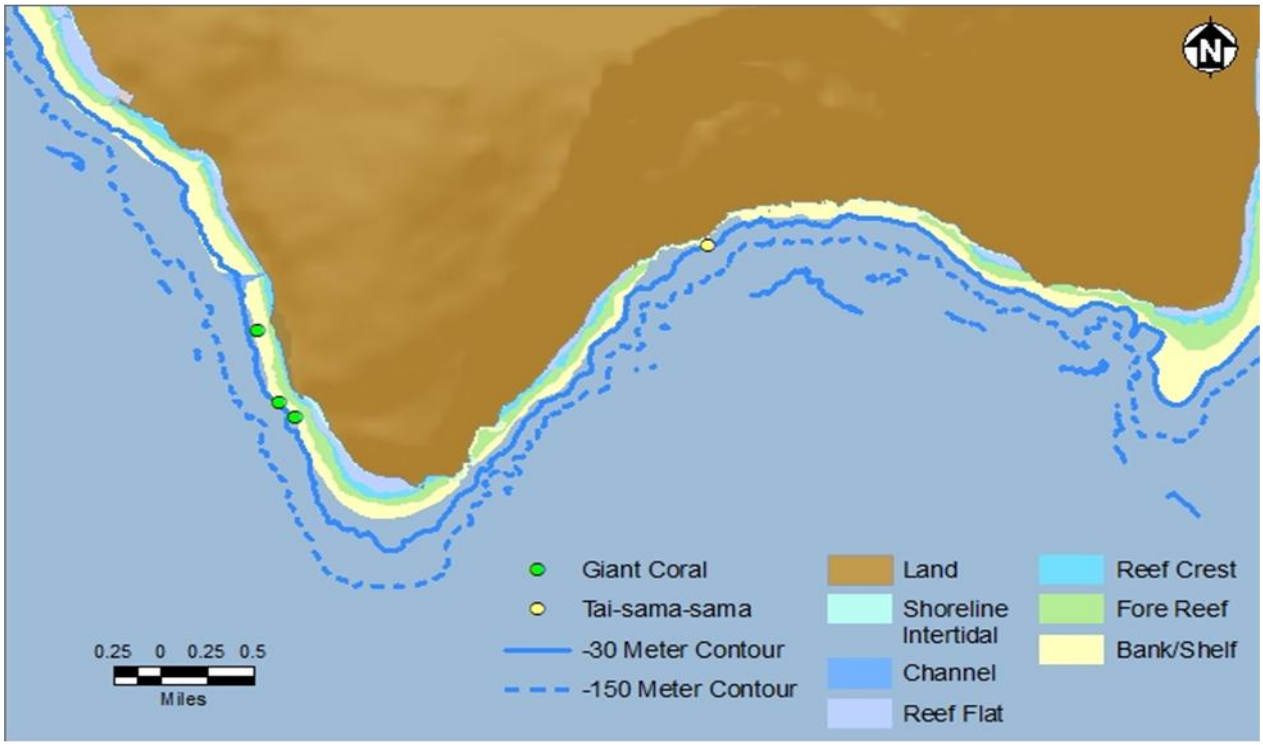

Figure 3-14: Ta'u Benthic Habitats.

Biological Significance

Massive *Porites* coral heads occur in the shallow waters just offshore of Afuli Cove, along the southwestern corner of the island. These huge colonies are among the oldest and largest known in the world (Brown *et al.* 2009), with one colony in 56 feet (17 m) of water measuring 23 feet (7 m) tall and 135 feet (41 m) in circumference. Its age is estimated at 360 to 800 years old, and is quite healthy, with an estimated 98 percent live tissue (Brown *et al.* 2009). While this is the largest known colony around Ta'u, it is surrounded by several smaller, yet quite large colonies between four and 28 meters in circumference. A dozen massive *Porites* colonies between 16 and 24 meters in circumference are located approximately 0.6 miles (1 km) south of these corals. In addition to *Porites* spp., large colonies of *Diploastrea heliopora* are also present.

Photo 29: Western waters offshore from Ta'u are home to some of the world's largest Porites *coral heads. NOAA CRED Photo.*

Nearshore waters in this area receive discharges from three streams that flow through relatively undisturbed uplands (Pederson 2000). These large corals are evidence that environmental conditions have been favorable for coral growth for a long time (Brown *et al.* 2009). The dynamic environmental conditions select for low-profile species that can withstand a high-energy environment (Photos 28, 29). Reefs on the northern side of Ta'u have great diversity of coral and comparably high water quality, a result of low erosion and sedimentation from land.

The western side of Ta'u Island is a regional hotspot for coral and fish richness and possesses a distinct coral community, whereas the eastern side is a hotspot for coral cover and richness. Coral cover and fish biomass values are relatively lower in the southern and southwestern nearshore waters relative to all of American Samoa (Kendall and Poti in prep.).

In addition to the large coral colonies, the north and west sides of Ta'u Island shelter a large population of the giant clam, second in importance only to Rose Atoll (Fenner *et al.* 2008b). The south side of Ta'u is completely devoid of manmade structures and habitation, representing natural conditions (Pederson 2000).

Cultural Significance

Ta'u has 82 known historic properties, including prehistoric villages, star mounds, legend sites, wells, fish bait cups, petroglyphs, and buried archeological deposits; archeological surveys conducted to date have been primarily coastal surveys (Herdrich 2010). A number of culturally significant sites and archaeologically relevant sites on Ta'u are reviewed in Van Tilburg (2007). Faga, Toa, and Saua are three ancient villages located along the northern coast of the island. Two naturally occurring boulders offshore from Saua make up the legendary site Luama'a Tupua, where the parents of the god Tagaloa-lagi turned to stone after they swam from Atafu Island in the Tokelaus to Ta'u. Two rocks in the vicinity represent their petrified bodies and the creation of the first people. On the west coast, there are 12 bait cups and two or three whetstones carved into the sole stone shelf along the Ta'u village beachfront. In deep offshore waters at the north end of Ta'u village, Ma'a Fe'e rock represents the devil fish that brought Loloi's canoe to rescue him in the legend of Loloi and the devilfish. South of Ta'u village, near Si'ufaga, lays Vai-o-tuli (which means spring of the flight). According to legend, this reef passage with a spring below the high water mark was the lair of a demon, and the site turtle was able to pass with a rooster's help to reach the beach to lay her eggs.

Another culturally significant site at Ta'u is that of Taisamasama, off the southern coast of the island. Varying legends explain why the waters offshore from Taisamasama have a yellow hue, including that it results from a historical Kava ceremony between significant Samoan chiefs. A more scientific hypothesis for the yellow color on the rocks is the presence of an underwater source of sulphur (A. Green, pers. comm.). The Secretary of Samoan Affairs has expressed interest in including this site within the boundaries of the sanctuary.

3.2.4.2 Current Human Uses

Human use at the Ta'u site is minimal since it is accessible only by boat.

Fishing

In the late 1990s, an estimated 30 people fished with poles, nets, and spears near the village of Faleasao. Fewer than a dozen people regularly fished from the shore near Luma and Tau, while 10 to 20 people fished daily in the nearshore waters around Maia and Fitiuta. No fishing was reported on the southern shores (Pederson 2000). Spurgeon *et al.* (2004) categorize the coral reef fishery values around Ta'u as high effort near the villages of Luma and Maia, medium effort along the north and east coasts, and zero effort along the south and south west coast, which includes the waters of the proposed sanctuary unit. Similar values were assigned for artisanal fishing. While Ta'u-specific information on fishing is not available, an estimated 5,000 pounds of fish and invertebrates per mile of shoreline (1,400 kilograms per km) is harvested by artisanal fishers each year across the Manua Island group (Craig *et al.* 2008).

Non-consumptive Recreation and Tourism

In the late 1990s, up to 100 people were reported to swim and play in the nearshore waters around Faleasao. The waters around Luma, Tau, Maia, and Fitiuta were considered too rough for swimming (Pederson 2000). Access to the southern half of the island requires several hours in a 4-wheel-drive vehicle. The importance of this area is not well known (Pederson 2000), although recreational use is considered low along the entire Ta'u shoreline (Spurgeon *et al.* 2004).

Research

A thorough review of the existing marine research and resource assessment surveys for the entire archipelago (Kendall and Poti in prep.) indicates a total of twelve surveys have been conducted in the waters proposed for the Ta'u Island unit, with three in the area of the giant corals, eight in the nearshore waters along the southern coast, and one off the shelf edge southwest of Si'ufa'alele Point. Towed diver and video transects of the area have also been conducted in recent years (Brainard et al. 2008).

3.2.4.3 Current Management Regimes

The management programs described for Fagatele Bay apply to Ta'u Island. In addition, the National Park of American Samoa Ta'u unit extends from Si'ufa'alele Point to the southeast of the island, to Saua on the east coast of the island, with seaward boundaries 0.25 miles offshore. The park boundary is described at 16 U.S.C. 410(qq). National Park Service general regulations are at 36 CFR Part 2, and the National Park of American Samoa does not have a subset of site-specific regulations. The general NPS regulations prohibit a variety of activity types, including (but not limited to) possessing, destroying, injuring, defacing, removing, digging, or disturbing living or dead wildlife or fish, plants, cultural or archeological resources; and introducing wildlife, fish or plants. The NPAS General Management Plan notes that its management is based on the following direction provided by Congress in Public Law 100-571:

> "preserve and protect the tropical forest and archeological and cultural resources..., and of associated reefs, to maintain the habitat of flying foxes, preserve the ecological balance of the Samoan tropical forest…"
>
> "(a)gricultural, cultural, and gathering uses shall be permitted in the park for subsistence purposes if such uses are generally prior existing uses conducted in areas used for such purposes as of the date of enactment of this Act and if such uses are conducted in the traditional manner and by traditional methods. No such uses shall be permitted in the park other than for subsistence purposes."
>
> "(s)ubsistence uses of marine areas of the park shall also be permitted."

Enforcement

Enforcement protocols described for Fagatele Bay apply to Ta'u Island, although a lack of roads in the area of the proposed sanctuary unit prohibit any land-based patrols, while the rough waters and few boats berthed in the Manu'a group make sea-based enforcement also difficult.

3.2.4.4 Current Threats to Resources

Historically, coral reefs around Ta'u have been in better condition than on more densely populated islands in the territory. However, outbreaks of crown-of-thorns starfish and coral bleaching are potential threats to coral resources (Pederson 2000). Coral disease is also on the increase and may spread to Ta'u.

Hurricanes occasionally cause severe shoreline erosion on Ta'u (Pederson 2000). Erosion near Faga and Lepula was reported to threaten the vehicular road in the 1990s (Pederson 2000). The current state of shoreline erosion is not known. Rising sea level and climate change are expected to increase the frequency and strength of tropical storms, which could intensify shoreline erosion.

3.2.5 Muliāva (Rose Atoll)

3.2.5.1 Description of Site Setting and Major Attributes

Photo 30: A national wildlife refuge, national monument, and Executive Order requiring sanctuary designation are a testament to the significant natural resources present at Rose Atoll. NOAA CRED Photo.

Rose Atoll is approximately 150 miles (240 km) east-southeast of Pago Pago Harbor. It is the easternmost Samoan island and the southernmost point of the United States. The only atoll in the Samoan archipelago and one of the smallest in the world, Rose Atoll consists of about 20 acres of land and 1,600 acres of lagoon surrounded by a narrow barrier reef, which drops to 984 feet (300 m) within 820 feet (250 m) from the reef crest (Brainard *et al.* 2008). The barrier reef drops so steeply that scientists were unable to safely maneuver a research vessel to collect optical data of the reef. Two small islets known as Rose and Sand comprise the land habitat of the atoll and surround its central lagoon, which reaches maximum depths of 100 feet (30 m). Geologically, the atoll is not part of the Samoan volcanic chain (Hart *et al.* 2004). Within the proposed boundary of the Muliāva unit, about 31 miles (50 km) east of Ta'u, lays the submerged volcanic cone known as the Vailulu'u Seamount. In the six years since the most recent bathymetric mapping effort, an 1100 foot (330 m) tall volcanic cone, known as Nafanua, has grown in the seamount's crater. Scientists speculate that Nafanua will breach the sea surface within decades, forming a new island in the Samoan island group. The seamount cone has several types of hydrothermal vents that provide habitat for an unusual group of organisms, ranging from microbial mats to polychaete worms. A thriving population of the eel *Dysommina rugosa* occupies the summit of Nafanua, surviving on crustaceans imported to the system from the water column above (WPFMC 2009a).

The AS-EPA excluded Rose Atoll from its 2010 integrated water quality monitoring and assessment report for logistical and practical reasons, as the land is too small for streams, associated watersheds, or notable freshwater sources (Brainard *et al.* 2008), making an assessment unnecessary.

Habitats (reef zones, pelagic, deep waters)

Most of the area within the 50 nm boundary of the proposed unit is open ocean and too deep to map with satellite imagery. The approximately 0.46 square miles (1.2 square km) of mapped benthic habitat outside the mean low water line of the atoll (i.e. seaward of the refuge) is dominated by coral reef and hardbottom. Spur and groove occupies the fore reef, which is surrounding by pavement and reef rubble in the bank/shelf and bank/shelf escarpment, respectively (Figure 3-15, Figure 3-16). Spur and groove and pavement cover approximately 80 percent of this area (Kendall and Poti in prep.).

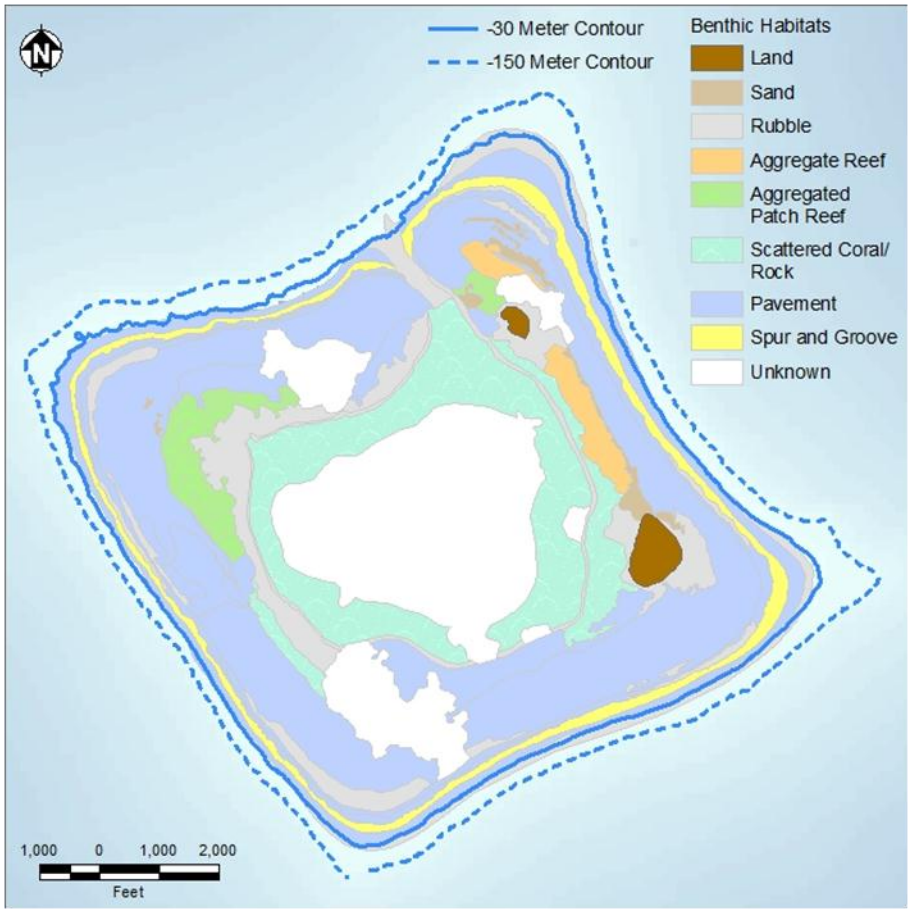

Figure 3-15: Rose Atoll Benthic Habitats.

Rose Atoll is nearly square, with the ocean-side slopes about 1 mile in length. Rose Atoll is one of the world's smallest atolls, and is surrounded for miles on all sides by very deep water, to at least 9,842 feet (3,000 m) (Brainard *et al.* 2008). A coralline algal reef enclose the lagoon, with a single, narrow, shallow channel connecting the lagoon to the sea. Sitting on the reef are two low sandy islets, Rose (14 acres) and Sand (7 acres) that rise a maximum of eight feet above sea level. The lagoon is a maximum of 1.2 miles wide and up to about 65 feet deep. The most significant habitat feature is the relatively pristine coral reefs. The extent of coral reefs in three depth ranges were estimated at 2.5 square miles (6.6 square km [(less than 98 feet (30 m) deep], 3.8 square miles (9.9 square km) [less than 164 feet (50 m) deep], and 4.5 square miles (11.6 square km) [less than 328 feet (100 m) deep] (Spurgeon *et al.* 2004). The seafloor immediately adjacent to the exposed reef is very steep, with smooth sides, while the forereef has generally high habitat complexity (Brainard *et al.* 2008). Coral cover is high along the fore reef, while coralline algae dominate the back reef and reef crest (Figure 3-16).

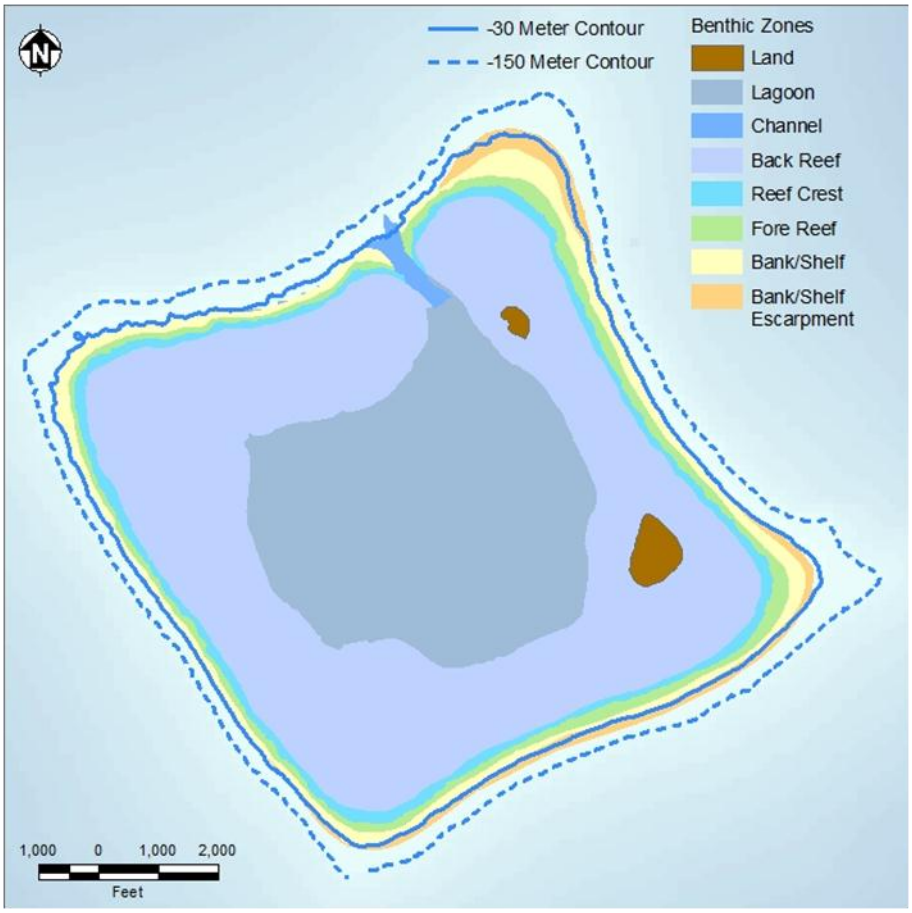

Figure 3-16: Rose Atoll Benthic Zones.

Biological Significance

Rose Atoll is a distinct bioregion within the archipelago and is positioned upstream in the South Equatorial Current relative to the rest of the Samoan Archipelago. Because of its position in the current, Rose Atoll may be isolated from larval sources and less resilient to disturbance, according to analysis of larval connectivity in the region (Kendall and Poti in prep.). Rose Atoll is a hotspot for fish biomass and has a unique coral community (Kendall and Poti in prep.). It is also dominated by crustose coralline algae and has a unique algal community (Tribollet et al. 2010). Rose Atoll supports the highest densities of the giant clam *Tridacna gigas* in the Samoan archipelago (Green and Craig 1999). More than 93 percent of the adult brood stock of giant clams in the Samoan archipelago is within its protected lagoon. Although similar suitable habitat for the giant clam exists elsewhere in American Samoa, such as on Tutuila and Upolu in the Independent State of Samoa, these unprotected populations have been severely depleted (Green and Craig 1999). Elsewhere in the Pacific Islands (Fiji), the giant clam has been harvested to local extinction (Ellison 2009). The giant clam population at Rose Atoll has thrived under protection and has proved to be resilient to injury from a ship grounding and fuel spill in 1993, suffering less than 1 percent mortality from the grounding (Green and Craig 1999).

Rose Atoll is the primary site for green turtle nesting in American Samoa, where several dozen nests laid annually between October and March (Maison *et al.* 2010). Satellite tagging indicates that this nesting population is highly migratory across the South Pacific (Craig *et al.* 2004).

The Vailulu'u Seamount has a diverse biological community that includes polychaetes, crinoids, octocorals, sponges, and a population of cutthroat eels (Staudigel *et al.* 2006).

Cultural Significance

There are a number of maritime heritage resources at Rose Atoll. They include a Navy survey marker, a Naval Administration era concrete monument from 1920 posting American Samoa's claim to the atoll, and an old *fale* foundation likely used by a family that briefly had a copra plantation on the island in the 19th century (Herdrich 2010). In addition, there are three known late 19th century shipwrecks: the British *Friendship* in 1849, the *Wakulla* in 1853, and the *Good Templar* in 1868 (Van Tilburg 2007).

The relatively pristine marine habitats at Rose Atoll also provide essential cultural resources by maintaining and supporting the traditional spiritual connection with coral reefs. In the Samoan creation legend, the god Tagaloa split a rock into clay, coral, cliffs, and stones (NPAS 2004). These fundamental natural formations are intact at Rose Atoll (Spurgeon *et al.* 2004).

3.2.5.2 Current Human Uses

The most significant "use" of the coral reefs at Rose Atoll is actually known as "non-use benefits" (Spurgeon *et al.* 2004). In general, remote and pristine areas such as Rose Atoll have the highest non-use value. In 2007, the use value of Rose Atoll was estimated to be zero, but the minimal non-use value was $16.89/square mile ($m^2$), by far the highest of all the reefs in American Samoa (Spurgeon *et al.* 2004). Under an optimal management scenario, the non-use value of the coral reefs at Rose Atoll could increase to $95/$m^2$ (Spurgeon *et al.* 2004).

Fishing

In a 2007 analysis of direct and indirect uses of resources at Rose Atoll, the value of fishing was given as zero, indicating that fishing is not an important extractive use (Spurgeon *et al.* 2004). This analysis therefore did not consider any potential fishing occurring in pelagic waters surrounding the atoll.

Non-consumptive Recreation and Tourism

Currently, the Rose Atoll NWR is closed to the public, and special use permits are required from USFWS to conduct scientific research. The USFWS is developing a Comprehensive Conservation Plan for the refuge and may be considering public programs such as environmental education and wildlife observation (USFWS 2009). If this Comprehensive Conservation Plan is approved, some possibility exists for tourism-related snorkeling trips to Rose Atoll. However, the carrying capacity for this activity would have to be carefully studied to ensure that the non-use value was not diminished by human activity (Spurgeon *et al.* 2004).

Research

A total of 39 surveys have been conducted in the spur and groove and pavement areas outside the mean low water line at Rose Atoll that enabled comparison to other islands. An additional 12 surveys have been conducted in the back reef and lagoon within the refuge that have also been used for island comparison (Kendall and Poti in prep.). It has been a site of the 2000, 2002, and 2006 ASRAMP cruises, with oceanographic sampling, mapping, and habitat and fish surveys (Brainard *et al.* 2008). The reports from these multi-discipline research efforts have been used to provide descriptions of Rose Atoll and other sites in this document. In addition, the American Samoa Department of Marine Wildlife Resources (AS DMWR) conducts an annual monitoring at Rose Atoll with local and off-island scientists (King 2010a).

3.2.5.3 Current Management Regimes

The land, lagoon, and fringing reef of Rose Atoll are under the jurisdiction of the USFWS through its National Wildlife Refuge System. The outer boundary of the Rose Atoll NWR is the extreme low water line on the outside reef (Greenwalt 1974). A Memorandum of Agreement between the USFWS and the ASG was enacted in 1993, which outlined research, monitoring, and enforcement within the NWR, but it lapsed in 1999 and has not been renewed. There are no territorial waters surrounding Rose Atoll (Grant 2011b). Rose Atoll NWR is closed to the public and is a no-take marine protected area. Entrance for scientific research requires a special use permit issued by the USFWS. In addition, federal fishery regulations designate all waters shallower than 50 fathoms (300 feet) surrounding Rose Atoll as a no-take area (50 CFR 665.99).

In 2009, Rose Atoll MNM was designated, encompassing the waters of the refuge and extending 50 nm from the mean low water line of the atoll. The MNM is approximately 13,451 square miles. Today, Rose Atoll is designated as both a NWR and an MNM. According to Presidential Proclamation 8337, the Secretary of the Interior has management responsibility for the monument, including Rose Atoll NWR, in consultation with the Secretary of Commerce. The proclamation also stipulates that the Secretary of Commerce, through NOAA, has primary management responsibility regarding management of the marine areas of the monument seaward of mean low water with respect to fishery-related activities. In addition, the proclamation states that the prohibitions required by the proclamation do not apply to the activities and exercise of the USCG and armed forces.

The proclamation directly addresses several matters pertaining to fishing within the monument. It directs the secretaries to prohibit commercial fishing within the monument but may permit noncommercial and sustenance fishing or, after consultation with the ASG, traditional indigenous fishing within the monument. It also directs the secretaries, in consultation with the ASG, to provide a process to ensure that recreational fishing is managed as a sustainable activity.

The proclamation allows that scientific exploration and research may be permitted inside the monument, including any that involves fishing, incidental appropriation, injury, destruction, or removal of monument features for scientific study. However, the Secretaries of Commerce and

of the Interior do not require permits or authorizations from one another for their scientific activities.

The Western Pacific Regional Fishery Management Council is currently developing regulations to implement the fishing restrictions described in the Rose Atoll MNM proclamation.

Enforcement

The information provided for Fagatele Bay applies to Rose Atoll.

3.2.5.4 Current Threats to Resources

Scoping comments identify a concern that the status of Rose Atoll as a National Monument rather than a NWR may open up the possibility of sport and subsistence fishing, which can significantly reduce the biomass and diversity of fish and invertebrates there.

As discussed earlier in Chapter 3, in 1993 the Taiwanese longliner *Jin Shiang Fa* ran aground at Rose Atoll, spilling 100,000 gallons of diesel fuel and other contaminants onto the reef and causing a variety of reef injuries (Green *et al.* 1997). Schroeder *et al.* (2008) found that benthic and reef fish assemblages were still being affected 13 years after the wreck and recommended continued biannual monitoring of these assemblages along with removal of any remaining wreck debris. One cause for these ecological changes may be due to iron from the wreck, a limiting nutrient for plant growth in the ocean, fostering unnaturally high algal growth.

3.2.6 Swains Island

3.2.6.1 Description of Site Setting and Major Attributes

Photo 31: Swains Island is surrounded by a narrow band of reef crest. Photo: Doug Fenner.

Swains Island is low-lying coral atoll located about 200 miles (350 km) northwest of Tutuila. It is approximately 2.4 km in diameter, with approximately 2.6 square km of highly vegetated sand and coral with a maximum elevation of 1.8 m (6 feet) above sea level. There is a brackish lagoon cut off from the ocean, while rainwater collected in catchments is the only freshwater source on the island (Brainard *et al.* 2008). Swains Island is geologically part of the Tokelau volcanic island group and not the Samoan volcanic chain (Hart *et al.* 2004). Swains is a conical emergent seamount and atoll with steep bathymetry immediately adjacent to the fringing reef (Brainard *et al.* 2008). It is privately owned by the Jennings family. The island is generally inhabited by between two and 30 people.

The AS-EPA excluded Swains Island from its 2010 integrated water quality monitoring and assessment report for logistical and practical reasons, as the 6-foot maximum elevation and lack of permanent surface fresh water make an assessment unnecessary. Subsurface freshwater springs may occur on the island. Oceanographic water quality assessments indicate a well-mixed water column with some nearshore areas of low salinity, possibly caused by slow seepage from the lagoon.

Swains Island was once the site of an active copra (dried coconut meat used as food and for extracting coconut oil) plantation. USDA (2005) agricultural census data for Swains Island (about 371 acres in area) couples it with data for Ta'u County (about 5,681 acres in area), rendering it inappropriate for describing the percent of land area currently used for agriculture on Swains Island.

Habitats

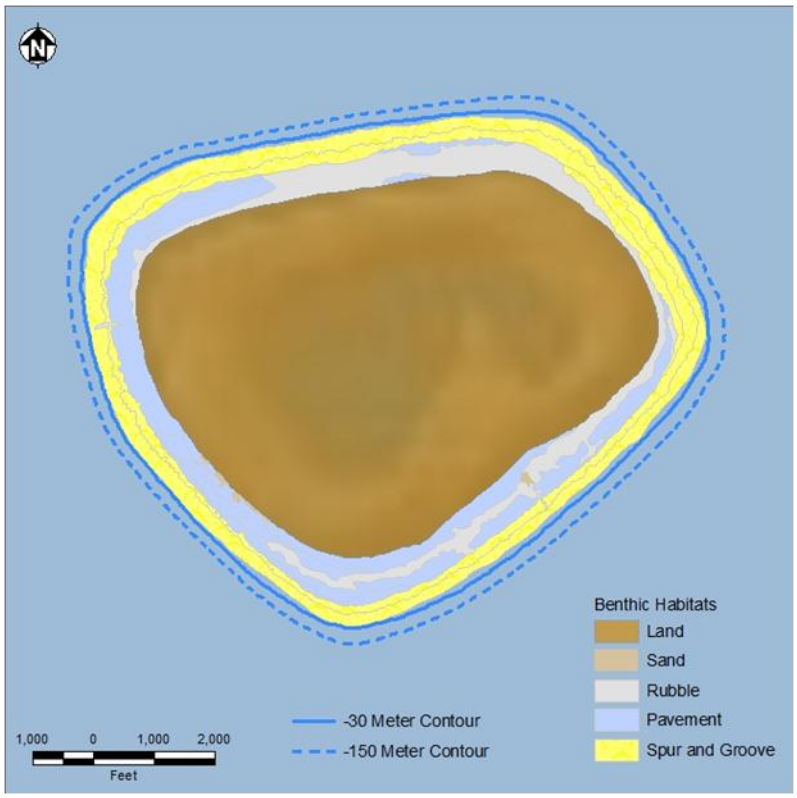

Figure 3-17: Swains Island Habitat Zones.

Most of the habitat surrounding Swains Island is open ocean and too deep to map using satellite imagery. A narrow band of coral reef and hardbottom habitat surrounds the island, with depths of more than 300 m only 0.15 mile (0.25 km) offshore. Almost half of the mapped benthic habitat in this narrow band is covered by spur and groove in the reef crest and fore reef (Figure 3-17). Nearshore, the island is surrounded by a shallow (1 m) reef flat covered mostly by pavement and reef rubble and extending from the shoreline to the reef crest (Figure 3-17). A 2002 survey indicated a mean coral cover of 60 percent, but a 2004 survey that occurred after Hurricane Heta and a crown-of-thorns starfish outbreak indicated that the coral cover was reduced to 30.5 percent. A 2006 survey indicated that live coral cover increased from these damaging events, indicating strong recovery from these natural stressors. The highest live coral cover occurs on the windward northeast region with 50 to 100 percent coral cover, and the lowest on the southwest corner with coral cover ranging from 5 to 75 percent (Brainard *et al.* 2008). Fleshy and crustose coralline algae cover appeared to increase from 32 percent in 2002 to 55 percent in 2006, with higher concentrations of fleshy algae throughout the reef habitat.

Biological Significance

Swains Island often lies in the middle of the South Equatorial Counter Current field. The eastern end of this current generally curls south between about 160^0 and 170^0 W and ultimately joins the southern component of the South Equatorial Current headed west across the Samoan Archipelago (Chen and Qui 2004). Its position makes it isolated from the Samoan Archipelago in terms of larval connectivity, making reef fish and coral communities at risk and relatively slow to recover following a disturbance event. Additionally, the distance these larvae would have to travel to be a source for other locations in the archipelago is likely too great for much connectivity (Kendall and Poti in prep.).

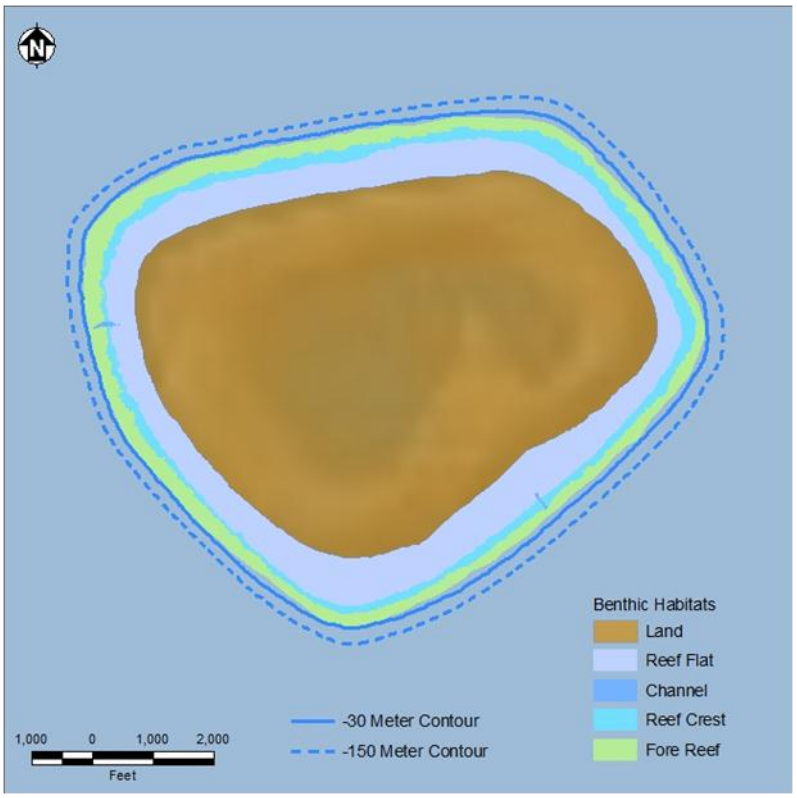

Figure 3-18: Swains Island Benthic Zones.

Swains Island is a hotspot for coral cover, fish biomass and fish richness (Kendall and Poti in prep.). A narrow band of habitat past the reef flat to a depth of 30 m is colonized by coral-dominated communities of relatively complex habitat that includes sand, hard substrate, coral rubble, and exceptionally high island-wide live coral cover (Figure 3-18). Approximately 80 percent of the 0.81 square miles (2.1 square km) of coral habitat is spur and groove and pavement. Coral disease is low at Swains Island, affecting only 0.04 percent of coral surveyed. With the exception of crown-of-thorns starfish, few macroinvertebrates are observed around Swains Island. Mean density of crown-of-thorns starfish increased from approximately 1.0 per ha in 2002 to 5.0 per ha in 2006 and were the most commonly observed type of damage to corals in the 2006 survey. Sea cucumbers (0.1 per ha) and sea urchins (13.7 per ha) were observed in low densities. Giant clams were observed at densities of 0.08 per ha in 2002 and 0.04 per ha in 2004, but were not observed in 2006 (Brainard *et al.* 2008).

Swains Island is characterized by large schools of predators, with barracudas dominating the biomass, followed by jacks and snappers. Overall, the large fish biomass is high around Swains Island, estimated between 0.256 and 0.132 tons per ha (Brainard *et al.* 2008), although overall fish biomass and richness are only slightly higher than the average for all of American Samoa (Kendall and Poti in prep.). Sharks and schools of humphead wrasse are frequently seen in the nearshore waters. Dogtooth tuna are also more common at the island than elsewhere in American

Samoa. The main species of herbivores — parrotfish and surgeonfish — occur in relatively low abundance, while the reef fish *Anthias* are rare throughout the archipelago, except at Swains Island (Fenner *et al.* 2008b). Species richness is approximately 30 fish species per site (Brainard *et al.* 2008), making this site a hotspot for fish species richness (Kendall and Poti in prep.).

Cultural Significance

Archeological surveys have not been conducted at Swains Island, but it likely holds prehistoric sites and buried archeological artifacts. In addition, it may have some *tupua*, and some buildings on the island may be historic (Herdrich 2010).

3.2.6.2 Current Human Uses

As at Rose Atoll, the most significant use of the coral reefs at Swains Island is actually "non-use;" only 10 percent of the total human value is derived from direct use, all in the form of subsistence fishing (Spurgeon *et al.* 2004). In 2007, the total use value of coral reefs at Swains Island was estimated at \$1.81/m^2 (about \$0.11/ m^2 from subsistence fishing) (Spurgeon *et al.* 2004). Under an optimal management scenario, the total value of the coral reefs at Swains Island could increase to \$9.70/m^2 (Spurgeon *et al.* 2004).

Fishing (subsistence, recreational, commercial)

In addition to farming for bananas, taro, breadfruit, and papaya, the population of Swains Island survives through subsistence fishing in the nearshore reef for lobsters and finfish, as well as in the deep water just offshore for coastal and oceanic pelagic species, including atule, tuna, and mahi mahi (Brainard *et al.* 2008). People on Swains Island catch an estimated 1.2 tons of fish and invertebrates per year, not including palolo, which averages of 0.6 tons per square km of reef per year (Spurgeon *et al.* 2004).

Non-consumptive Recreation and Tourism

While the reef surrounding Swains Island is healthy, with high densities of large fish species, snorkeling and scuba diving trips do not currently occur at Swains Island. The distance from population centers and the lack of tourist infrastructure make current or near-future ocean recreation unlikely. Snorkeling may be feasible at Swains Island, although this use is not currently realized (Spurgeon *et al.* 2004).

Research

A total of 34 marine surveys have been conducted around Swains Island to date. The PIFSC CRED conducted in-depth surveys of the biological and physical characteristics of Swains Island, including fish and coral transects, benthic mapping, and oceanographic parameters (Brainard *et al.* 2008, Kendall and Poti in prep.).

3.2.6.3 Current Management Regimes

Swains Island is surrounded by 41 square miles of territorial waters. The coast and waters surrounding Swains Island are subject to territory-wide American Samoa Government coastal resource management measures, such as those administered through the Coastal Management Program, the AS-EPA, and the DMWR. Each of these is described in more detail in section 3.1.5.1.

Enforcement

The information provided for Fagatele Bay applies to Swain's Island.

3.2.6.4 Current Threats to Resources

Vargas-Àngel and Wheeler (2008) report on an invasive Indo-Pacific tunicate spreading across coral reefs at Swains Island between 2004, 2006, and 2008 surveys. They suggest this invasion may be the result of the tunicate rapidly colonizing open spaces created in the reef matrix by stochastic events such as that of Hurricane Heta in 2004. Coral disease, including fungal disease, was recorded at Swains Island for the first time in 2008. Diseased corals were more frequently encountered on the leeward side of the island. The incidence of coral disease was higher at Swains Island than at Rose Atoll or Ta'u (Vargas-Àngel 2010).

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4.0 ACTION PLANS

Introduction

This chapter presents the sanctuary action plans. These action plans are designed to directly address current priority resource management issues and guide management of the sanctuary over the next 5 to 10 years. The action plans identify and organize the wide variety of management tools sanctuary staff will employ toward this end. The eight action plans are:

4.1 – Cultural Heritage & Community Engagement (CH&CE)
4.2 – Marine Conservation Science (MCS)
4.3 – Climate Change (CC)
4.4 – Operations and Administration (O&A)
4.5 – Ocean Literacy (OL)
4.6 – Resource Protection and Enforcement (RP&E)
4.7 – Partnerships & Interagency Cooperation (P&IC)
4.8 – Program Evaluation (PE)

Figure 4-1 demonstrates the hierarchy among components of the action plans, the overarching sanctuary goals and guiding principles, and the ONMS mission. The sanctuary goals, guiding principles and ONMS mission are discussed in Chapter 1.

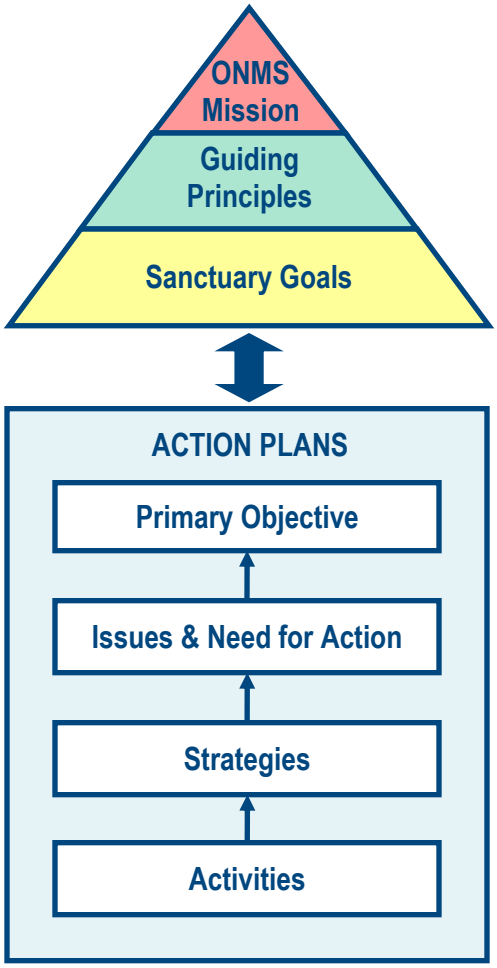

Figure 4-1: Relationship between Action Plan Components and the Overarching Management Framework

Each action plan consists of three principal sections. The *Overview* section states the action plan's objective and provides introductory and supporting information. The *Issues and Need for Action* section summarizes the various resource management issues the action plan addresses. The *Addressing the Issues* section identifies how sanctuary staff will address the issues through management strategies and regulations. In addition, the last action plan provides performance measures to gauge program effectiveness in implementing the other seven action plans.

Each action plan's primary objective provides the unifying theme for the collection of strategies housed within it. In addition to stating the objective, each action plan overview also clarifies which overarching sanctuary goals the action plan addresses.

Members of the public, along with ONMS and sanctuary staff, identified the list of issues addressed in each action plan. Sanctuary constituents identified issues during the public scoping

period (February 9 to March 27, 2009). During this time, the sanctuary held three public forums to solicit public input regarding priority management issues for the next 5 to 10 years, as well as corresponding sanctuary management strategies. After the public scoping period, sanctuary staff organized the scoping comments into 12 issue areas (see Chapter 1).

Strategies begin with a brief background articulating why the activities they contain are important and how they help meet the given action plan's primary objective. Each activity is summarized along with information on its implementation status and, where possible, information on partners involved in implementation. Sanctuary staff have developed the activities using S.M.A.R.T. guidelines, making them: Specific, Measurable, Achievable, Realistic, and Time-bounded. After the strategies is a summary of sanctuary regulations that help address the given action plan's list of issues when appropriate.

ONMS and sanctuary staff will evaluate implementation of each action plan through one or more performance measures, which are provided in the Program Evaluation Action Plan. These measures will demonstrate baseline (current) and future progress toward achieving the desired outcomes stated for each action plan. As part of the effort to improve overall resource management, ongoing and routine performance evaluation has become a national priority for ONMS and, by extension, for the sanctuary. Both location-specific and national programmatic efforts are under way to better gauge the sanctuary's ability to meet its stated objectives and to address the issues identified in this management plan. Beyond these principal purposes, performance evaluation has additional benefits that are described in the Program Evaluation Action Plan.

Implementing Action Plans - Adaptive Management

Adaptive management is a continuous learning cycle designed to inform management actions and decision making based on implementation of management strategies and actions, conducting monitoring and evaluation, and providing feedback to management on the success of meeting the desired outcomes and strategies (Figure 4-2). The sanctuary's adaptive management process includes the following elements: management plan development and review; implementation and enforcement; monitoring and evaluation; integration of ecosystem science and traditional knowledge; scientific research; information management; and education and public outreach. Ecosystem science and traditional knowledge are inputs to the learning process, together with the results of monitoring and evaluation. A comprehensive information management system facilitates compilation of information and data from research, monitoring, plan review, education, and public outreach and also helps to inform research and management priorities. An effective adaptive management process provides managers with timely feedback and information. If the desired outcomes and goals are achieved, then this approach confirms that the management strategies and activities are on the right course. If the results are not achieved, then feedback into the management framework can help identify whether it is a specific action or a group of strategies or activities that may need to change. Periodic updates to the management plan will incorporate feedback from this adaptive management process and result in refined and sometimes new management strategies and activities to meet overall sanctuary goals and desired outcomes.

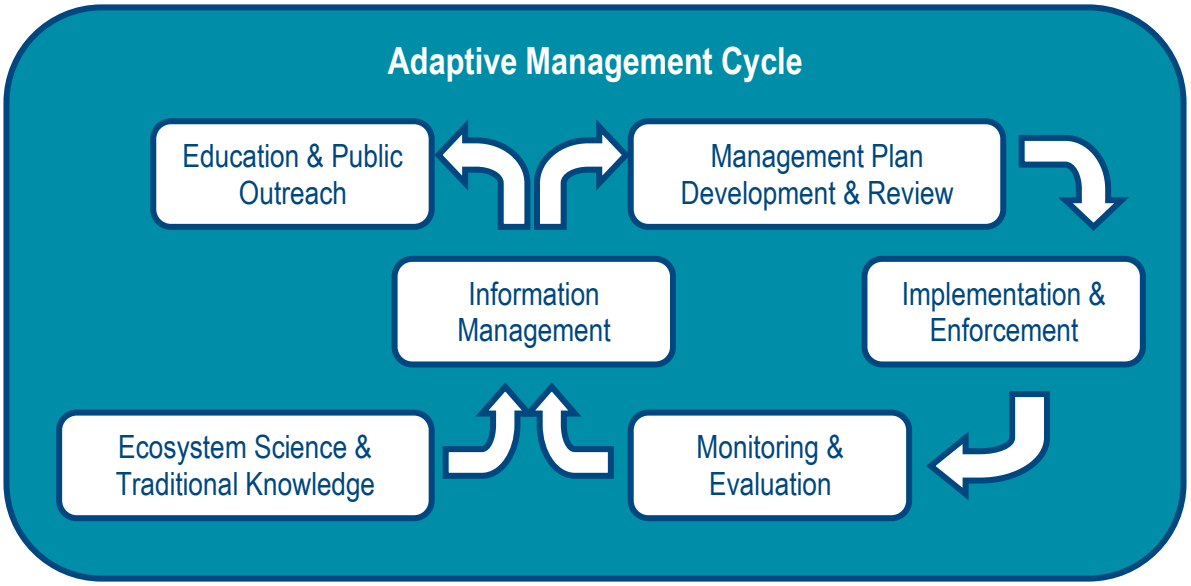

Figure 4-2: Adaptive Management Cycle to Inform Management Decision Making.

Framework for Determining When Sanctuary Staff Should Develop Additional Action Plans

Sanctuary staff must be prepared to address new and emerging issues, including by developing new action plans. Staff, in consultation with the sanctuary advisory council, will consider the following to assess and prioritize new and emerging issues:

- Does the issue pose a potential threat to sanctuary resources or qualities?
- At what rate is the issue or potential threat growing or emerging?
- What is the scale, complexity, intensity, duration, and geographic extent of the issue?
- Does the issue fall within the sanctuary's mandate?
- Does the sanctuary have the jurisdiction or authority to address the issue?
- What is the degree of public and sanctuary advisory council interest in sanctuary involvement in the issue?

Depending on the answers to these questions, sanctuary staff may opt to address the issue in question by one or more of the following means:

- Consulting with territorial and other federal agencies with a leading or shared authority for addressing the issue;
- Commenting on local or regional private sector, or government projects;
- Forming a working group, via the sanctuary advisory council, to develop options for addressing the issue;
- Addressing the issue through existing sanctuary programs (such as education, outreach, research, or monitoring) and action plans; and/or
- Developing a new action plan.

Estimated Cost of Management Plan Implementation

The total estimated cost to fully implement the sanctuary management plan over the next 5 years is $8,176,620. Table 4-1 below displays the estimated costs of implementing each action plan, by year, and shows the percent of the total estimated costs attributed to each action plan. In addition, the total estimated cost of procuring, operating and maintaining a new sanctuary vessel, as called for in activity O&A-4.2, is $8,500,000. The new vessel estimated costs, broken down by year, are displayed below in Table 4-2. The new vessel costs are separated from those displayed in Table 4-1 since: (1) the new vessel is called for as part of the Operations & Administration Action Plan, but would actually support all action plans; and (2) presenting its significant costs as part of the Operations & Administration Action Plan would artificially affect the relative percentages of total costs among all action plans.

The estimated costs of implementing each action plan over 5 years help ONMS allocate annual funds for the sanctuary and are based on approximate calculations. The availability of funds is contingent upon the federal appropriations process and can vary from year to year. As a result of possible changes in federal funding levels certain sanctuary programs may require modification or deferred implementation to reflect budgetary reality. The estimated costs were developed to encompass base budget core operations and programmatic costs. “Core operations” costs include staff and contract labor, training, transportation and travel, utilities, property rental, printing, supplies, equipment, vessels, and vessel maintenance. “Programmatic costs” are the additional costs sanctuary management incurs in carrying out the strategies in the action plans.

Prioritization of activities in the management plan is not a linear process nor necessarily measured by the amount of funds allocated. Several factors apply in setting the implementation schedule and allocating funding. These factors include, but are not limited to: natural and cultural resource needs; agency funding and capacity; completion of necessary planning and environmental review; and community input and support.

Table 4-1: Total Estimated Costs to Fully Implement Action Plans by Year (excluding new vessel).

Action Plan	Estimated Annual Costs					Action Plan 5-Year Total	% of Total
	Year 1	Year 2	Year 3	Year 4	Year 5		
4.1 – Cultural Heritage & Community Engagement	$233,600	$229,580	$191,980	$173,100	$222,700	**$1,050,960**	12.9%
4.2 – Marine Conservation Science	$119,900	$418,160	$146,360	$469,625	$156,120	**$1,310,165**	16.0%
4.3 – Climate Change	$103,800	$159,110	$163,060	$166,950	$210,300	**$803,220**	9.8%
4.4 – Operations & Administration*	$204,400	$171,890	$209,320	$227,950	$260,820	**$1,074,380**	13.1%
4.5 – Ocean Literacy	$780,300	$270,020	$297,400	$299,660	$301,040	**$1,948,420**	23.8%
4.6 – Resource Protection and Enforcement	$105,100	$155,410	$385,930	$222,900	$270,600	**$1,139,940**	13.9%
4.7 – Partnerships & Interagency Cooperation	$110,800	$121,730	$139,655	$158,700	$182,000	**$712,885**	8.7%
4.8 – Program Evaluation	$23,400	$26,210	$26,830	$29,950	$30,260	**$136,650**	1.7%
Total Annual Cost	**$1,681,300**	**$1,552,110**	**$1,560,535**	**$1,748,835**	**$1,633,840**	**$8,176,620**	
Total Estimated 5-Year Cost (excluding new vessel procurement, operations and maintenance)						**$8,176,620**	

*Operations & Administration includes all facilities costs (internet, power, phones, maintenance, *etc.*) and all vessel costs (vessel operation and maintenance) for all action plans. However, all costs associated with the procurement, operation and maintenance of a new vessel are separated in Table 4-2 below because including this significant expense in the table above would artificially affect the relative percentages of total costs among all action plans.

Table 4-2: Total Estimated Costs of New Vessel Procurement, Operations and Maintenance by Year.

Activity O&A-4.2: Maintain vessel(s), including required records, and acquire vessels as necessary	**Estimated Annual Costs**					**5-Year Total**
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	
*New Vessel Procurement, Operations & Maintenance**	$0	$ 6,500,000	$ 700,000	$ 650,000	$ 650,000	**$8,500,000**

* Notes: Acquisition of the new vessel would support all Action Plans. Year 2 cost estimate is for construction of the new vessel (design/hull/engines). Year 3 cost estimate is for fully outfitting the vessel (including electronics, science equipment, crucial spare parts, and materials for galley/staterooms) and shipping to American Samoa. Year 4 and 5 cost estimates are for new vessel operations and maintenance (mooring, shore side power and security, fuel, crew of 3).

4.1 CULTURAL HERITAGE AND COMMUNITY ENGAGEMENT ACTION PLAN

The primary objective of this action plan is to promote stewardship through active engagement of sanctuary communities while incorporating Samoan culture and protecting cultural heritage and maritime heritage resources.

4.1.1 Overview

Links to Other Action Plans
4.4 Operations and Administration 4.5 Ocean Literacy 4.6 Resource Protection and Enforcement 4.7 Partnerships & Interagency Cooperation 4.8 Program Evaluation

The sanctuary's activities aimed at engaging communities and protecting cultural heritage are closely tied and thus combined with one another in this action plan because cultural heritage is an integral part of American Samoan communities. Below is an explanation of how cultural heritage relates to the sanctuary, followed by an introduction to the means through which sanctuary staff engage communities.

Links to Goals
Goal 2 Goal 3 Goal 4 Goal 6

Cultural heritage features a variety of cultural resources, both tangible and intangible, that reflect the cultural identity of a people. This broad category includes within it a smaller subset called maritime heritage — the cultural, archeological, and historical resources specifically associated with coastal and marine areas and seafaring activities and traditions. The broad cultural heritage of American Samoa has developed over the past 3,000 years, emphasizing human connections to the sea, and is reflected in Samoan traditions and lifestyles (*fa'a-Samoa*). Therefore, one component of this action plan proposes activities aimed directly at understanding and protecting maritime heritage resources. Beyond protecting these resources, understanding the larger cultural heritage and connections between people and the marine environment is essential to achieving and maintaining healthy coastal and marine ecosystems. Hence, this action plan also presents strategies and activities designed to preserve and perpetuate the relationship between society and traditions, culture, and history, as they relate to the sanctuary, in ways that recognize and share multiple cultural values and knowledge systems for the benefit of all.

The best way to preserve and perpetuate the relationship between the community and the sanctuary is to actively involve and engage the community in sanctuary management and operations. This end can be accomplished in two ways: (1) developing a structured and organized volunteer program (engaging village councils and youth groups) that enhances the sanctuary's operational capacity and directly engages local communities as sanctuary stewards; and (2) enhancing community involvement in sanctuary management by providing additional support to the sanctuary advisory council. Though unified through shared cultural heritage, local communities are also highly diverse. One important facet of this diversity for the sanctuary is the broad range of interests among sanctuary constituents, which the advisory council is designed to represent. Volunteer programs and advisory councils are tools to increase community involvement in critical aspects of ocean stewardship.

Photo 1: Including traditional dances and customs in sanctuary events is a symbolic means of demonstrating ONMS respect for Samoan culture. Photo: Claire Fackler, NOAA National Marine Sanctuaries.

4.1.2 Issues and Need for Action

4.1.2.1 Fostering Traditional Samoan Stewardship Ethics

Fa'a-Samoa is often heard in American Samoa. It means "the Samoan Way." As noted above, the culture of Samoa is more than 3,000 years old. *Fa'a-Samoa* has kept Samoans strongly nationalistic and cautious about changes that might threaten the traditional way of life. However, *fa'a-Samoa* has an inherent flexibility that has allowed it to withstand and absorb the ways of foreign traders, missionaries, and military forces; it is a dynamic cultural force. Perhaps more than people in any other Polynesian culture, Samoans try to observe the traditional ways on a daily basis.

One aspect of *fa'a-Samoa* is the ancient concept of *tapu* – restricting use in overstressed areas to protect resources. The sanctuary adds a new dimension to local awareness of the treasures of the marine environment and the community involvement needed to protect and preserve it. By connecting the sanctuary with the concept of *tapu*, an increased understanding of resource protection and management can emerge, one which can have vital cultural and environmental significance.

4.1.2.2 Protecting Maritime Heritage Resources

In addition to the conservation and management of natural marine resources, most sanctuaries within the system have the responsibility to preserve and protect special cultural heritage resources, initially highlighted within the National Marine Sanctuaries Act as "cultural, archeological, and historical" resources. Cultural and maritime heritage resources in or near Fagatele Bay as well as proposed additional sanctuary units, and in American Samoa in general, are described in detail in Chapter 3; a brief overview is provided here. The overarching issues that need to be addressed regarding these resources are locating and inventorying them, improving understanding about them through research and interpretation, and protecting these resources from a variety of threats.

There are a wide variety of prehistoric and historic artifacts and sites in American Samoa. Of those related to the ancient past, only a few recur repeatedly in the marine and coastal context: whet stones, petroglyphs, grinding holes/bait cups, and certain coastal villages. In some instances, local sites such as coastal villages have been the subject of archeological investigation and excavation, but these surveys have never included submerged lands. Historic artifacts and sites in American Samoa include shipwrecks, markers, and World War II-era fortifications, gun emplacements, coastal pillboxes and naval aircraft.

Much more remains to be learned about the wealth of prehistoric and historic maritime heritage resources in American Samoa. The potential for additional information from further study of marine and coastal archeological sites in American Samoa remains high given: (1) in other locations, ancient artifacts associated with indigenous host cultures have been located on the seafloor in abundance (McGinnis *et al.* 2004), and (2) the effect of sea level changes on coastal habitation sites (*e.g.*, sea level rise resulting in submergence of archeological sites). Regarding historic resources, unfortunately, like many other places in the Pacific, American Samoa's maritime heritage resources have received very little attention and have generally not been taken into consideration from the perspectives of resource preservation or marine protected area management. Current data (only 10 known historic shipwrecks) are based on informal oral accounts and scattered historical documents. There has been no systematic field survey either by divers or by remote sensing methods directed at maritime heritage resources in American Samoa. To begin addressing this issue, in June 2007 ONMS completed an initial maritime heritage resource inventory for American Samoa to support this management plan and conservation and preservation efforts in the territory (Van Tilburg 2007). This initial resource inventory was document-based and did not involve comprehensive field surveys. There may be significant historic resources that are not recorded in currently accessible documents. The inventory includes a suite of recommendations to address these issues, and activities in this action plan represent a significant step toward implementing the recommendations.

National Historic Preservation Act Section 110 requires, among other things, that federal agencies identify, evaluate, and nominate to the National Register of Historic Places historic properties under their jurisdiction or control, and further that federal agencies establish a preservation program enabling them to do so (16 U.S.C. 470h-2(a)(2)). Some historic sites in or near proposed sanctuary units may be eligible for the National Register of Historic Places, while a few others are already listed on the National Register. The National Register defines the

significance of heritage properties in terms of: (1) association with an important historical event, (2) association with the lives of significant persons, (3) evidence of design or construction that embodies the distinctive characteristics of a type or period, represents the work of a master or possesses high artistic values, or (4) potential for further information important in history or prehistory (NPS 2002). Categories of properties considered under the National Register process include buildings, structures, objects, sites, and districts (NPS 2002). Shipwrecks, depending on their integrity, may be either structures (mostly intact) or sites (broken localized scatter). The National Park Service Register Bulletin 20 ("Nominating Historic Vessels and Shipwrecks to the National Register of Historic Places"; Delgado *et al.*, n.d.) details the way shipwrecks are evaluated under federal preservation management.

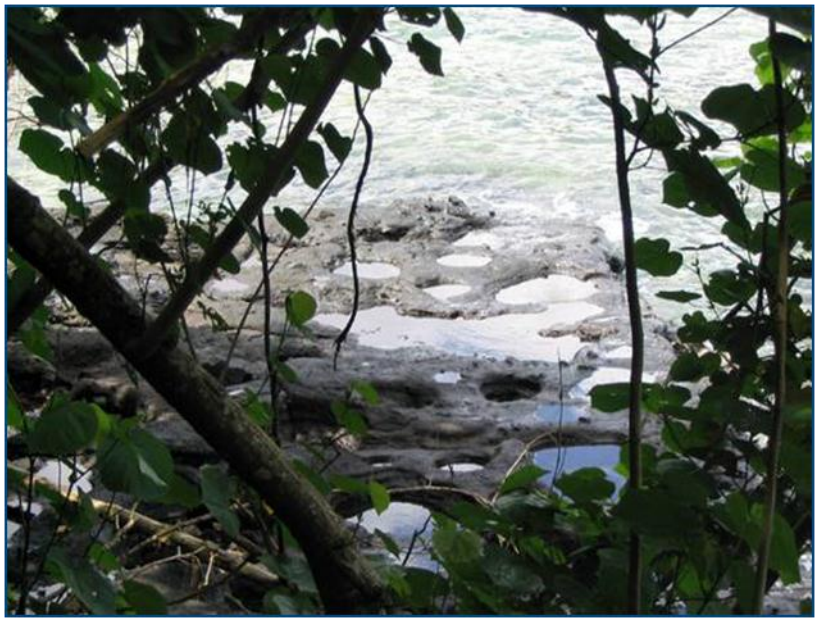

Photo 2: Grinding holes and/or bait cups, carved into the sea-washed reef at Fagatele Bay. Photo: NOAA National Marine Sanctuaries.

The broader category of cultural heritage includes aspects beyond just physical resources, such as oral traditions, practices, and values connected with the sea. In addition, the features of the landscape and seascape serve as visible touchstones of oral history:

> "…these sites are of extraordinary significance to Samoan culture. Compared to all of the archaeological and historic sites that the HPO [Historic Preservation Office] tries to protect, these sites are seen as the most significant to local residents." (Volk *et al.* 1992)

Like natural resources, cultural heritage resources (including maritime heritage resources) can be threatened. Traditions and lifestyles can be forgotten, cultural uses of marine species or ancient archeological sites can be lost, and historic resources such as significant shipwrecks or submerged structures can be damaged or destroyed by both natural and human impacts. True preservation and perpetuation of cultural values and heritage demand positive action rather than just passive acknowledgment. Therefore, efforts are needed to enhance the understanding and appreciation of cultural heritage by: (1) highlighting and incorporating Samoan culture in sanctuary projects and programs; and (2) preserving the sanctuary's diverse cultural heritage by minimizing or avoiding negative impacts to maritime heritage resources.

4.1.2.3 Sanctuary Advisory Council

ONMS is one of many authorities responsible for managing resources and human activities in sanctuary units. As such, it places a high value on working with the community and other regional authorities. Effective management requires an understanding of each authority's roles and responsibilities, as well as coordination among them. This understanding is important not only for staff of the various authorities, but also for their constituents. There is a great diversity of sanctuary constituents. They include, for example, members of the public, fishermen, recreation enthusiasts, researchers, environmental educators, students, tourists, and associated businesses. They also include the other government agencies with jurisdiction in sanctuary waters and over sanctuary resources. Given the diversity of interests among sanctuary constituents, it is important for sanctuary management to consider a wide range of perspectives in making management decisions, while ensuring consistency with the purposes of the NMSA.

It is equally important that sanctuary management and staff make a concerted effort to build a well-informed sanctuary constituency so that members of the community know that they have a nationally significant resource in their own front yards – a national marine sanctuary. A well-informed constituency knows where sanctuary units are, why they are deemed nationally significant, and what activities are appropriate and allowed within them.

To address these issues, the sanctuary needs to maintain a regular forum for gathering input from and informing its diverse constituency. That forum is the sanctuary advisory council – a community-based advisory group consisting of representatives from various user groups, government agencies, and the public at large. The advisory council brings community members together to provide advice to the sanctuary superintendent on sanctuary management and protection, including the management plan review process. The advisory council provides a venue for two-way communication, allowing stakeholder groups to bring their messages to sanctuary management, and for sanctuary management and staff to provide information to diverse constituents. Maintaining the advisory council requires human resources and other forms of support.

4.1.2.4 Volunteers

The sanctuary currently lacks a structured volunteer program to plan, implement, and properly oversee volunteer activities. Volunteers and interns are a critical component of operations and a tremendous asset at other sanctuary sites in the National Marine Sanctuary System, which can serve as models for developing a local sanctuary volunteer program. Volunteer programs can provide a mechanism for involving the community in sanctuary activities, events, and functions.

Once the sanctuary has a volunteer program in place, there are two issues volunteers can help address: (1) a need for more human resource capacity; (2) a need to engage local communities in marine environmental stewardship. The tremendous potential for volunteers to help address the need for more human resource capacity is demonstrated by volunteers at the Channel Islands National Marine Sanctuary, where total annual volunteer service hours in recent years have been approximately equal to the work of eight full-time equivalent (FTE) employees (US DOC 2008). A volunteer program could help the sanctuary staff connect with a greater proportion of

American Samoa's approximately 69,000 residents and 6,500 annual tourists. In turn, engaging local residents as volunteers and therefore representatives of the sanctuary can help further the sense of local pride in the sanctuary and its living and non-living resources. As volunteers seize opportunities to be involved in sanctuary activities — from education and outreach, to research and monitoring, to interpretive enforcement — they will not only be serving to help meet the goals of the sanctuary, but also enhancing their own knowledge and experience and sharing these with other community members. It is important to engage local communities in marine environmental stewardship because these resources are in the front yards of the local communities. The local communities have the potential to affect sanctuary resources, both negatively and positively. With the old adage in mind that people protect what they love and love what they know, local volunteers can help build better-informed communities that care about their impacts on the sanctuary and marine resources in general and learn how to lessen their negative impacts and reinforce positive ones.

4.1.2.5 Relevant Issues Raised During Scoping

Several issues pertaining to cultural heritage and community engagement were raised during the scoping meetings. The public requested that the sanctuary:

- Involve local villages and *aumaga* in enforcement efforts;
- Take culture into account in everything the sanctuary does ;
- Maintain *fa'a-Samoa*;
- Be "transparent, cooperative and coordinated";
- Provide avenues for public input;
- Include a better cross section of people on the sanctuary advisory council (*e.g.*, include recreation and water sports representation).

4.1.3 Addressing the Issues – Strategies for this Action Plan

The strategies and associated activities in this action plan are intended to:

- Highlight and incorporate the Samoan culture in sanctuary projects and programs;
- Actively engage sanctuary communities and volunteers;
- Enhance the understanding and appreciation of cultural heritage;
- Preserve the sanctuary's diverse cultural heritage by minimizing or avoiding negative impacts to maritime heritage resources; and
- Provide critical leadership in the emerging cultural heritage preservation effort across the Pacific Region.

Four strategies have been developed for achieving the desired outcome of promoting stewardship through active engagement of sanctuary communities while incorporating Samoan culture and protecting cultural heritage and maritime heritage resources. The strategies and activities are coded by the acronym for the action plan title, "Cultural Heritage & Community Engagement"

(CH&CE). A summary of strategies and activities is provided in Table 4-3 at the end of this action plan (see p. 202).

- Strategy CH&CE-1: Create a sanctuary-based Samoan cultural heritage outreach and preservation program.
- Strategy CH&CE-2: Develop volunteer programs that increase site visibility while engaging resource users and promoting local stewardship.
- Strategy CH&CE-3: Provide staff support, resources, and guidance to assist with sanctuary advisory council operations.
- Strategy CH&CE-4: Inventory and assess maritime heritage resources within the sanctuary and American Samoa.

Strategy CH&CE-1: Create a sanctuary-based Samoan cultural heritage outreach and preservation program.

Sanctuary staff and management place a high value on partnerships with local communities and maintain great respect for *fa'a-Samoa*. Samoan cultural heritage will be highlighted in a number of ways to better integrate *fa'a-Samoa* into sanctuary programs and policies. Numerous programs and agencies contribute critical components to the cultural resource field. In addition, collaboration with cultural heritage programs at the regional and international levels can open opportunities for heritage exchange and education abroad.

Activity CH&CE-1.1: *Support development of an advisory council working group on Samoan cultural heritage within 2 years.*
Better incorporating Samoan culture into sanctuary management can gain long-term support and greater understanding from the community that represents the host culture of the entire Samoan Archipelago. An advisory council working group on Samoan cultural heritage composed of diverse agency, advisory council, and public membership could provide consensus advice to the advisory council and sanctuary management on sanctuary issues. Sanctuary management will request that the advisory council form this working group within 2 years after the management plan is released.

Activity CH&CE-1.2: *Engage the Samoan cultural heritage working group in development of a Sanctuary Cultural Resources Program within 4 years.*
Sanctuary staff plan to highlight not only the natural resources of the sanctuary units in American Samoa, but also the units' cultural resources. A Cultural Resources Program will be developed with the assistance of the Samoan cultural heritage working group. The program will identify and prioritize opportunities for integrating *fa'a-Samoa* into sanctuary management. During program development, staff and working group members will identify cultural heritage partner programs and agencies and conduct an initial sanctuary cultural heritage workshop for potential collaborating entities.

Activity CH&CE-1.3: *Establish a Sanctuary Cultural Exchange Program within 3 years.*
ONMS has sanctuary sites spread across the United States that serve as the optimal setting to enhance cross-cultural relationships based on common themes regarding cultural and natural resource protection. A Cultural Exchange Program will be established to provide local students and sanctuary volunteers (youth and adults) a unique opportunity to experience the indigenous culture inherent in other sanctuary settings and to share a common stewardship ethic. This program will include not only support for sanctuary site exchanges, but also for the ONMS *Ocean for Life* program.

Activity CH&CE-1.4: *Provide opportunities to promote traditional artisanal crafts and skills throughout the life of the management plan.*
Sanctuary staff will continue to support the traditions and customs of the Samoan culture. One way to do so is to provide mechanisms for these customs to be shared with a larger audience. Sanctuary staff will invite cultural practitioners to promote traditional artisanal crafts and skills at the visitor center and at meetings and conferences held in the territory.

Activity CH&CE-1.5: *Develop education and outreach programs and materials featuring fa'a-Samoa and cultural heritage resources in the sanctuary and American Samoa.*
Samoan cultural resources such as ancient stone structures or archeological sites can provide outreach and education material that features the unique culture of Samoa as well as sanctuary conservation and preservation efforts. *Fa'a-Samoa* and Samoan cultural heritage likewise provide unique perspectives that can enhance education and outreach programs. Programs may include hosting elders to "talk story," featured presentations, and examples of traditional crafts and skills. Materials may include not only brochures and posters, but also static displays with some video and material for higher-end digital displays, kiosks (see Activity OL-2.4), and film creation.

Activity CH&CE-1.6: *Pursue opportunities to preserve, protect, and promote heritage assets through the Preserve America Initiative.*
Preserve America is a federal initiative that encourages and supports community efforts to preserve and enjoy cultural and natural heritage. Preserve America Community status recognizes those communities that use their historic assets for economic development and community revitalization and encourage people to experience and appreciate local historic resources through education and heritage tourism programs. On Friday, April 1, 2010, American Samoa became the 814th community to receive the Preserve America Community designation since the initiative's inception in 2003. The territory was designated for its robust history and living culture, as well as its commitment to American heritage. Sanctuary staff will collaborate with territorial partners to pursue other opportunities under the Preserve America Initiative.

Activity CH&CE-1.7: *Provide technical guidance to the public in establishing a sanctuary friends group.*
If warranted by public interest, sanctuary staff will provide technical guidance to the public regarding establishing a non-profit friends group to contribute to the interpretation and promotion of sanctuary programs and Samoan cultural traditions.

Photo 3: A celebration of American Samoa's Preserve America Community status was held in July 2010, and included christening of the sanctuary's R/V Manumā *(background). Photo: Claire Fackler, NOAA National Marine Sanctuaries.*

Strategy CH&CE-2: Develop volunteer programs that increase site visibility while engaging resource users and promoting local stewardship.

Many sanctuary functions can be enhanced through establishment of a volunteer program that provides essential support for sanctuary projects and builds community support and commitment to sanctuary goals and strategies. Successful volunteer programs are a critical component to the success of sanctuary efforts in American Samoa. Volunteer programs offer an opportunity to build a new base of constituents who are closely connected to and involved in sanctuary efforts. While volunteer programs require staff support, it is well worth providing this support since volunteers can help the sanctuary reach far more people than possible through staff outreach efforts alone. In addition, volunteer programs engage local resource users and develop increased stewardship of marine resources. In turn, local community members who become volunteers have unique opportunities to gain experience and knowledge in fields ranging from education and outreach, to research and monitoring, to interpretive enforcement. Volunteers also have opportunities to participate in special sanctuary programs such as inter-sanctuary cultural exchanges. Furthermore, volunteers who demonstrate exemplary community service have opportunities to be recognized for service locally as well as nationally as the National Marine Sanctuary Foundation Volunteer of the Year.

Activity CH&CE-2.1: *Develop a volunteer operations plan within 1 year.*
Sanctuary staff will develop a volunteer operations plan to provide a structured volunteer program including planning, implementing, and properly overseeing volunteer activities. This operations plan will outline volunteer opportunities in existing programmatic areas and identify other specific volunteer events such as Earth Day.

Activity CH&CE-2.2: *Develop and implement a volunteer tour guide training program for residents in villages adjacent to sanctuary units within 3 years.*
A formalized program of local volunteer tour guides could bring more users to the sanctuary and enhance the experience for visiting guests. Tour guides can be trained as naturalists to lead hiking and snorkeling and other tours for school groups, community groups, and off-island

visitors. A formal arrangement should also be made with the cruise ships to coordinate guided tours for visitors to American Samoa.

Activity CH&CE-2.3: *Partner with village and youth groups to periodically maintain beaches and coastal areas adjacent to sanctuary units in American Samoa.*
Engaging villagers and youth groups in beach maintenance will ensure that the coastal areas remain clean with little or no additional resources from the sanctuary staff. Regular monitoring of marine debris will provide sanctuary management with information on abundance and types of debris. The next step would be to remove it, if possible. Sanctuary staff will work with church groups, village groups, youth groups (including the Boy Scouts), local resource agencies, and others to participate in coastal cleanup events. These events will happen annually, unless debris monitoring data indicate the need for a different timeframe, or in the case of an unusual event (*e.g.*, natural disaster or a cargo spill). This activity will be coordinated with the marine debris assessment and monitoring program described in Activity RP&E-3.2.

Activity CH&CE-2.4: *Develop and implement a program to formalize community involvement in sanctuary stewardship within 3 years.*
Interpretive enforcement approaches, such as Community-Oriented Policing and Problem Solving (COPPS), seek voluntary compliance with sanctuary regulations. Increasing the public's knowledge and understanding of the importance of sanctuary regulations will help to gain the greatest level of compliance and public support of sanctuary goals, as well as foster a sense of stewardship among sanctuary users and the local communities. This program will emphasize informing the public through educational messages and literature about responsible behavior before resources can be adversely affected. Training community members to effectively share this information will also be a priority. Included will be efforts to have villagers keep records of visitor use (how many people, what were they doing, how many vessels fishing, and when). Records will be collected by sanctuary staff on a quarterly basis. The information gathered will be analyzed for trends and presented to the villages.

Activity CH&CE-2.5: *Develop a visitor center interpretive training and community volunteer program within 4 years.*
Youth, community, and elder members will have an opportunity to apply for and receive development in interpretive skills and training as visitor center guides for major events held at the facility such as cruise ship visits, educational tours, and special V.I.P. activities.

Strategy CH&CE-3: Provide staff support, resources, and guidance to assist with sanctuary advisory council operations.

Adequate support of the advisory council ensures continued public input to management decision-making, while expanding public awareness of the sanctuary and the related marine resource management issues. The activities within this strategy reflect the effort necessary to support, maintain, and operate the advisory council.

Activity CH&CE-3.1: *Provide staff support for the advisory council and affiliated working groups and subcommittee meetings throughout the life of the management plan.*
Sanctuary staff help develop meeting agendas, secure meeting locations, equipment, and other logistics, advertise meetings locally, send out reminders about upcoming meetings, prepare and distribute meeting materials, and set up the meeting room. Sanctuary staff also participate in and as necessary facilitate advisory council, working group, and subcommittee meetings. Staff help brief advisory council members on advisory council-related matters, field questions, and direct members to other staff for additional information, as appropriate. The advisory council coordinator ensures that meeting minutes are taken, records the meeting electronically or by other means, if needed or desired, and conducts meeting follow-up.

Activity CH&CE-3.2: *Facilitate communication between sanctuary staff and advisory council members throughout the life of the management plan.*
Sanctuary staff should enhance communications with advisory council members by instituting regular methods of communication with the council. These methods could include, but are not limited to, annual presentations by the sanctuary superintendent and staff, regular meetings or conference calls with the chair and other council officers, and e-mails or other updates provided to council members on a regular basis to keep them abreast of sanctuary projects and issues of concern.

Activity CH&CE-3.3: *Amend the advisory council charter every 5 years, or as needed.*
An advisory council's charter is the instrument used to officially establish the council, providing the scope of the council's responsibilities and serving as the constitution for the council's operation. About 6 months before the expiration date, the sanctuary superintendent and advisory council coordinator should review the charter, discuss the past operation of the council with council members and with appropriate sanctuary and ONMS staff, review the charters of other sanctuary sites, and consider what amendments should be made to the existing charter.

Activity CH&CE-3.4: *Review advisory council membership every 3 years for non-government members and as needed for government members.*
Non-governmental seat representatives serve 3-year terms, allowing for a 3-year membership review cycle. At the end of each 3-year term, or as needed (*e.g.*, when members resign prior to completion of their term), new members are selected through a public, competitive recruitment process. Current members whose terms have expired have the opportunity to apply for reappointment during the recruitment process. Each agency that holds a governmental seat (or is made a non-voting member) is responsible for appointing its representative to the advisory council. The governmental representatives are appointed indefinitely instead of for a 3-year term. The sanctuary manager may consult with the given agency regarding appropriate qualifications for its appointees.

Activity CH&CE-3.5: *Conduct basic advisory council member orientation and training for new members.*
Sanctuary staff conduct multiple levels of basic orientation and training when a new council member (either governmental or non-governmental) first joins the council and periodically after for members who have served on the council for a number of years. The sanctuary superintendent and advisory council coordinator provide a general orientation either one-on-one or with a small group, if a

number of new members are starting around the same time. The sanctuary superintendent and advisory council coordinator also provide seat-specific orientation to describe the role and scope of the seat, emphasize the need to continuously reach out to the new council members' constituents, describe how past council members fulfilled the responsibilities of the seat, and highlight tools available to the member to reach out to his or her constituents. Sanctuary staff also furnish informational material to council members as part of a Site Advisory Council Handbook.

Strategy CH&CE-4: Inventory and assess maritime heritage resources within the sanctuary and American Samoa.

Appreciating and preserving maritime heritage resources begins with identifying, documenting, and interpreting known and unknown maritime heritage resources. This effort is a combination of documentary research and field assessment or site interpretation and is a key component of understanding the significance of maritime heritage resources at the local, regional, and national levels. Coordination and collaboration with partner programs and agencies are critical to conducting field surveys in remote Pacific areas. Often, maritime heritage projects are conducted as or with multidisciplinary projects in coordination with ocean marine resource survey efforts.

Activity CH&CE-4.1: *Identify, collect, and review existing documents, publications, and data sets pertinent to maritime heritage resources in American Samoa.* Resource surveys begin with archival documentary research. Compiling existing documents, maps, and associated data sets establishes a baseline of existing information that can assist in developing research plans and prioritizing survey areas. This phase involves research time and travel support for data collection from regional and national archives.

Photo 4: One of several fishing vessels washed ashore in American Samoa near Amouli, Tutuila. Photo: Irene Kelly, NOAA Fisheries.

Activity CH&CE-4.2: *Conduct bi-annual field surveys and individual site assessments to locate, identify, and record known and unknown maritime heritage resources.*
Effective inventory and monitoring efforts must be conducted to provide proper preservation management for maritime heritage resources in the sanctuary. Methods include remote sensing (side scan and magnetometer) surveys to locate potential heritage targets; noninvasive scuba diving surveys to characterize individual sites; and (when appropriate) excavation and conservation of selected maritime heritage materials for research, education, and outreach purposes. Maritime heritage resources are often submerged, but can also be associated with coastline beach areas, so shoreline terrestrial surveys are a part of any research plan.

Activity CH&CE-4.3: *Initiate maritime heritage and cultural resource surveys at the remote atolls of American Samoa (Rose Atoll and Swains Island) within 2 years.*
There is a need for initiating cultural resource and maritime heritage resource surveys at Rose Atoll and Swains Island. Since project opportunities at these distant locations are rare, the cultural heritage surveys should combine remote sensing, diving, near shore, and terrestrial methods. Incorporating these cultural heritage surveys onto multidisciplinary platforms may make the remote operations more efficient.

Activity CH&CE-4.4: *Identify and nominate cultural and maritime heritage resources eligible for nomination to the National Register of Historic Places within 5 years.*
As more information is gathered regarding cultural and maritime heritage resources in the sanctuary and American Samoa, some may be identified as resources worthy of preservation. If so, these resources should be nominated to the National Register of Historic Places per the National Historic Preservation Act Section 110 requirement. Nomination will provide national attention to the unique cultural and maritime heritage resources of American Samoa.

Activity CH&CE-4.5: *Develop education and outreach opportunities featuring maritime heritage assets in the sanctuary and American Samoa.*
Maritime heritage resources such as historic shipwrecks often provide outreach and education material that can feature the unique history of American Samoa, aspects of the marine ecosystem such as deep "artificial" reefs, and more. Possible heritage outreach products include brochures, short films, informative websites, and shipwreck "trail" guides. Maritime heritage activities such as presentations, artifact conservation, and hands-on training in maritime archeology survey techniques can provide the community with unique opportunities to experience marine science and ocean stewardship.

Table 4-3: Summary of Strategies and Activities for the Cultural Heritage and Community Engagement Action Plan.

STRATEGIES AND ACTIVITIES	
Strategy CH&CE-1: Create a sanctuary-based Samoan cultural heritage outreach and preservation program.	
Activity CH&CE-1.1:	Support development of an advisory council working group on Samoan cultural heritage within 2 years.
Activity CH&CE-1.2:	Engage the Samoan cultural heritage working group in development of a Sanctuary Cultural Resources Program within 4 years.
Activity CH&CE-1.3:	Establish a Sanctuary Cultural Exchange Program within 3 years.
Activity CH&CE-1.4:	Provide opportunities to promote traditional artisanal crafts and skills throughout the life of the management plan.
Activity CH&CE-1.5:	Develop education and outreach programs and materials featuring *fa'a-Samoa* and cultural heritage resources in the sanctuary and American Samoa.
Activity CH&CE-1.6:	Pursue opportunities to preserve, protect, and promote heritage assets through the Preserve America Initiative.
Activity CH&CE-1.7:	Provide technical guidance to the public in establishing a sanctuary friends group.
Strategy CH&CE-2: Develop volunteer programs that increase site visibility while engaging resource users and promoting local stewardship.	
Activity CH&CE-2.1:	Develop a volunteer operations plan within 1 year.
Activity CH&CE-2.2:	Develop and implement a volunteer tour guide training program for residents in villages adjacent to sanctuary units within 3 years.
Activity CH&CE-2.3:	Partner with village and youth groups to periodically maintain beaches and coastal areas adjacent to sanctuary units in American Samoa.
Activity CH&CE-2.4:	Develop and implement a program to formalize community involvement in sanctuary stewardship within 3 years.
Activity CH&CE-2.5:	Develop a visitor center interpretive training and community volunteer program within 4 years.
Strategy CH&CE-3: Provide staff support, resources, and guidance to assist with sanctuary advisory council operations.	
Activity CH&CE-3.1:	Provide staff support for the advisory council and affiliated working groups and subcommittee meetings throughout the life of the management plan.
Activity CH&CE-3.2:	Facilitate communication between sanctuary staff and advisory council members throughout the life of the management plan.
Activity CH&CE-3.3:	Amend the advisory council charter every 5 years, or as needed.
Activity CH&CE-3.4:	Review advisory council membership every 3 years for non-government members and as needed for government members.
Activity CH&CE-3.5:	Conduct basic advisory council member orientation and training for new members.

STRATEGIES AND ACTIVITIES	
Strategy CH&CE-4: Inventory and assess maritime heritage resources within the sanctuary and American Samoa.	
Activity CH&CE-4.1:	Identify, collect, and review existing documents, publications, and data sets pertinent to maritime heritage resources in American Samoa.
Activity CH&CE-4.2:	Conduct bi-annual field surveys and individual site assessments to locate, identify, and record known and unknown maritime heritage resources.
Activity CH&CE-4.3:	Initiate maritime heritage and cultural resource surveys at the remote atolls of American Samoa (Rose Atoll and Swains Island) within 2 years.
Activity CH&CE-4.4:	Identify and nominate cultural and maritime heritage resources eligible for nomination to the National Register of Historic Places within 5 years.
Activity CH&CE-4.5:	Develop education and outreach opportunities featuring maritime heritage assets in the sanctuary and American Samoa.

4.1.4 Addressing the Issues – Strategies from other Action Plans

A number of strategies from other action plans either directly or indirectly help to address the issues identified in this Cultural Heritage & Community Engagement Action Plan:

- Strategy MCS-3: Interpret and communicate the results of scientific activities taking place in and around the sanctuary throughout the life of the management plan.
- Strategy CC-4: Partner to promote public awareness about potential climate change impacts to sanctuary units within 5 years.
- Strategy O&A-2: Assess and, as necessary, enhance human resource and organizational capacity over the life of the management plan.
- Strategy O&A-3: Assess and, as necessary, enhance sanctuary physical infrastructure and facilities over the life of the management plan.
- Strategy OL-1: Open and operate a Sanctuary Visitor Center of American Samoa.
- Strategy OL-2: Increase outreach to communities in American Samoa and abroad.
- Strategy OL-3: Increase ocean literacy through development and implementation of formal education programs and materials in American Samoa.
- Strategy OL-4: Develop creative programs for student participation that encourage learning about sanctuary resources and ocean stewardship.
- Strategy RP&E-1: Develop and disseminate education and outreach materials regarding all new regulations (including boundaries) within 1 year.
- Strategy RP&E-3: Reduce the effects of marine debris on sanctuary resources through targeted removal efforts and increasing public awareness of marine debris hazards.
- Strategy RP&E-5: Facilitate research and monitoring regarding the effect of land-based sources of pollution on sanctuary resources and develop outreach materials to share the results.
- Strategy P&IC-1: Cultivate the AS DOC partnership.
- Strategy P&IC-2: Support cooperation and coordination among agencies and organizations throughout the life of the management plan.

4.1.5 Addressing the Issues – Regulations

One sanctuary regulation is directly associated with sanctuary cultural heritage. In summary, this regulation prohibits removing, damaging, or otherwise harming historical or cultural resources.

Sanctuary regulations are available at 15 CFR Part 922 Subpart J.

Photo 5: NOAA ONMS and Fagatele Bay National Marine Sanctuary leadership and staff, NCCOS scientists and AS DOC leadership met with members of the Fono in 2010 to discuss possible sanctuary designation for special marine areas near the communities the Fono members represent. Photo: NOAA National Marine Sanctuaries.

4.2 MARINE CONSERVATION SCIENCE ACTION PLAN

The primary objective of this action plan is to improve ecosystem-based management by providing a strong foundation of science and increasing knowledge of sanctuary marine ecosystems.

4.2.1 Overview

Links to Other Action Plans

- 4.1 Cultural Heritage & Community Engagement
- 4.3 Climate Change
- 4.4 Operations and Administration
- 4.5 Ocean Literacy
- 4.6 Resource Protection and Enforcement
- 4.7 Partnerships & Interagency Cooperation
- 4.8 Program Evaluation

Links to Goals

- Goal 1
- Goal 4
- Goal 5
- Goal 6
- Goal 7
- Goal 9

ONMS marine conservation science efforts are driven by the related NMSA purpose: "to support, promote, and coordinate scientific research on, and long-term monitoring of, the resources of these marine areas" (16 U.S.C. 1431(b)(5)). The mission of ONMS is "to serve as trustee for the nation's marine protected areas to conserve, protect and enhance the biodiversity, ecological integrity, and cultural legacy of these ecosystems." Accomplishing this mission requires a rigorous, objective, scientific foundation for understanding ecosystem structure and function, evaluating the status of sanctuary resources, understanding socioeconomic impacts of management actions, and implementing effective, sustainable, and adaptive management strategies (Gittings *et al.* 2003). Sanctuary research and monitoring efforts focus on the development and application of a program to support this scientific foundation. Priority science needs are identified primarily through the management plan review process and periodic reporting on threats, resource status, and management responses in sanctuary condition reports.

4.2.2 Issues and Need for Action

4.2.2.1 Assessing Baseline Conditions

Several long-term monitoring studies have been conducted in Fagatele Bay, including studies by Dr. Charles Birkeland and Dr. Ali Green on recovery and resilience of coral reef benthic communities from a crown-of-thorns starfish (*Acanthaster planci*) outbreak in the early 1980s. NOAA CRED, through the ASRAMP research cruises, has conducted extensive benthic habitat mapping, ecological and environmental assessment and monitoring, and applied management-relevant research in the sanctuary and American Samoa. These studies provide invaluable information on the resiliency of the ecosystem and are essential to informing management decisions. The Birkeland monitoring studies provide the longest-term dataset for Fagatele Bay, and the impressive historical data for some of these studies are unprecedented for coral reef research. With the inclusion of additional units in the sanctuary beyond Fagatele Bay, it is imperative that marine conservation science efforts include identifying current baseline conditions at the proposed sanctuary units. This work includes mapping habitats to identify the diversity, extent, and location of various habitat types within each sanctuary unit.

4.2.2.2 A Formal Science Program

Sanctuary management necessarily includes assessing scientific needs and identifying means to meet them; however, there is currently no formal science plan that articulates and prioritizes sanctuary science needs and activities. Having such a plan is especially important given that much research conducted in the sanctuary is conducted by outside researchers. Three types of research projects provide information for sanctuary management:

1. Intramural research projects funded by ONMS and conducted by sanctuary staff;
2. Extramural research projects funded and conducted by outside agencies and institutions; and
3. Directed research projects carried out by outside agencies and institutions with guidance and support from sanctuary staff and ONMS headquarters.

Photo 6: A NOAA researcher surveys benthic habitat at Rose Atoll in 2006. NOAA Photo: By Jean Kenyon.

Thus, the sanctuary has significant partnerships with researchers from other government agencies, universities, and organizations who contribute invaluable research to the body of sanctuary knowledge (for example, see Pacific Islands Ocean Observing System below). Having a science plan will help sanctuary management and the sanctuary research coordinator stress the need for research projects that address current sanctuary science needs and priorities.

A great variety of research projects are conducted within the sanctuary, and sanctuary staff must monitor those efforts, process permit applications and issue permits for them as necessary and appropriate, compile and assess research results, and synthesize research results and scientific information to the public in an accessible way.

Beyond establishing baseline conditions at all sanctuary units, discussed above, developing a long-term monitoring program for all sanctuary units is a priority science need. These basic elements of marine conservation science allow researchers and in turn sanctuary management to identify changes in sanctuary conditions over time. Identifying changing conditions is important in the development of sanctuary assessment tools such as condition reports (see Chapter 1) and to assessing effectiveness of and prioritizing sanctuary resource protection efforts. Maximizing

the value of monitoring requires developing monitoring protocols so that comparable data are collected in a consistent manner over time.

Pacific Islands Ocean Observing System (PacIOOS)

PacIOOS is intended to create an effective partnership of data providers and users, working together to develop, disseminate, evaluate, and apply new ocean data and information products designed specifically to address the needs of the communities, businesses, and resources that call the Pacific home. Sanctuary staff actively participated in a PacIOOS American Samoa stakeholder workshop that was held in June of 2010 to identify:

- Outstanding model, observational needs, and gaps that PacIOOS could deploy assets to address in American Samoa;
- Specific data products PacIOOS should be producing, and whom those products should be targeting; and
- How PacIOOS can enhance existing projects and partnerships and increase leveraging opportunities in American Samoa.

4.2.2.3 The Link Between Conservation Science and Management

Sanctuary managers employ conservation science to help identify and better understand potential threats to sanctuary resources. A summary list of management issues, many of which are described in the Resource Protection and Enforcement Action Plan, will be informed by the variety of research, monitoring, and evaluation work embodied in this Marine Conservation Action Plan. These issues include:

- Introduced (alien and invasive) species;
- Marine debris;
- Anchor damage to sensitive habitats;
- Land-based sources of pollution;
- Emergency response-related events (*e.g.*, vessel groundings or oil and fuel spills);
- Coral and coralline algae disease; and
- Climate change related issues.

4.2.2.4 Relevant Issues Raised During Scoping

Community members raised a number of issues relevant to sanctuary marine conservation science during scoping. They included indications that sanctuary management should (in summary):

- Establish environmental and socioeconomic baseline conditions;
- Improve sanctuary resource characterization and long-term monitoring;
- Expand its science goal and objectives;

- Bring in off-island special projects;
- Develop research, characterization and monitoring plans;
- Prioritize scientific research (and resulting peer-reviewed publications) within Fagatele Bay;
- Consider the land-sea connections, which are important to the Samoan culture;
- Assess and monitor water quality concerns including potential landfill impacts near Fagatele Bay, and nutrient loading;
- Make research results publicly available, including in Samoan; and
- Make a connection between science and traditional knowledge.

4.2.3 Addressing the Issues – Strategies for this Action Plan

Three strategies have been developed for achieving the desired outcome of improving ecosystem-based management by providing a strong foundation of science and increasing knowledge of sanctuary marine ecosystems. The strategies and activities are coded by the acronym for the action plan title, Marine Conservation Science (MCS). A summary of strategies and activities is provided in Table 4-4 at the end of this action plan (see p. 213).

- Strategy MCS-1: Assess and prioritize scientific activities over the life of the management plan.
- Strategy MCS-2: Continue to assess baseline conditions and enhance research, monitoring, and characterization programs throughout the life of the management plan.
- Strategy MCS-3: Interpret and communicate the results of scientific activities taking place in and around the sanctuary throughout the life of the management plan.

Strategy MCS-1: Assess and prioritize scientific activities over the life of the management plan.

Recognizing the value and necessity of greater understanding of marine habitats, this strategy details the need to regularly assess and prioritize research, characterization, and monitoring of marine habitats and species. A Sanctuary Science Plan and monitoring protocols will be developed and scientific priorities will be assessed throughout the life of the management plan. As part of the prioritization process, partnerships will be developed to assure that necessary scientific activities will be undertaken to help ensure the sanctuary's ecological integrity.

Activity MCS-1.1: *Develop monitoring program protocols within 1 year.*
Several long-term monitoring studies have been and are currently being performed by outside researchers and local government agencies in the sanctuary. Though the information they yield can be extremely useful for sanctuary management, the studies are often not directly comparable as a result of differences in study design and sampling methods. Consistency in data collection protocols is of vital importance to enable statistically valid comparisons over time and to identify any possible trends. Monitoring program protocols will be established using design principles outlined in the ONMS document "A Monitoring Framework for the National Marine Sanctuary

System" (http://sanctuaries.noaa.gov/library/national/swim04.pdf). Following these principles will ensure that sampling and site selection methodologies adequately represent the range of sanctuary habitats and provide adequate statistical power to detect differences among sites, or changes between time periods, and that the data are useful to inform decision making for sanctuary management. Protocols will be designed to complement and supplement existing monitoring programs within the sanctuary and American Samoa.

Activity MCS-1.2: *Within 2 years, develop a Sanctuary Science Plan to coordinate, prioritize, and manage sanctuary scientific activities.*
It is essential to have well designed and planned scientific studies as well as proper management and coordination of research. Building on the Science Needs workshop held in 2010, a Sanctuary Science Plan will be developed, in consultation with regional and territorial partners, to serve as a more detailed implementation plan. It will incorporate the monitoring protocols (Activity MCS-1.1), ongoing and enhanced research, monitoring and characterization activities listed in this action plan, as well as specific management-related research and monitoring activities found in other action plans (*i.e.*, Cultural Heritage & Community Engagement, Climate Change, and Resource Protection & Enforcement). The Sanctuary Science Plan will also contain priority topics identified in the NOAA Coral Reef Conservation Program document, "American Samoa's Coral Reef Management Priorities," and in American Samoa's Local Action Strategies, including coral disease, small-scale oceanographic patterns, trophic interactions, and genetic connectivity, among others. Science priorities for the sanctuary will be posted, along with those of other marine sanctuaries, and updated periodically on the ONMS "Science Needs" website (http://sanctuaries.noaa.gov/science/assessment/welcome.html).

Activity MCS-1.3: *Formalize sanctuary collaborative research and monitoring programs within 2 years.*
The sanctuary does not have the resources or expertise to conduct all of the scientific activities identified above, or those that will be included in the Sanctuary Science Plan. Sanctuary staff must therefore foster and facilitate partnerships to accomplish these activities. Many organizations already conduct scientific activities in American Samoa including: NOAA Fisheries (Pacific Islands Fisheries Science Center), DMWR, the National Park Service, the Nature Conservancy, AS DOC, and several academic institutions, including the Hawai'i Institute of Marine Biology (HIMB). Sanctuary staff will identify possible collaborations and work to formalize them to better implement the Sanctuary Science Plan.

Strategy MCS-2: Continue to assess baseline conditions and enhance research, monitoring, and characterization programs throughout the life of the management plan.

This strategy is focused on enhancing ecological integrity through continued marine research, characterization, and monitoring designed to support an ecosystem-based approach to protection and management. The activities listed are either on-going or have been identified as priorities.

Activity MCS-2.1: *Continue long-term ecological monitoring efforts at Fagatele Bay.*
The on-going monitoring projects occurring within Fagatele Bay offer critical baseline information and allow for comparisons over time. Sanctuary staff will continue to support ongoing quantitative surveys of coral, algae, fish, and invertebrates in the bay.

Activity MCS-2.2: *Develop and implement ecological and environmental monitoring of shallow-water reef habitats for all sanctuary units.*
Quantitative surveys of coral, algae, fish and invertebrates will be conducted annually in any additional sanctuary units (beyond Fagatele Bay) by sanctuary staff and through interagency collaborative efforts. For the first year, basic baseline information will be collected and compared with existing datasets. The monitoring program protocols developed in Activity MCS-1.1 will be implemented beginning in year 2. The results of these activities will better define resource baselines for comparisons in protection and management efforts.

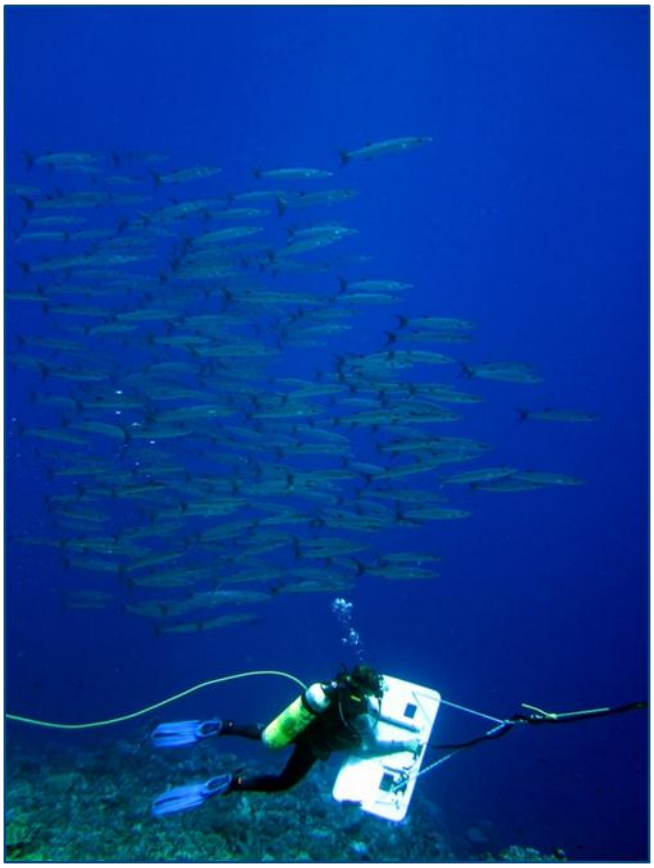

*Photo 7: NOAA scientists often use towed diver surveys to assess large areas of reef habitat. A school of Cheveron barracuda (*Sphyraena qenie*) was observed during this 2010 survey of Swains Island. NOAA CRED Photo.*

Activity MCS-2.3: *Map and characterize deepwater habitat.*
It is essential to gain a better understanding of ecosystem dynamics for sanctuary deepwater habitats to inform management decisions. Sanctuary staff will partner to use multi-beam sonar to acquire data and produce deep-water benthic habitat maps. All available technologies (submersibles, remotely operated vehicles [ROVs], autonomous underwater vehicles [AUVs], and technical diving) should be used to ground-truth the habitat maps and to continue development of a baseline inventory of biological resources in sanctuary deepwater habitats.

Activity MCS-2.4: *Support and enhance PacIOOS.*
It is possible to monitor general surface weather and sea conditions through information provided by NOAA's National Data Buoy Center. However, sanctuary staff do not currently have the ability to monitor physical parameters within specific sanctuary units. Physical parameters that should be monitored include temperature, conductivity, fluorescence, radiation, and current movements, among others. The addition of sensors to measure these parameters will provide data that will conform to PacIOOS standards. It will also help sanctuary managers understand the effects of small-scale or short-term events.

Activity MCS-2.5: *Conduct socioeconomic studies to identify local perceptions and traditional ecological knowledge regarding marine resources within 4 years.*
Local perceptions regarding marine resource status and use can be captured through, among other methods, structured and semi-structured interviews with village residents. Only through direct interactions can accurate information be gathered on sources of livelihood, perceived resource threats, and local ideas regarding improving marine resources. Information of interest includes fishing effort, quantities of catch used (shared, sold, or consumed), and quantities of marine food resources obtained from markets and stores. In addition, traditional ecological knowledge about spawning aggregations and the timing of spawning events can be particularly important to resource managers.

Activity MCS-2.6: *Continue to support marine mammal surveys in sanctuary units and American Samoa.*
For years, sanctuary staff have supported research efforts of staff from the Hawaiian Islands Humpback Whale National Marine Sanctuary and the Provincetown Center for Coastal Studies. These studies have included multiple surveys of Southern humpback whales that come to American Samoa waters to breed and calve in the Austral winter. The research goal is to define the local humpback whale population, to clarify its relationship to other parts of Oceania, and to identify its Antarctic migratory destinations. Significant contributions have been made to understanding these populations and the management implications of these findings. Sanctuary staff will continue to support these efforts.

Strategy MCS-3: Interpret and communicate the results of scientific activities taking place in and around the sanctuary throughout the life of the management plan.

Scientific activities provide an exciting way to promote ocean literacy and stewardship. They can be promoted a number of ways. The primary method entails informing the public about research efforts and findings conducted by professional scientists in the sanctuary. Clear communication is one of the most important products of research and monitoring. As it is difficult for the public to access some of the submerged sanctuary resources, the results from studies conducted in and around the sanctuary should be made available to the public. Informing the public and the research community of research and monitoring, new discoveries, and the status of sanctuary resources is vitally important to creating a well-informed and engaged public and to fostering knowledge sharing among researchers. Another means of promoting ocean literacy and stewardship through scientific activities is to directly involve community members in these activities.

Activity MCS-3.1: *Interpret and disseminate results of sanctuary scientific activities.*
It is important to be able to inform a general audience about not only the types of scientific activities occurring, but also the results of these activities. Sanctuary staff will work closely with the scientific community to coordinate interpretation and dissemination of the results of scientific activities occurring in and around the sanctuary, including scientific activities that are voluntarily reported to the sanctuary (see Activity O&A-5.3). Information dissemination may include written materials, radio spots, and active participation in relevant public venues. All information

will be developed for general audiences and in a bilingual format (English and Samoan) as necessary.

Activity MCS-3.2: *Coordinate annual meetings for partnering agencies to present research.*
Meetings provide an important forum for the research community, managers, and the interested public to keep informed of current research initiatives and recent findings. Sanctuary staff will partner with CRAG to support annual meetings that bring partnering agencies together to present their current scientific activities and findings and provide a forum for discussion, capacity building, and partnership opportunities.

Activity MCS-3.3: *Compile existing relevant scientific publications and, if possible, make them available on the sanctuary website within 1 year and update annually.*
There are numerous scientific publications regarding the marine environment of American Samoa. Relevant publications will be made available on the sanctuary's website. This publications list will be updated annually to ensure the most up-to-date publications are publicly available.

Activity MCS-3.4: *Develop and implement monitoring programs that involve the public within 3 years.*
With careful design and quality control by marine researchers, long-term monitoring studies can be developed that could be performed largely by the public. These studies may include annual Reef Environmental Education Foundation (REEF) surveys, a seasonal whale count event with volunteers, low-tide shallow water benthic monitoring surveys, seasonal palolo catch surveys, or a forum for general reporting of fish catch in the sanctuary.

Table 4-4: Summary of Strategies and Activities for the Marine Conservation Science Action Plan.

STRATEGIES AND ACTIVITIES	
Strategy MCS-1: Assess and prioritize scientific activities over the life of the management plan.	
Activity MCS-1.1:	Develop monitoring program protocols within 1 year.
Activity MCS-1.2:	Within 2 years, develop a Sanctuary Science Plan to coordinate, prioritize, and manage sanctuary scientific activities.
Activity MCS-1.3:	Formalize sanctuary collaborative research and monitoring programs within 2 years.
Strategy MCS-2: Continue to assess baseline conditions and enhance research, monitoring, and characterization programs throughout the life of the management plan.	
Activity MCS-2.1:	Continue long-term ecological monitoring efforts at Fagatele Bay.
Activity MCS-2.2:	Develop and implement ecological and environmental monitoring of shallow-water reef habitats for all sanctuary units.
Activity MCS-2.3:	Map and characterize deepwater habitat.
Activity MCS-2.4:	Support and enhance PacIOOS.
Activity MCS-2.5:	Conduct socioeconomic studies to identify local perceptions and traditional ecological knowledge regarding marine resources within 4 years.
Activity MCS-2.6:	Continue to support marine mammal surveys in sanctuary units and American Samoa.
Strategy MCS-3: Interpret and communicate the results of scientific activities taking place in and around the sanctuary throughout the life of the management plan.	
Activity MCS-3.1:	Interpret and disseminate results of sanctuary scientific activities.
Activity MCS-3.2:	Coordinate annual meetings for partnering agencies to present research.
Activity MCS-3.3:	Compile existing relevant scientific publications and, if possible, make them available on the sanctuary website within 1 year and update annually.
Activity MCS-3.4:	Develop and implement monitoring programs that involve the public within 3 years.

4.2.4 Addressing the Issues – Strategies from other Action Plans

A number of strategies from other action plans either directly or indirectly help to address the issues identified in this Marine Conservation Science Action Plan:

- Strategy CC-2: Partner to identify and implement strategies to maximize the resiliency of sanctuary coastal and marine resources within 5 years through implementation of the Sanctuary Climate Change Plan.
- Strategy CC-3: Partner to target research and monitoring efforts to identify, and where appropriate respond to, climate change impacts at sanctuary units within 5 years.
- Strategy O&A-4: Assess and, as necessary, enhance sanctuary vessel platforms and capabilities over the life of the management plan.
- Strategy O&A-5: Track and, where necessary, permit activities occurring within the sanctuary.
- Strategy OL-2: Increase outreach to communities in American Samoa and abroad.

- Strategy OL-3: Increase ocean literacy through development and implementation of formal education programs and materials in American Samoa.
- Strategy OL-4: Develop creative programs for student participation that encourage learning about sanctuary resources and ocean stewardship.
- Strategy RP&E-2: Conduct and facilitate research and monitoring regarding detection, prevention, ecosystem effects of, control and where feasible eradication of introduced species.
- Strategy RP&E-4: Minimize anchoring impacts to sensitive marine habitats, particularly coral reef formations, while providing reasonable access to sanctuary resources.
- Strategy RP&E-5: Facilitate research and monitoring regarding the effect of land-based sources of pollution on sanctuary resources and develop outreach materials to share the results.
- Strategy P&IC-2: Support cooperation and coordination among agencies and organizations throughout the life of the management plan.
- Strategy P&IC-3: Promote international, national, and local agency collaborations to increase capacity building and foster networks that will improve management effectiveness.

4.2.5 Addressing the Issues – Regulations

Marine conservation science activities may require a sanctuary permit. The sanctuary's permit regulations and the National Marine Sanctuary System-wide regulations address terms and conditions for issuing sanctuary permits. These regulations are available at 15 CFR Part 922 Subpart J and 15 CFR Part 922.48.

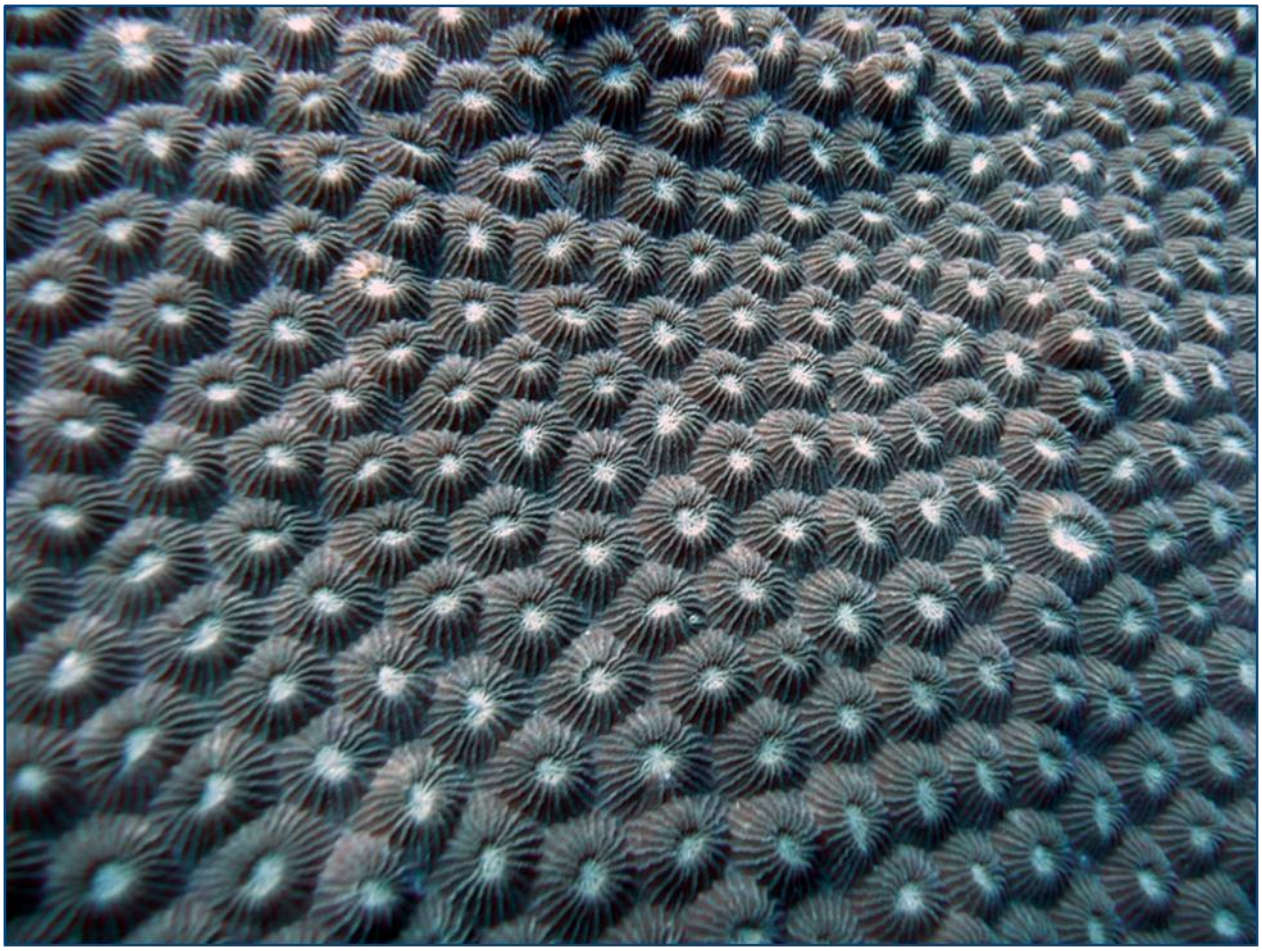

Photo 8: The esthetic beauty of coral is evident at the reef scale, but also at the scale of individual coral polyps and the intricate patterns they form, such as this coral observed during a 2008 NOAA survey of Tutuila reefs. NOAA CRED Photo.

4.3 CLIMATE CHANGE ACTION PLAN

The primary objective of this action plan is to minimize and mitigate the impact from climate change events on coastal and marine ecosystems in sanctuary units.

4.3.1 Overview

Links to Other Action Plans
4.1 Cultural Heritage & Community Engagement 4.2 Marine Conservation Science 4.5 Ocean Literacy 4.6 Resource Protection and Enforcement 4.7 Partnerships & Interagency Cooperation 4.8 Program Evaluation

Coastal and marine resources are vulnerable to several potential climate change events including, but not limited to, rising sea levels, increasing sea and air temperatures, intensifying storms, changing rainfall patterns, ocean currents, and acidifying oceans. Coral reef ecosystems may experience widespread degradation and potential mortality resulting from mass coral bleaching and ocean acidification. The extent of the impact from climate change events will be determined by the rate of climate change and the resources' resilience to change. Efforts described in this action plan aim to understand and characterize climate change drivers and impacts in the sanctuary, "green" sanctuary operations and seek ONMS Climate Smart certification, identify habitats vulnerable and resilient to climate change, conduct and prioritize climate change research and monitoring, and promote public awareness about climate change.

Links to Goals
Goal 1 Goal 4 Goal 5 Goal 6 Goal 7

4.3.2 Issues and Need for Action

The sanctuary is particularly vulnerable to the potential impacts of climate change. The following climate change impacts have been identified as priority risks to marine ecosystems (note that no scoping comments pertained specifically to climate change):

- **Marine Habitat:** With coral being the primary habitat structure, there is a high potential for change in marine habitat from climate change impacts such as increased ocean temperatures and carbon dioxide (CO_2) levels, which threaten coral reefs.
- **Fisheries:** Elevated temperatures, reduced pH, and altered dissolved oxygen levels can cause serious complications for fish at multiple life stages. Migration patterns and spatial distributions of large pelagic fish can also be altered indirectly through climate-induced changes in prey abundance (Polovina 1996).
- **Coral:** Elevated sea surface temperatures may cause corals to expel their symbiotic algae (zooxanthellae) and bleach. Bleaching frequency and intensity will likely increase unless corals are capable of adapting in time with the temperature increases.
- **Carbon Sinks:** Oceans are able to absorb a large part of CO_2 emissions in carbon sinks. Currently, more than half of the biological carbon captured worldwide is stored by living marine organisms. However, degradation of the marine ecosystem can release stored carbon into the atmosphere. Furthermore, increasing winds caused by climate change events can result in a release of stored CO_2 into the atmosphere.

- **Phytoplankton:** Phytoplankton need to remain close to the ocean's surface to capture sunlight for photosynthesis, so certain phytoplankton will be favored while others will decline if the surface becomes depleted of nutrients required for growth. This decline in turn could affect many species along the food chain.

4.3.3 Addressing the Issues – Strategies for this Action Plan

This action plan contains four strategies for achieving the desired outcome to minimize and mitigate the impact from climate change events on coastal and marine ecosystems in sanctuary units. The strategies were developed with assistance from scientists, educators, and managers from territorial and federal environmental agencies in American Samoa. The strategies and activities are coded by the acronym for the action plan title, "Climate Change" (CC). A summary of strategies and activities is provided in Table 4-5 at the end of this action plan (see p. 223).

- Strategy CC-1: Complete Climate Smart Sanctuary certification standards within 3 years.
- Strategy CC-2: Partner to identify and implement strategies to maximize the resiliency of sanctuary coastal and marine resources within 5 years through implementation of the Sanctuary Climate Change Plan.
- Strategy CC-3: Partner to target research and monitoring efforts to identify, and where appropriate respond to, climate change impacts at sanctuary units within 5 years.
- Strategy CC-4: Partner to promote public awareness about potential climate change impacts to sanctuary units within 5 years.

Strategy CC-1: Complete Climate Smart Sanctuary certification standards within 3 years.

ONMS developed the Climate Smart Sanctuary Initiative to inform climate change management at national marine sanctuary sites. Sanctuary sites that have made certain efforts and achieved a set of standards are certified "Climate Smart." Included in the requirements, sanctuaries must complete a Climate Change Site Scenario and organize and implement a Climate Change Action Plan. These efforts support larger agency efforts toward NOAA's Climate Goal (*An informed society anticipating and responding to climate and its impacts*), as well as enhance NOAA's compliance with Executive Order 13423 (*Strengthening Federal Environmental, Energy and Transportation Management*).

<u>Activity CC-1.1</u>: *Revise the Climate Change Site Scenario to incorporate any additional sanctuary units within 1 year.*
The Climate Change Site Scenario is designed to present a picture of what Fagatele Bay might look like in 30 to 50 years. In the current Climate Change Site Scenario, sanctuary staff synthesize existing information on the main climate change impact drivers and the potential impacts to ecosystems, cultural resources, and communities relevant to Fagatele Bay. Relevant information on climate change regarding any newly designated sanctuary units will be incorporated into a revised Climate Change Site Scenario. Sanctuary staff will continue to work with local and regional climate scientists to gather existing information on the main climate change impact drivers and the potential impacts to human and natural resources.

Activity CC-1.2: *Develop a Sanctuary Climate Change Plan within 2 years.*
Sanctuary staff will develop a Sanctuary Climate Change Plan to coordinate, prioritize, and manage sanctuary activities related to climate change. This plan is designed to identify priority actions for sanctuary staff to take in the next 5 to 10 years to help address the impacts of climate change specific to sanctuary units in American Samoa and as identified in the Climate Change Site Scenario. This document is the companion to the Climate Change Site Scenario for the sanctuary. Each activity will include a description of the activity and information about ways to address the problem and how to implement solutions, as well as identify existing resources, resources needed, a timeline, and possible outcomes and milestones.

Activity CC-1.3: *Complete energy, transportation, and waste audits, and derive an emissions inventory within 2 years.*
The greenhouse gas emissions inventory will be completed using the Climate Leadership In Parks (CLIP) Tool developed by the National Park Service Climate Friendly Parks Program to inventory greenhouse gas emissions. The tool is also compatible with sanctuary offices because sanctuary operations are similar to that of a park. The tool has been applied at other national marine sanctuary offices, including Gulf of the Farallones in California and Stellwagen Bank in Massachusetts. The emissions inventory will help to prioritize recommended actions and provide an effective evaluation and education tool to sanctuary management. This activity complements, and will help address, the American Samoa climate change LAS Objective 4 (to reduce American Samoa's carbon footprint to provide a regional and international model of progress towards a low carbon sustainable economy; the LAS is discussed in the climate change section of Chapter 3).

Activity CC-1.4: *Support development of a green operations working group within 3 years.*
Sanctuary management will request that the advisory council form a green operations working group within 3 years after the management plan is released. This working group could inform additional strategies to reduce the green house gas emissions that result from sanctuary facilities and operations, including transportation, energy efficiency, waste management and supplies, and water management. Aside from advisory council members, potential working group members may include representatives from the U.S. Environmental Protection Agency (EPA), the American Samoa Power Authority (ASPA) and the U.S. Department of Energy (which is funding several clean energy projects in American Samoa using American Recovery and Reinvestment Act funds). This activity complements, and will help address, the American Samoa climate change LAS Objective 4 (to reduce American Samoa's carbon footprint to provide a regional and international model of progress towards a low carbon sustainable economy).

Activity CC-1.5: *Form a Climate Smart Sanctuary Local Review Team within 3 years.*
This team will conduct a certification visit and document achievement of, or substantive progress toward, each of the certification standards. The team should be composed of a minimum of three representatives chosen from outside ONMS and one representative from the ONMS Climate Subcommittee. The external members should represent the following areas of expertise: protected areas, climate science, and facilities. The team will be asked to review documentation on how the sanctuary has met Climate Smart Standards and assess the facility. The team will

document its findings and submit its recommendations for certification to the certifying authority. In the situation that the sanctuary is not certified as Climate Smart, the team will reconvene to determine whether the sanctuary has taken steps to address the deficiencies as recommended by the certifying authority.

Strategy CC-2: Partner to identify and implement strategies to maximize the resiliency of sanctuary coastal and marine resources within 5 years through implementation of the Sanctuary Climate Change Plan.

Ecosystem resilience refers to the capacity of an ecosystem to withstand, recover from, or adapt to impacts and stressors to the environment, such as climate change. A healthier ecosystem is more likely to be resilient to the potential impacts of climate change events. Therefore, it is important to prioritize investments and make use of marine spatial planning to ensure the greatest protection is given to key marine resources. Sanctuary staff will work with partners to achieve this end across all sanctuary units in American Samoa within the next 5 years.

Activity CC-2.1: *Collaborate to identify areas that are generally more stable during climate change events, within 3 years.*
Specific attention should go to areas that are less prone to temperature fluxes, such as areas with strong upwelling and currents that have shown greater resistance to coral bleaching. In addition, areas that serve as important carbon sinks should be protected. Strategies to identify and protect these areas should be developed in collaboration with federal and territorial partner agencies, as well as NGOs.

Activity CC-2.2: *Collaborate to identify species and habitats that are highly vulnerable to climate change, within 3 years.*
Reducing non-climate stressors on marine ecosystems will help to restore and maintain resilience and minimize impacts on marine ecosystems. Healthy marine resources will be better able to resist or recover from disturbances such as coral bleaching, disease outbreaks, or anoxia events. Strategies should be developed in collaboration with partner agencies to identify highly vulnerable species and habitats and will consider non-climate pressures to species and habitats vulnerable to climate. For example, sanctuary staff will work with territorial and federal partners to address land-based anthropogenic stressors (see Strategy RP&E-5).

Activity CC-2.3: *Collaborate to identify habitats potentially affected by climate change, including transition or alternative habitats, within 5 years.*
Climate change may lead to shifts in distribution and abundance of species and habitats. With increasing ocean temperatures, coral may begin settling in deeper or more off shore locations to find a thermally suitable habitat. Areas with increased water flow may also be favored as ocean temperatures increase and would lead to shifts of other obligate species (species living in coral reef communities) as well as temporary users. Coral has already been observed to be settling in locations farther from the equator than in recent history (Precht and Aronson 2004). This shift in location is fitting with the expected pole-ward migration of species seeking cooler temperatures as global temperatures rise with climate change. Strategies to identify transition or alternative habitats should be developed in collaboration with partner agencies to better inform marine spatial planning and sanctuary management.

Activity CC-2.4: *Complete a vulnerability assessment of villages adjacent to sanctuary units.* Through the vulnerability assessment sanctuary staff will work to identify how the effects of climate change on coral reef ecosystems will impact sanctuary communities. American Samoan communities are extremely vulnerable to future climate change events. Many Samoans depend on coastal areas and coral reef ecosystems for fishing and gathering for their livelihood. The effects of climate change on coastal lands and coral reefs could be devastating to certain communities, so it is critical to identify which villages are the most vulnerable and develop strategies to help protect these communities. This activity complements and will help address the American Samoa climate change LAS Objective 3 (to foster adaptation and resilience of communities and economic systems to respond to climate change impacts).

Strategy CC-3: Partner to target research and monitoring efforts to identify, and where appropriate respond to, climate change impacts at sanctuary units within 5 years.

Sanctuary units can serve as sentinel sites to conduct research to monitor climate change. Sanctuaries, with their place-based focus, long-term data sets, and controlled activities, are able to serve as control areas for monitoring climate change and other impacts. Sanctuary staff will work with partners to conduct and facilitate research on climate change impacts at sanctuary units. These efforts will be captured in the Sanctuary Science Plan (see Activity MCS-1.2). Real-time results from monitoring programs, advice and feedback from stakeholders and advisory councils, and long-term synthesized information from condition reports all feed into sanctuary decision-making. This strategy complements and will help address the American Samoa climate change LAS Objective 1 (to solicit and support research and monitoring to implement and support management strategies for reducing climate change and its impacts).

Activity CC-3.1: *Regularly measure critical climate change indicators throughout the life of the management plan.*
The following climate change indicators should be regularly measured at sanctuary units:

- Temperature;
- Dissolved oxygen;
- Salinity;
- Direct acidification;
- Nutrients;
- Sea level;
- Circulation;
- Upwelling intensity;
- Coralline algae; and
- Storm intensity and frequency.

These indicators may be measured in conjunction with PacIOOS efforts (see MCS 2.4 above).

Activity CC-3.2: *Monitor climate event ecological impacts on coral reef ecosystems throughout the life of the management plan.*

Monitoring the marine ecological impacts of climate events is important to better understand potential future impacts and to better refine potential intervention measures. Some of the ecological impacts of climate change events that should be monitored include coral bleaching, ocean acidification, incidence and range of coral disease, and damage and recovery from storms and other natural events. Measurements should be taken with sufficient regularity to capture potential changes from climate change indicators. Measurements should continue after intervention measures have been implemented to monitor the success of those projects (see Activity CC-3.3).

Photo 9: Assessing incidents of coral disease, such as the fungal infection on this stony coral, is one component of climate change ecological impact monitoring. Photo: Doug Fenner.

Activity CC-3.3: *Investigate the feasibility of implementing techniques to reduce stress from climate change and ocean acidification on coral reef ecosystems within 5 years.*

Possible intervention measures may include, but are not limited to, shading, pumping in cool water, and local reduction of acidification. While currently applicable only on small spatial scales, these techniques may be developed into more versatile applications with further testing. Successful implementation of intervention measures is important to the long-term sustainability of marine resources that are sensitive to climate change impacts. Measurements should continue to be taken after intervention measures have been implemented to evaluate their success (see Activity CC-3.2). This activity also supports NOAA Coral Reef Conservation Program National Objective 4.1 and 4.3.

Strategy CC-4: Partner to promote public awareness about potential climate change impacts to sanctuary units within 5 years.

Education and outreach are critical to the success of climate change adaptation planning in American Samoa. Activities within this strategy are designed to promote climate literacy, which is “an understanding of your influence on the climate and climate's influence on you and society” (Climate Literacy Network 2010). When the public is aware of the complexity of climate change issues, they are more likely to embrace change. Climate education and outreach functions will be informed in part by the Climate Smart Sanctuary certification guidelines; the essential principals and fundamental concepts of climate literacy developed by NOAA and other partners in the Climate Literacy Network (see http://oceanservice.noaa.gov/education/literacy.html); and by communications tools ONMS is currently developing to help sanctuaries address climate change with constituents. In addition, sanctuary staff plan to reach out to local and regional partners to

develop and distribute materials to local schools and government leaders. Sanctuary staff also plan to support national efforts to integrate indigenous knowledge into climate planning through a symposium event scheduled for 2011. This strategy complements and will help address the American Samoa climate change LAS Objective 5 (to create a populace who is informed about climate change and taking steps to reduce climate change causes and impacts).

Activity CC-4.1: *Identify and establish climate change education and outreach functions within 2 years.*
Climate Smart Sanctuary education and outreach functions include a core program as well as materials that integrate the National Marine Sanctuary System-wide subset of climate change messages and climate literacy talking points. The messages and talking points were developed to describe sanctuary-specific issues and present case studies from around the sanctuary system to help inform climate education at the site level. Climate Smart Sanctuary education and outreach functions also include strategies to address climate literacy needs, implementation timelines, and funding requirements.

Activity CC-4.2: *Support the education and outreach working group with current, relevant climate change information throughout the life of the management plan.*
The advisory council's education and outreach working group is composed of representatives from the American Samoa Department of Education, ASCC, DMWR, and the NOAA PIRO in American Samoa. The working group informs many of the education and outreach programs coordinated by sanctuary staff. Its advice has been a critical component to the program and will continue to inform sanctuary management during development and implementation of the climate education and outreach programs.

Activity CC-4.3: *Collaborate with* Le Tausagi *to develop and distribute climate change-related education and outreach materials throughout the life of the management plan.*
Le Tausagi has already begun to formulate education and outreach programs related to climate change by hosting educators and teachers workshops and developing outreach materials. By working in collaboration with *Le Tausagi*, sanctuary staff can ensure that resources are maximized and larger audiences are reached while continuing to support territorial efforts in American Samoa.

Activity CC-4.4: *Make climate change data sets, summary data, and publications publicly accessible throughout the life of the management plan.*
It is critical that all climate change information collected by sanctuary staff and partners is presented in a usable format that is easily accessible to the public. Sanctuary staff will develop a formal process to ensure public accessibility of relevant information. Accessibility could be through informational brochures, displays, or through posting on the sanctuary website.

Table 4-5: Summary of Strategies and Activities for the Climate Change Action Plan.

STRATEGIES AND ACTIVITIES	
Strategy CC-1: Complete Climate Smart Sanctuary certification standards within 3 years.	
Activity CC-1.1:	Revise the Climate Change Site Scenario to incorporate any additional sanctuary units within 1 year.
Activity CC-1.2:	Develop a Sanctuary Climate Change Plan within 2 years.
Activity CC-1.3:	Complete energy, transportation, and waste audits, and derive an emissions inventory within 2 years.
Activity CC-1.4:	Support development of a green operations working group within 3 years.
Activity CC-1.5:	Form a Climate Smart Sanctuary Local Review Team within 3 years.
Strategy CC-2: Partner to identify and implement strategies to maximize the resiliency of sanctuary coastal and marine resources within 5 years through implementation of the Sanctuary Climate Change Plan.	
Activity CC-2.1:	Collaborate to identify areas that are generally more stable during climate change events, within 3 years.
Activity CC-2.2:	Collaborate to identify species and habitats that are highly vulnerable to climate change, within 3 years.
Activity CC-2.3:	Collaborate to identify habitats potentially affected by climate change, including transition or alternative habitats, within 5 years.
Activity CC-2.4:	Complete a vulnerability assessment of villages adjacent to sanctuary units.
Strategy CC-3: Partner to target research and monitoring efforts to identify, and where appropriate respond to, climate change impacts at sanctuary units within 5 years.	
Activity CC-3.1:	Regularly measure critical climate change indicators throughout the life of the management plan.
Activity CC-3.2:	Monitor climate event ecological impacts on coral reef ecosystems throughout the life of the management plan.
Activity CC-3.3:	Investigate the feasibility of implementing techniques to reduce stress from climate change and ocean acidification on coral reef ecosystems within 5 years.
Strategy CC-4: Partner to promote public awareness about potential climate change impacts to sanctuary units within 5 years.	
Activity CC-4.1:	Identify and establish climate change education and outreach functions within 2 years.
Activity CC-4.2:	Support the education and outreach working group with current, relevant climate change information throughout the life of the management plan.
Activity CC-4.3:	Collaborate with *Le Tausagi* to develop and distribute climate change-related education and outreach materials throughout the life of the management plan.
Activity CC-4.4:	Make climate change data sets, summary data, and publications publicly accessible throughout the life of the management plan.

4.3.4 Addressing the Issues – Strategies from other Action Plans

A number of strategies from other action plans either directly or indirectly help to address the issues identified in this Climate Change Action Plan:

- Strategy CH&CE-3: Provide staff support, resources, and guidance to assist with sanctuary advisory council operations.
- Strategy MCS-1: Assess and prioritize scientific activities over the life of the management plan.
- Strategy MCS-2: Continue to assess baseline conditions and enhance research, monitoring, and characterization programs throughout the life of the management plan.
- Strategy MCS-3: Interpret and communicate the results of scientific activities taking place in and around the sanctuary throughout the life of the management plan.
- Strategy O&A-5: Track and, where necessary, permit activities occurring within the sanctuary.
- Strategy OL-3: Increase ocean literacy through development and implementation of formal education programs and materials in American Samoa.
- Strategy OL-4: Develop creative programs for student participation that encourage learning about sanctuary resources and ocean stewardship.
- Strategy P&IC-1: Cultivate the AS DOC partnership.
- Strategy P&IC-2: Support cooperation and coordination among agencies and organizations throughout the life of the management plan.
- Strategy P&IC-3: Promote international, national, and local agency collaborations to increase capacity building and foster networks that will improve management effectiveness.

4.3.5 Addressing the Issues – Regulations

No sanctuary regulations are associated with the issues in the Climate Change Action Plan. Sanctuary regulations are available at 15 CFR 922 Subpart J.

Photo 10: Coral bleaching is a phenomenon that may be exacerbated by climate change. Photo: Doug Fenner.

4.4 OPERATIONS AND ADMINISTRATION ACTION PLAN

The primary objective of this action plan is to outline the means and level of support necessary to successfully achieve sanctuary goals and implement the strategies and activities detailed in the other action plans.

4.4.1 Overview

Links to Other Action Plans
4.1 Cultural Heritage & Community Engagement 4.2 Marine Conservation Science 4.3 Climate Change 4.5 Ocean Literacy 4.6 Resource Protection and Enforcement 4.7 Partnerships & Interagency Cooperation 4.8 Program Evaluation

This action plan describes day-to-day operational and administrative activities, and the manner in which budget and staffing are organized to efficiently implement sanctuary programs in American Samoa. Annual Operating Plan (AOP) budget development ensures funding priorities are reviewed and adjusted annually to reflect evolving budgetary conditions and overall national program priorities. Adequate human resources and physical infrastructure are required to conduct effective and well-planned operations and to support sanctuary management.

Links to Goals
Goal 1 Goal 4

Administrative roles for governing the sanctuary are divided up between the sanctuary superintendent and ONMS. ONMS provides oversight and coordination among all national marine sanctuaries by developing a framework for resource management, setting priorities for addressing resource management issues, and directing program and policy development. Sanctuary staff are responsible for on-site management and day-to-day sanctuary operations.

4.4.2 Issues and Need for Action

4.4.2.1 Capacity Building

Sanctuary staff do not have expertise in every issue raised and addressed in this management plan. Furthermore, despite recently added new staff (*e.g.*, a research coordinator), the sanctuary has a small staff (see Chapter 3) and each staff member is overseeing multiple program or functional areas. Building human resources capacity will enable the sanctuary to build on its existing programs and address issues and develop programs not sufficiently met with current human resources. In addition, the increasing roles and responsibilities of the sanctuary and ever-evolving techniques for effective marine sanctuary management require that the skill sets of present and future staff continue to grow as well. Finally, a variety of mechanisms are available to build human resource capacity, and sanctuary management must evaluate each mechanism to determine which is best for the given need. Mechanisms include FTE positions and a number of contract vehicles.

4.4.2.2 Facilities

Since 2002, the sanctuary has used office space provided by the American Samoa Government at the ASG-Convention Center in Utulei (on Tutuila). In 2009, the ONMS Pacific Region, working with contractor Ferraro Choi & Associates, finalized a Facilities Master Plan that detailed a number of necessary renovations to the sanctuary office space. Many of the suggested renovations were incorporated in the architecture and engineering designs for a complete renovation of the Convention Center. These suggestions include increasing staff work stations from three to nine (included future staff space requirements), storage for wet gear, a conference room, and incorporating approximately 380 square feet for a sanctuary visitor center. Plans also call for a phased construction approach to include an additional 1,250 square feet building to house the sanctuary's 10 m vessel, the R/V *Manumā*, and a small dive locker. Groundbreaking for the ASG-Convention Center renovations occurred in spring of 2011.

From 2008 to present, AS DOC provided sanctuary staff with temporary office space since the ASG-Convention Center building needed major repairs. The temporary sanctuary office is collocated within AS DOC offices at the A.P. Lutali Executive Office Building. Sanctuary staff will return to ASG-Convention Center building after the renovations.

4.4.2.3 Vessel Operations

Sanctuary vessel operations require maintenance of the R/V *Manumā*, currently operating from Pago Pago Harbor. Maximizing use of this vessel necessitates acquisition of a sanctuary vehicle and trailer capable of towing it.

Photo 11: NOAA NCCOS scientists prepare the R/V Manumā *for a biogeography research cruise in 2010. Photo: Sarah Kinsfather.*

Currently, there is only one certified passenger and cargo vessel in all of American Samoa (the M/V *Sili*) that has the capability to reach remote proposed sanctuary units (Muliāva and Swain's Island). In 2010, the M/V *Sili* obtained U.S. Coast Guard certification to carry passengers and cargo. However, the M/V *Sili* does not have the capabilities to carry out the scientific, enforcement, and emergency response capabilities necessary for effective sanctuary management.

Additional issues pertaining to vessel operations include:

- NOAA ships come only every 2 to 3 years (at a cost of approx $20,000 per day);
- It has been estimated that a vessel that meets sanctuary requirements could be operated for approximately $2,000 to $3,000 per day;

- Partner agencies (NOAA Fisheries, NOAA Coral Reef Ecosystem Division, and NPAS) have expressed interest in having a vessel approximately 85 to 100 feet in length permanently based in American Samoa;
- Having a vessel permanently located in the territory would exponentially increase territorial research and monitoring capabilities as well as enforcement and emergency response efforts, could provide a platform for NOAA-wide and territorial partners, and could save money by reducing more costly NOAA ship time to the territory; and
- Sanctuary mission requirements have been outlined in a draft document that will be updated and finalized.

4.4.2.4 Permitting and Activity Tracking

Sanctuary permits are required in all sanctuaries for conducting activities otherwise prohibited by sanctuary regulations. American Samoa sanctuary management may issue permits for research, education, and salvage activities. Tracking these permitted activities is important to sanctuary operations to ensure that permit conditions are met. These conditions typically include providing sanctuary management with any information gained by permitted activities. Information gleaned from activities that do not require a permit may also be beneficial to sanctuary management. Gathering this information requires developing a means of tracking activities that do not require a permit.

4.4.2.5 Administrative Initiatives

Administrative initiatives such as finances and procuring supplies are another important aspect of day-to-day sanctuary operations. The primary issue sanctuary staff must address in terms of these initiatives is determining how to secure sufficient funding. While sanctuary staff develop an annual operating plan that outlines fiscal needs for the given year, the federal budget is not always sufficient to fully implement all planned sanctuary activities. As a result, staff must pursue alternative means to fund activities, such as grants or partnerships.

4.4.2.6 Relevant Issues Raised During Scoping

Sanctuary scoping comments raised a suite of issues relevant to sanctuary operations and administration. They include (in summary):

- Programs need funding to implement activities;
- Constituents should have input on the annual budget; and
- Future provision of administrative resources (staff, infrastructure, and finances) should be included that are sufficient to encourage effective sanctuary management.

4.4.3 Addressing the Issue – Strategies for this Action Plan

The strategies and associated activities in this action plan are intended to outline the means and level of support necessary for sanctuary staff to successfully implement the sanctuary goals and the strategies and activities detailed in the other action plans. Six strategies have been developed for achieving this desired outcome. The strategies and activities are coded by the acronym for the action plan title, "Operations and Administration" (O&A). A summary of strategies and activities is provided in Table 4-6 at the end of this action plan (see p. 232).

- Strategy O&A-1: Identify and address financial and administrative needs throughout the life of the management plan.
- Strategy O&A-2: Assess and, as necessary, enhance human resource and organizational capacity over the life of the management plan.
- Strategy O&A-3: Assess and, as necessary, enhance sanctuary physical infrastructure and facilities over the life of the management plan.
- Strategy O&A-4: Assess and, as necessary, enhance sanctuary vessel platforms and capabilities over the life of the management plan.
- Strategy O&A-5**:** Track and, where necessary, permit activities occurring within the sanctuary.

Strategy O&A-1: Identify and address financial and administrative needs throughout the life of the management plan.

Effectively managing the sanctuary requires a strong operational foundation to support sanctuary goals. Key portions of this operational foundation include budget development and tracking; meeting site equipment, supply, and service needs; and ensuring staff are aware of administrative procedures.

Activity O&A-1.1: *Develop and implement Annual Operating Plans and financial administration initiatives.*
AOPs will be developed in accordance with ONMS requirements and in consultation with the AS DOC. The AOPs will clarify program priorities to be carried out through financial administration initiatives, including budget tracking and managing the financial portions of memoranda of agreement and contracts as well as purchasing and procurement.

The management plan will serve to outline budget and program priorities, and AOP development will be guided by site-specific needs and based on the availability of funding.

Activity O&A-1.2: *Identify, prioritize, and fill office equipment and service needs annually.*
Sanctuary staff will annually assess supply, equipment, and technical support needs, including office supplies, fax machines, copiers, printers, Internet and phone access lines, staff computers, software, and other office support functions. The needs of the office will be prioritized and new equipment purchased as funding allows.

Activity O&A-1.3: *Develop and maintain administrative standard operating procedures and disseminate to staff within 1 year.*
The sanctuary currently has a variety of administrative standard operating procedures (SOPs) for many program activities, but the SOPs have not been consolidated into a single, user-friendly format. A single document will provide clear formal policy guidance to all staff. Administrative topics to be addressed include controlled correspondence, Freedom of Information Act (FOIA) requests, procurement, accountable property, security, travel, IT security, and vehicle and vessel operations.

Activity O&A-1.4: *Identify external funding opportunities.*
Given that the federal budget is not always sufficient to fully implement all planned sanctuary activities, as necessary and appropriate, sanctuary staff will pursue alternative means to fund activities. Alternative funding sources include grants and partner agencies and organizations (including the National Marine Sanctuary Foundation).

Strategy O&A-2: Assess and, as necessary, enhance human resource and organizational capacity over the life of the management plan.

Human resource capacity is needed to achieve effective site operations. Over the life of the management plan, its activities will necessitate an increase in staff support, either through the addition of permanent staff positions or through effective use of contract services to meet these needs. Decisions on adding permanent staff or addressing needs through contractual support will hinge on a variety of factors such as available personnel positions through NOAA, the annual budget, and the nature of the tasks to be addressed. Consequently, the staffing plan described below outlines the needs to be addressed but is not prescriptive in indicating the mechanism used to provide support. Those decisions will be made on an annual basis, weighing the factors described above.

Activity O&A-2.1: *Assess current status and future needs for human resources annually.*
Human resource capacity will have to be regularly assessed to successfully implement the management plan. These assessments will be used to better organize and utilize existing staff and to identify human resource overlaps and gaps. The assessment will also prioritize capacity building needs and identify opportunities to coordinate and share resources with partners. Alternative human resource capacity-building measures, such as internships, volunteer programs, and partnerships, are directly addressed elsewhere in this management plan (see Strategy CH&CE-2 and all activities in the Partnerships & Interagency Cooperation Action Plan) and will be considered in the capacity building assessments.

Activity O&A-2.2: *Improve human resource capacity as necessary.*
As funding and other factors allow, the sanctuary's human resource and organizational capacity should be enhanced to address specific needs identified in the human resources assessment (Activity O&A 2.1).

Activity O&A-2.3: *Identify and provide for staff participation in human resource development opportunities annually.*

Sanctuary staff currently maintain familiarity with agency directives and regulations through a variety of training and communication strategies, including information technology-based trainings. Staff will continue to complete all mandatory NOAA trainings in a timely manner. In addition, sanctuary management will examine current employee skill sets, identify any training necessary for each employee, and provide for opportunities in human resource development. Trainings may include a wide variety of topics and courses and will be implemented in accordance with the ONMS's Training and Continuing Education Policy.

Strategy O&A-3: Assess and, as necessary, enhance sanctuary physical infrastructure and facilities over the life of the management plan.

Effective sanctuary operations must be supported by sufficient infrastructure. Ongoing efforts will include regularly maintaining the sanctuary offices and visitor center, as well as assessing the current status of and future needs for sanctuary facilities in American Samoa.

Activity O&A-3.1: *Assess current status and future needs for physical infrastructure and facilities annually.*
In conjunction with assessments of human resource needs (Activity O&A-2.1), sanctuary staff will review infrastructure and facilities needs to optimize facilities utilization. These assessments will identify physical resource overlaps and gaps and identify needs to support future growth. Assessments will continuously revise existing requirements identified in the ONMS Pacific Islands Regional Facilities Master Plan, as needed, and seek to identify facilities needs for all sanctuary units.

Activity O&A-3.2: *Maintain and improve infrastructure and facilities.*
Current sanctuary facilities will be maintained or, if necessary, improved. As funding allows, future facilities should be developed to address specific needs identified in facilities and infrastructure needs assessments (Activity O&A-3.1).

Strategy O&A-4: Assess and, as necessary, enhance sanctuary vessel platforms and capabilities over the life of the management plan.

Sanctuary vessel needs and requirements will be assessed and current assets maintained. Vessel maintenance operations include determining when vessels need to be repaired or replaced, overseeing maintenance and repair work, procuring new vessels and associated equipment, training staff in the proper use and safety protocols for all vessels and associated equipment, and keeping required records for al vessels.

Activity O&A-4.1: *Update and finalize Sanctuary Vessel Requirements document within 1 year.*
A vessel requirements document was drafted in 2009. This document will be updated and finalized. Sanctuary staff will work with partner agencies to incorporate their needs to maximize efficiencies and provide a first-rate platform for research, monitoring, outreach and education, enforcement, and emergency response in American Samoa.

Activity O&A-4.2: *Maintain vessels, including required records, and acquire vessels as necessary.*

Maintenance of sanctuary vessels is required to ensure they are in safe operating condition. Maintenance schedules and vessel safety issues, including arranging safety inspections by authorized inspectors, trainings and drills, and trip planning, will be performed in accordance with the NOAA Small Boat Program and ONMS policies. All required records will be maintained and submitted as necessary.

Using the Sanctuary Vessel Requirements document (Activity O&A-4.1), sanctuary staff will work closely with ONMS headquarters staff to acquire a fully outfitted vessel that meets the sanctuary's needs. In addition, partnerships will be investigated to leverage costs for operations, personnel, and maintenance.

Strategy O&A-5: Track and, where necessary, permit activities occurring within the sanctuary.

The sanctuary permit program provides a mechanism to review requests to conduct activities otherwise prohibited within the sanctuary. It also provides a mechanism to modify or set conditions for proposed projects to minimize their impacts to sanctuary resources. Tracking research, education, management and other activities, and where appropriate, permitting these activities otherwise prohibited by sanctuary regulations is important for effective sanctuary operations. Permitting will be conducted and coordinated by sanctuary staff.

Activity O&A-5.1: *Maintain careful oversight and issuance of permits throughout the life of the management plan.*
Sanctuary staff will promptly review permit applications and effectively issue permits, as necessary. When a proposed activity otherwise prohibited by sanctuary regulations is assessed, the potential for resource injury is evaluated against the expected benefits of the activity. Modifications or conditions to proposed activities may be required to minimize impacts to sanctuary resources before a permit is issued.

Activity O&A-5.2: *Annually maintain a database for sanctuary permitting.*
The NMSA provides for permits in four otherwise prohibited activity categories: research, education, management, and salvage. Sanctuary staff will use the ONMS's on-line permitting database (Online Sanctuary Permitting, Reporting, and Evaluation System, also known as OSPREY) to facilitate the efficient and timely issuance of local sanctuary permits on an as-needed basis.

Activity O&A-5.3: *Develop a voluntary registry of research, education, and outreach activities occurring in the sanctuary within 2 years.*
Depending upon the nature of an activity, a permit may or may not be required to conduct an activity within the sanctuary. For activities that do not require a permit, sanctuary staff will develop an outreach program to encourage sanctuary users to inform sanctuary management of the nature and intent of their activities. This extramural activity registry will allow the sanctuary to track, understand that nature of, and benefit from findings and projects the sanctuary did not directly assist or permit.

Table 4-6: Summary of Strategies and Activities for the Operations and Administration Action Plan.

STRATEGIES AND ACTIVITIES	
Strategy O&A-1: Identify and address financial and administrative needs throughout the life of the management plan.	
Activity O&A-1.1:	Develop and implement Annual Operating Plans and financial administration initiatives.
Activity O&A-1.2:	Identify, prioritize, and fill office equipment and service needs annually.
Activity O&A-1.3:	Develop and maintain administrative standard operating procedures and disseminate to staff within 1 year.
Activity O&A-1.4:	Identify external funding opportunities.
Strategy O&A-2: Assess and, as necessary, enhance human resource and organizational capacity over the life of the management plan.	
Activity O&A-2.1:	Assess current status and future needs for human resources annually.
Activity O&A-2.2:	Improve human resource capacity as necessary.
Activity O&A-2.3:	Identify and provide for staff participation in human resource development opportunities annually.
Strategy O&A-3: Assess and, as necessary, enhance sanctuary physical infrastructure and facilities over the life of the management plan.	
Activity O&A-3.1:	Assess current status and future needs for physical infrastructure and facilities annually.
Activity O&A-3.2:	Maintain and improve infrastructure and facilities.
Strategy O&A-4: Assess and, as necessary, enhance sanctuary vessel platforms and capabilities over the life of the management plan.	
Activity O&A-4.1:	Update and finalize Sanctuary Vessel Requirements document within 1 year.
Activity O&A-4.2:	Maintain vessels, including required records, and acquire vessels as necessary.
Strategy O&A-5: Track and, where necessary, permit activities occurring within the sanctuary.	
Activity O&A-5.1:	Maintain careful oversight and issuance of permits throughout the life of the management plan.
Activity O&A-5.2:	Annually maintain a database for sanctuary permitting.
Activity O&A-5.3:	Develop a voluntary registry of research, education, and outreach activities occurring in the sanctuary within 2 years.

4.4.4 Addressing the Issues – Strategies from other Action Plans

A number of strategies from other action plans either directly or indirectly help to address the issues identified in this Operations and Administration Action Plan:

- Strategy CH&CE-2: Develop volunteer programs that increase site visibility while engaging resource users and promoting local stewardship.
- Strategy MCS-1: Assess and prioritize scientific activities over the life of the management plan.
- Strategy MCS-2: Continue to assess baseline conditions and enhance research, monitoring, and characterization programs throughout the life of the management plan.
- Strategy OL-1: Open and operate a Sanctuary Visitor Center of American Samoa.

- Strategy P&IC-1: Cultivate the AS DOC partnership.

4.4.5 Addressing the Issues – Regulations

Strategy O&A-5 (Track and, where necessary, permit activities occurring within the sanctuary) is guided by the sanctuary's permit regulations as well as National Marine Sanctuary System-wide regulations, which address terms and conditions for sanctuary permits. These regulations are available at 15 CFR Part 922 Subpart J and 15 CFR Part 922.48.

Photo 12: During the ASG-Convention Center renovations, AS DOC provided temporary sanctuary office space in the A.P. Lutali Executive Office Building, adorned with a Wyland mural commemorating the 2008 International Year of the Reef. Photo: Sarah Kinsfather.

4.5 OCEAN LITERACY ACTION PLAN

The primary objective of this action plan is to cultivate an informed public and enhance ocean stewardship by increasing public awareness, understanding, and appreciation of sanctuary resources in American Samoa.

4.5.1 Overview

Links to Other Action Plans
4.1 Cultural Heritage & Community Engagement 4.2 Marine Conservation Science 4.3 Climate Change 4.6 Resource Protection and Enforcement 4.7 Partnerships & Interagency Cooperation 4.8 Program Evaluation

Links to Goals
Goal 6

Ocean literacy is "the understanding of the ocean's influence on you and your influence on the ocean" (NOAA NOS 2010). NOAA has collaborated with a consortium of partners in the Ocean Literacy Network to develop a series of ocean literacy essential principals and fundamental concepts (available at http://oceanservice.noaa.gov/education/literacy.html/) to help guide education efforts and bring them in line with National Science Education Standards. Effective local ocean literacy encourages public involvement in resource protection, increases knowledge about American Samoa's marine resources, creates an informed public, and helps nurture future marine science and resource management professionals. Achieving ocean literacy requires educational initiatives for learners of all ages. "Education" encompasses formal education, informal education, and outreach for education. Formal education is learning "within a structured education system in which children or adults are required to demonstrate proficiency" (NOAA ONMS 2010: 3). Informal education is learning "outside the established formal system that meets clearly defined objectives through organized education activities" (NOAA ONMS 2010: 3). Finally, outreach for education is defined as activities "that are designed to build awareness, develop relationships, promote education products and inspire educators, students and the public to pursue further learning opportunities" (NOAA ONMS 2010: 3).

Sanctuary ocean literacy activities are part of ONMS work to enhance the overarching NOAA education vision to create "an informed society that uses a comprehensive understanding of the role of the ocean, coasts, and atmosphere in the global ecosystem to make the best social and economic decisions" (NOAA ONMS 2010: 1). These activities are informed by the ocean literacy essential principals and fundamental concepts referred to above and are also in line with the overall NOAA education goals (NOAA 2009b):

- *Environmental literacy*: An environmentally literate public supported by a continuum of lifelong formal and informal education and outreach opportunities in ocean, coastal, Great Lakes, weather, and climate sciences.

- *Workforce development*: A future workforce, reflecting the diversity of the nation, skilled in science, technology, engineering, mathematics, and other disciplines critical to NOAA's mission.

The overall intent of this action plan is to provide information and build ocean literacy programs that benefit not only sanctuary units, but the broader Samoan archipelago and the Pacific region as well. Hands-on learning opportunities for students and teachers, as well as youth leadership opportunities in sanctuary stewardship, are powerful approaches to reinforce and augment ocean literacy in formal classroom education. Ocean literacy activities will draw on and provide education about sanctuary programs in other disciplines such as marine conservation science, cultural and traditional heritage, maritime heritage, and natural resource protection.

Since it was established, the sanctuary has provided a suite of education and outreach materials and programs, most of which were accomplished via efforts with sanctuary partners:

- Posters and brochures;
- Annual Art & Tide Calendars;
- Tide charts;
- School educational programs (presentations, hikes, and field trips);
- Teacher workshops; and
- A sanctuary website.

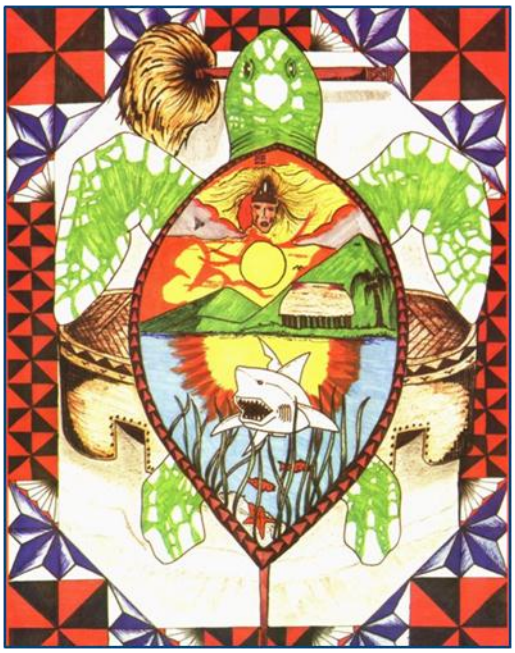

Photo 13: Artwork by area kindergarten through 12th graders, like this piece by Patrick Mafo'e of Leone High School, is often featured in education products such as art and tide calendars.

A number of key sanctuary education partners belong to *Le Tausagi*, an inter-agency environmental education consortium established in 1996, for which sanctuary staff played a coordinating role. Member agencies include AS-EPA, ASCC Land & Sea Grant and Marine Science Programs, USDA Natural Resources Conservation Service, the Territorial Emergency Office, AS DOC – Coastal Management Program, the National Park of American Samoa, and AmeriCorps. *Le Tausagi* members collaborate on major environmental events in the territory to maximize their limited resources toward their common objective of sharing information on resource protection. Such events occur throughout the year and include Earth Day, Career Days, Enviro-Discoveries Summer Camps (grades 5 through 8), Coastweeks, Arbor Day, and the annual Art & Tide Calendar awards ceremony. Partners work together to develop educational booth displays, presentations and activities for these and other events.

4.5.2 Issues and Need for Action

4.5.2.1 Improving Sanctuary Awareness

It was evident from the 2009 scoping sessions that there was a lack of general awareness about the cultural, economic, and ecological significance of the sanctuary and of the National Marine Sanctuary System. This lack of awareness may, in part, be due to the lack of sufficient: (1) coordination of educational materials and investments; (2) promotion, access, and distribution of materials and programs; (3) maintenance and updating of materials and programs; (4) teacher training and encouragement to incorporate American Samoa marine concepts into classroom activities; (5) educational and outreach access to resources; and (6) partnerships with village communities and agencies to support conservation programs and highlight pride among residents of American Samoa and visitors. Aside from improving general sanctuary awareness, sanctuary staff are faced with challenges in terms of how best to increase sanctuary awareness among diverse constituents. This challenge is further complicated when considering that, "While local environmental education has made great strides in the last decade, there is still a widespread lack of understanding, acknowledgment, and acceptance of environmental issues that affect the Territory" (AS-EPA 2010).

Bringing the Place to the People

Although access to Fagatele Bay and Larsen Bay improved in 2007 when sanctuary staff worked with villages, land holders, and other partners to develop the Fagatele Bay Trail, sanctuary accessibility remains an issue. The sanctuary units are located in remote locations within American Samoa, which is itself remote and located far from population centers in Hawai'i, the U.S. mainland, and beyond. Some units are accessible only by boat, those that are accessible by land require access permission from private land holders, and other units are located in far reaches of the territory. In addition to accessibility issues, most American Samoans are not water sport enthusiasts, so encouraging locals to enjoy sanctuary activities such as swimming, snorkeling, or diving is not practical. To help address the lack of awareness about the sanctuary and the difficulty of reaching it, sanctuary staff and partners will bring the place to the people – as well as work to inform people who visit the place (described below). This action plan presents several means for bringing the place to the people, including a new visitor center, education and outreach activities, and outreach tools such as interactive touch screen kiosks that can be strategically placed in high traffic public locations.

Informing People at the Place

It is crucial to make sanctuary visitors aware that they are in a national marine sanctuary, and furthermore to make them aware of which activities are appropriate and which are prohibited or restricted within the sanctuary. While the Fagatele Bay unit includes a number of sanctuary signs on the trail leading from Futiga to the bay (including a sign in Samoan at the entrance, one at the landing above the bay, and four along the trail), there are currently no sanctuary signs at the entrances to the trail leading from Vaitogi or Taputimu. The other sanctuary units do not have any sanctuary signs. Although sanctuary staff developed a sanctuary brochure that includes

information about sanctuary resources and access via the Fagatele Bay trail, it needs to be updated to reflect additional sanctuary units and access points.

Supporting Formal and Informal Education Opportunities

Photo 14: The first EnviroDiscoveries summer camp was held in 1993 in Futiga Village. Photo: Nancy Daschbach, NOAA National Marine Sanctuaries.

Education has been an important element of the sanctuary since it was designated in 1986, with educational projects covering a range of topics including community-based programs that encourage public involvement in resource protection, student educational programs, sanctuary experiences, student internships and mentorship, and outreach events. There has been a coordinated effort through formal and informal education at all school levels from elementary through community college to further enhance public awareness and understanding of the marine ecosystem. Some of today's formal education challenges pertain to student accessibility to modern education tools, namely computers and Internet access. Information technology is at different stages of development in American Samoa's schools. Computer and Internet access varies. With so much of today's information in electronic and web-based forms, sanctuary education staff must find innovative ways to bring this information to local students and to engage local students in the growing realm of interactive, media-based education.

Local students require professional development opportunities, which may come in the form of sanctuary internships, to build local capacity in fields such as marine environmental education, marine science, and marine resource management. Interns and volunteers (described in the Cultural Heritage & Community Engagement Action Plan) are a critical component of operations and a tremendous asset at other sites in the National Marine Sanctuary System, which can serve as models for enhancing local sanctuary internship programs. Internships provide students not only with opportunities to gain valuable work experience, but also to explore career options and make meaningful contributions to their field. Interns may earn college credit, move on to higher education, or find interesting and productive marine-resource related employment. Sponsoring interns can enable sanctuary staff to raise awareness about the sanctuary among the local student population, as well as foster careers in marine science and resource management.

4.5.2.2 Relevant Issues Raised During Scoping

During the 2009 public scoping meetings, it was clear that public knowledge about this sanctuary and the National Marine Sanctuary System is limited. This point was reinforced during the sanctuary's 2010 Dive into Education Workshop, where 40 percent of participants indicated that they had low or very low knowledge about this sanctuary, and 44 percent had low to very knowledge of the National Marine Sanctuary System. Issues relevant to ocean literacy that were raised during public scoping sessions within villages may be summarized as:

- Lack of awareness and availability of information;
- Lack of a visitor center to promote visitor interest in Fagatele Bay and increase the scope of outreach efforts;
- Lack of a developed ocean awareness program among all age groups;
- A need to better clarify the co-management relationship between ASG and the NOAA Office of National Marine Sanctuaries;
- Outreach regarding enforcement and regulations is needed, as few villagers understand what the regulations are, including the zoning of Fagatele Bay;
- Greater awareness of regulations would facilitate enforcement efforts;
- There is a need to target outreach efforts for village communities with promotion of the importance of place-based marine conservation and the benefits it provides to American Samoa and the rest of the nation;
- Samoan legends should be included in all outreach efforts – including outreach to tourists;
- Need improved outreach that clarifies the sanctuary mission, programs, goals, and objectives;
- Need resources to market or readily share sanctuary information with the community;
- The sanctuary should provide internships for college and high school students in education, outreach, science, and management;
- Lack of a collaborative approach with partners to package and market natural assets in American Samoa;
- Improve access to Fagatele Bay:
  - Road maintenance;
  - The trail is overgrown;
  - Build a walkway on the trail to stop erosion and make it more accessible to people; and
  - Regularly clear and mark trails to Sliding Rock and Larsen Bay.

4.5.3 Addressing the Issues – Strategies for this Action Plan

The strategies and associated activities identified in this action plan aim to cultivate an ocean-literate public making informed environmental decisions. This action plan calls for innovative approaches to formal and informal education, as well as public awareness, outreach, constituency building, and ocean literacy for American Samoa. The intent is also to nurture existing partnerships with enhanced programs and develop new relationships to further marine conservation, build local capacity, and reach all audiences in American Samoa and abroad. In addition to this effort, sanctuary staff will implement a robust communication effort and public interface, which will allow for various levels of support for and participation in sanctuary activities. This strategy calls for sanctuary staff to work with partners such as the AS Visitors Bureau, AS Department of Port Administration and Office of Samoan Affairs, *Le Tausagi* members, and the sanctuary advisory council on new issues and take appropriate action to address current and emerging opportunities that support resource protection.

These strategies have been developed to reach all constituencies within American Samoa and beyond, including Pacific regional, national, and international government, industry, and community stakeholders. Key sanctuary constituencies include, but are not limited to, the following:

- Territorial and federal government partners such as the National Park of American Samoa;
- American Samoa Legislature;
- Villages and communities near sanctuary units and across the territory;
- Commercial and recreational fishers;
- Schools, organizations, and institutions that conduct marine education and outreach programs throughout American Samoa;
- Other states, territories, and Pacific Nations managing coral reefs;
- Business and industry;
- Public (locally and abroad); and
- Research and academia.

Outreach to these diverse constituencies must be closely coordinated with strategies and activities to achieve sanctuary resource protection at units across the archipelago. A strong public outreach and education effort that bridges community concerns and needs should be led by instilling a sense of ownership and commitment from the adjacent communities, villages, schools, and public at large. In turn, local ownership and commitment can galvanize broader support for ocean and island conservation within the territory. The following strategies have been identified by a working group consisting of sanctuary advisory council members, private industry, and members of the public, to cultivate an informed, involved constituency that supports and enhances conservation of the natural, cultural, and heritage resources of sanctuary units in American Samoa. The desired outcomes of these strategies include:

- A community informed and educated about sanctuary resources;
- Increased stewardship of sanctuary resources; and
- An integrated educational curriculum for schools.

The strategies and activities are coded by the acronym for the action plan title, “Ocean Literacy” (OL). A summary of strategies and activities is provided in Table 4-7 at the end of this action plan (see p. 246).

- Strategy OL-1: Open and operate a Sanctuary Visitor Center of American Samoa.
- Strategy OL-2: Increase outreach to communities in American Samoa and abroad.
- Strategy OL-3: Increase ocean literacy through development and implementation of formal education programs and materials in American Samoa.
- Strategy OL-4: Develop creative programs for student participation that encourage learning about sanctuary resources and ocean stewardship.

Strategy OL-1: Open and operate a Sanctuary Visitor Center of American Samoa.

Sanctuary management and the AS DOC have accelerated efforts to renovate and expand the ASG-Convention Center to include a new sanctuary visitor center to foster appreciation and preservation of the people, place, marine resources and cultural heritage of American Samoa. The facility will also serve as the new home of sanctuary staff offices and should be completed by mid-2012. In addition, it will house a reception area, gift shop, storage, and a rotunda. The approximately 3,000–square-foot rotunda will provide both residents and visitors a unique experience to acquire information about the sanctuary, as well as accommodate a wide range of education and outreach activities. The approximately 500–square-foot area dedicated to the visitor center will incorporate interactive exhibits that provide locals and visitors visual access to the local sanctuary units. This facility represents the first sanctuary visitor center in the territory and will provide opportunities to share information about the importance of marine conservation in American Samoa.

Activity OL-1.1: *Develop exhibits and displays for new visitor center within 1 year.*
The visitor center is expected to be completed by fall 2011. Sanctuary staff will work with ONMS headquarters staff to design and develop new exhibits and displays within 3 months after the final management plan is published. Incorporation of the principles and fundamental concepts of ocean and climate literacy will help ensure the facility serves to cultivate an ocean-literate public. These principles and fundamental concepts are available on line at http://oceanservice.noaa.gov/education/literacy.html.

Activity OL-1.2: *Develop a Visitor Center Operations and Program Plan within 6 months.*
The visitor center will disseminate information and provide a memorable experience for every visitor to the facility to facilitate access to sanctuary resources and materials. Sanctuary staff will develop a Visitor Center Operations and Program Plan within 6 months to ensure the new visitor center is adequately maintained, exhibits are relevant as well as current, and the visitor experience is positive and achieves desired outcomes. The plan will include necessary administration, capacity building, outreach, education, and constituency building program requirements.

Activity OL-1.3: *Develop and implement a visitor experience survey and evaluation within 1 year.*
Sanctuary staff will develop a voluntary visitor experience survey to gauge audience views and opinions of the new visitor center. In addition, sanctuary staff will request that the advisory council's education working group assist in development of pre- and post-experience Ocean Literacy Knowledge Surveys to evaluate the visitor center's effectiveness. The survey will meet all requirements of the Paperwork Reduction Act.

Activity OL-1.4: *Investigate and establish partnerships with the private sector and government agencies to promote the sanctuary visitor center in American Samoa and abroad.*
Sanctuary staff will develop partnerships with a number of local government agencies and private sector entities within 1 year after the visitor center opens. These partnerships will promote visitor opportunities available at the visitor center and sanctuary units, and will market

these opportunities locally and abroad. These partnerships will include, but are not limited to, the AS Department of Port Administration, AS Visitors Bureau, shipping agencies, and tour operators. Outreach will extend to include Pacific-wide audiences targeting airline magazines and regional focus.

Strategy OL-2: Increase outreach to communities in American Samoa and abroad.

Outreach to local communities and stakeholders must be increased to increase public awareness and cultivate responsible ocean stewardship. Outreach products and programs will be developed with partners, as appropriate, and address information needs of the public and sanctuary constituents. Messages will be identified in consultation with ONMS headquarters, the sanctuary advisory council, and other partners, and will incorporate climate and ocean literacy principles developed by NOAA (http://oceanservice.noaa.gov/education/literacy.html).

Activity OL-2.1: *Develop and implement an integrated communications plan to engage constituencies within 2 years after the management plan is released.*
Using ONMS "Best Practices," sanctuary staff will develop a comprehensive communications plan to raise sanctuary awareness locally, regionally, and nationally. Print, television, Internet, and radio are all valuable media to enhance public awareness of the sanctuary. For example, sanctuary staff will continue to create commercial radio messages in support of ocean stewardship and sanctuary programs. A radio message will be broadcast each month that focuses on a different sanctuary perspective, from snorkeling and diving interests, to academic and scientific interests, to education and conservation perspectives. Sanctuary staff have been working with local radio stations for a number of years and will build off of this local experience as well as radio outreach experiences from other sanctuaries.

The written word is equally powerful and has applications where television and radio are not appropriate. Sanctuary staff will continue to develop written materials such as newsletters, e-newsletters, magazine articles, brochures, pamphlets, and posters to inform stakeholders about the sanctuary, its programs, and its regional and national value as a natural resource. A campaign of regular press releases in English and Samoan will be used to raise awareness about the sanctuary among territorial and regional media, decision makers and the public.

Activity OL-2.2: *Maintain and enhance public outreach and awareness partnerships throughout the life of the management plan.*
By working with organizations, foundations, and institutions on coastal and marine issues, resources can be leveraged, so that all parties achieve common goals and increase public awareness of ocean stewardship and sanctuary programs. Sanctuary staff will continue to investigate new partnerships and, where needed, formalize partnerships through various means, including memoranda of agreement.

Activity OL-2.3: *Participate in special events annually.*
Sanctuary staff will participate in annual events such as Earth Day, Enviro-Discoveries Camps, Arbor Day, and Coastweeks celebrations, as well as several other events that allow for the exchange of sanctuary information, to increase the visibility of the sanctuary. Staff will also give numerous presentations to civic and non-profit organizations throughout the year to increase public awareness.

Activity OL-2.4: *Develop signs and kiosks within 2 years, maintain annually.*
Sanctuary visitors will experience the sanctuary by visiting the actual sanctuary units or the visitor center. Appropriate signage will be developed for each within 2 years to ensure there is adequate outreach to everyone who visits sanctuary units. Signs at each unit will provide information about sanctuary resources, rules, and regulations. Signs will be developed within 2 years and maintained annually thereafter.

Photo 15: A sign in Samoan marks the turnoff from Rt. 1 to Futiga Road and the entrance gate to Fagatele Bay National Marine Sanctuary, but additional signs in Samoan and English could help improve public awareness of the sanctuary. Photo: Sarah Kinsfather.

Sanctuary staff will develop and install interactive kiosks at the Pago Pago International Airport and LBJ Hospital to better share information about sanctuary resources with a broader audience than that visiting sanctuary units and the visitor center. Sanctuary interactive kiosks are developed through the ONMS Interactive Touch Screen Kiosk Project.[1] The kiosks offer a high-impact visual and auditory showcase of all the treasures the sanctuary has to offer. With the click of a button, users learn about the various activities of the sanctuary; educational and outreach programs; research projects; and resource protection programs; as well as extensive information about species and habitats. Each kiosk offers real-time weather information from the National Weather Service, site specific, as well as national program information. The ONMS's user interface is one of the most in-depth and content rich kiosks anywhere. The local kiosk project will also be completed within 2 years, and kiosks will be maintained annually thereafter.

[1] For more information on sanctuary interactive kiosks, visit: http://sanctuaries.noaa.gov/visit/kiosk/kiosk.html.

Activity OL-2.5: *Research, and where feasible implement telepresence technologies and tools to increase public understanding of American Samoa's marine ecosystems within 5 years.*
Since few people will likely visit this remote sanctuary, it is important to be able to bring the place to the people. Telepresence technologies such as real-time video transmission and underwater video cameras can provide a wide audience with unique learning opportunities, such as virtual sanctuary field trips. Sanctuary staff will investigate suitable technologies to achieve this type of outreach from this remote location and will work to incorporate this sanctuary into the larger ONMS OceansLIVE initiative. Obstacles to implementing these technologies exist, such as cost; however, partnerships can be developed to help provide this virtual experience to the world.

Activity OL-2.6: *Acquire "Science on a Sphere®" technologies within 1 year, maintain and update annually.*
Science On a Sphere® (SOS®) is a room-sized, global display system that uses computers and video projectors to display planetary data onto a 6-foot-diameter sphere, analogous to a giant, animated globe. NOAA researchers developed Science On a Sphere® as an educational tool to help illustrate earth system science to people of all ages. Animated images of atmospheric storms, climate change, and ocean temperature can be shown on the sphere, which is used to explain complex environmental processes in a way that is simultaneously intuitive and captivating. The sanctuary will be the first in the South Pacific to acquire SOS® technologies. Data specific to American Samoa and the Samoan archipelago will be developed and integrated into the SOS® programming, and all programming will be updated on a periodic basis.

Photo 16: Flower Garden Banks National Marine Sanctuary (Texas) featured SOS® technology during their Ocean Discovery Day in 2010. NOAA Photo: By Will von Dauster.

Activity OL-2.7: *Develop interpretive materials targeting recreational sanctuary users within 2 years.*
One of the sanctuary's goals is to "Facilitate, to the extent compatible with the primary objective of resource protection, public and private recreational uses of the sanctuary not prohibited pursuant to other authorities." Ensuring responsible sanctuary use requires outreach to constituents who intend to visit the sanctuary. A targeted program is needed for fishermen, divers, snorkelers, kayakers, and boaters, which encourages appropriate activities and ocean ethics to promote the wise use of sanctuary resources. Messages sanctuary staff develop as part of this program will be disseminated at sanctuary units.

Strategy OL-3: Increase ocean literacy through development and implementation of formal education programs and materials in American Samoa.

Sanctuary staff will address educators' needs for sanctuary-related materials and marine-related programs by working with the American Samoa Department Of Education (ASDOE) and *Le Tausagi*. Together, sanctuary staff and partners will decide how to augment existing materials for kindergarten through grade 12 and ensure that these materials are consistent with learning standards in various disciplines in American Samoa. For example, sanctuary staff will incorporate climate and ocean literacy principles developed by NOAA and partners (http://oceanservice.noaa.gov/education/literacy.html).

Activity OL-3.1: *Develop marine-related education programs for visitors to sanctuary units and the visitor center, annually.*
Sanctuary staff, in partnership with other coastal agencies, will continue to develop educational programs to provide students and teachers with basic information on topics such as coral reef ecology, oceanographic connectivity, and watersheds (ridge-to-reef). The programming will use sanctuary examples, as appropriate, and familiarize teachers and students with the sanctuary system and its goals. The programs and associated materials will be developed for use during student field trips to the sanctuary and at the sanctuary visitor center and will target students ranging from elementary to the community college level.

Activity OL-3.2: *Develop marine science/marine conservation education programs and materials for K-12 classrooms.*
Sanctuary staff will collaborate with ASDOE Science Division, local teachers, and *Le Tausagi* to develop formal marine-related educational programs and materials. The educational programs and materials will use sanctuary examples, as appropriate, and familiarize teachers and students with the sanctuary system and its goals. The programs may include sanctuary staff attending classrooms to present the information. The materials will be developed for classroom use in coordination with ASDOE and will serve to supplement and complement existing materials.

Activity OL-3.3: *Retrofit the Hawaiian "Navigating Change" curriculum to make it applicable to American Samoa and the Samoan Archipelago within 4 years.*
NOAA staff in Hawai'i developed the Navigating Change program to raise awareness and motivate people to change their attitudes and behaviors to better care for land and ocean resources. This successful program provides an excellent framework for instructional activities that focus on science, social studies, and language and cultural arts. Sanctuary staff will work with Navigating Change experts in Hawai'i to retrofit the curriculum for American Samoa. Sanctuary staff will also coordinate with the ASDOE Science Division on development of these materials to ensure that they meet local standards, supplement and complement existing materials.

Strategy OL-4: Develop creative programs for student participation that encourage learning about sanctuary resources and ocean stewardship.

In addition to formal education, sanctuary staff will support a number of informal education opportunities for students to learn about marine science and marine conservation. These opportunities will provide the substance of formal education, but will do so in exciting and innovative ways that maintain student interest long after their experience has ended.

Activity OL-4.1: *Develop a sanctuary Student Ocean Council within 2 years and support quarterly meetings.*
Sanctuary staff will collaborate with ASCC and *Le Tausagi* to develop a sanctuary Student Ocean Council (SOC). The SOC would serve as an educational initiative offered to local high school and community college students interested in the ocean sciences. It would provide them with broad exposure to data collecting, career opportunities, and marine conservation issues, with a focus on the sanctuary and its partnerships with other agencies and the private sector. The content of quarterly gatherings would vary depending on current events and would be made relevant to student interests. Participants will learn about current research, track NOAA exploration and research missions, and participate in hands-on projects including: fish and squid dissections, interpretive hikes around sanctuary units, water quality monitoring, and marsh studies, among others.

Activity OL-4.2: *Foster youth leadership through annual SOC Internship opportunity.*
Sanctuary staff will identify one student annually to serve as a sanctuary education intern. The intern will be responsible for organizing and managing the SOC and for recruiting students to the program. The intern will be provided temporary space in the sanctuary offices and will participate in various sanctuary functions and meetings. The intern will receive a broad experience that may help serve as a bridge to future work in the marine science field.

Activity OL-4.3: *Continue to support the student/teacher education day aboard the NOAA Ship* Hi'ialakai.
The NOAA ship *Hi'ialakai* makes port in American Samoa every 2 to 3 years (depending on scheduling). When it is in port, the ship provides a platform for a unique learning experience in American Samoa. An education day targeting American Samoa high schools (including Manu'a schools), has typically allowed more than 30 teachers and students to spend a day aboard the *Hi'ialakai* learning about ship operations and marine science. Participating students typically complete education modules on topics such as water quality, GIS, benthic sampling, and habitat identification. This experience provides a wonderful hands-on opportunity for American Samoan students to discover marine conservation career options. Sanctuary staff will continue to support this activity every time the *Hi'ialakai* comes to American Samoa.

Activity OL-4.4: *Organize, host, and support 12 school trips to the sanctuary visitor center each year.*
The new sanctuary visitor center will provide a venue for learning unlike any other in American Samoa. This unique center will provide a memorable experience in a setting conducive to learning. Sanctuary staff will host at least one school group every month to participate in educational programs on topics such as coral reef ecology, oceanographic connectivity and

watersheds (ridge-to-reef). The programs will use sanctuary examples, as appropriate, and familiarize teachers and students with the sanctuary system and its goals (see Activity OL-3.1). Students will be given pre- and post-experience Ocean Literacy Knowledge Surveys to evaluate program effectiveness (see Activity OL-1.3).

Activity OL-4.5: *Continue to support programs that promote student participation and learning about marine conservation issues.*
Sanctuary staff will continue to support special programs that highlight marine conservation efforts. These programs may include poster and art contests, photo contests, and the annual Art & Tide Calendar, among others.

Table 4-7: Summary of Strategies and Activities for the Ocean Literacy Action Plan.

STRATEGIES AND ACTIVITIES	
Strategy OL-1: Open and operate a Sanctuary Visitor Center of American Samoa.	
Activity OL-1.1:	Develop exhibits and displays for new visitor center within 1 year.
Activity OL-1.2:	Develop a Visitor Center Operations and Program Plan within 6 months.
Activity OL-1.3:	Develop and implement a visitor experience survey and evaluation within 1 year.
Activity OL-1.4:	Investigate and establish partnerships with the private sector and government agencies to promote the sanctuary visitor center in American Samoa and abroad.
Strategy OL-2: Increase outreach to communities in American Samoa and abroad.	
Activity OL-2.1:	Develop and implement an integrated communications plan to engage constituencies within 2 years after the management plan is released.
Activity OL-2.2:	Maintain and enhance public outreach and awareness partnerships throughout the life of the management plan.
Activity OL-2.3:	Participate in special events annually.
Activity OL-2.4:	Develop signs and kiosks within 2 years, maintain annually.
Activity OL-2.5:	Research, and where feasible implement telepresence technologies and tools to increase public understanding of American Samoa's marine ecosystems within 5 years.
Activity OL-2.6:	Acquire "Science on a Sphere®" technologies within 1 year, maintain and update annually.
Activity OL-2.7:	Develop interpretive materials targeting recreational sanctuary users within 2 years.
Strategy OL-3: Increase ocean literacy through development and implementation of formal education programs and materials in American Samoa.	
Activity OL-3.1:	Develop marine-related education programs for visitors to sanctuary units and the visitor center, annually.
Activity OL-3.2:	Develop marine science/marine conservation education programs and materials for K-12 classrooms.
Activity OL-3.3:	Retrofit the Hawaiian "Navigating Change" curriculum to make it applicable to American Samoa and the Samoan Archipelago within 4 years.

STRATEGIES AND ACTIVITIES	
Strategy OL-4: Develop creative programs for student participation that encourage learning about sanctuary resources and ocean stewardship.	
Activity OL-4.1:	Develop a sanctuary Student Ocean Council within 2 years and support quarterly meetings.
Activity OL-4.2:	Foster youth leadership through annual SOC Internship opportunity.
Activity OL-4.3:	Continue to support the student/teacher education day aboard the NOAA Ship *Hi'ialakai*.
Activity OL-4.4:	Organize, host, and support 12 school trips to the sanctuary visitor center each year.
Activity OL-4.5:	Continue to support programs that promote student participation and learning about marine conservation issues.

4.5.4 Addressing the Issues – Strategies from other Action Plans

A number of strategies from other action plans either directly or indirectly help to address the issues identified in this Ocean Literacy Action Plan:

- Strategy CH&CE-1: Create a sanctuary-based Samoan cultural heritage outreach and preservation program.
- Strategy CH&CE-2: Develop volunteer programs that increase site visibility while engaging resource users and promoting local stewardship.
- Strategy CH&CE-3: Provide staff support, resources, and guidance to assist with sanctuary advisory council operations.
- Strategy CH&CE-4: Inventory and assess maritime heritage resources within the sanctuary and American Samoa.
- Strategy MCS-3: Interpret and communicate the results of scientific activities taking place in and around the sanctuary throughout the life of the management plan.
- Strategy CC-4: Partner to promote public awareness about potential climate change impacts to sanctuary units within 5 years.
- Strategy RP&E-1: Develop and disseminate education and outreach materials regarding all new regulations (including boundaries) within 1 year.
- Strategy RP&E-3: Reduce the effects of marine debris on sanctuary resources through targeted removal efforts and increasing public awareness of marine debris hazards.
- Strategy RP&E-5: Facilitate research and monitoring regarding the effect of land-based sources of pollution on sanctuary resources and develop outreach materials to share the results.
- Strategy P&IC-2: Support cooperation and coordination among agencies and organizations throughout the life of the management plan.
- Strategy P&IC-3: Promote international, national, and local agency collaborations to increase capacity building and foster networks that will improve management effectiveness.

4.5.5 Addressing the Issues – Regulations

Education and outreach are important tools used to assist with increasing compliance with sanctuary regulations. However, certain education activities may themselves require a sanctuary permit. The sanctuary's permit regulations and the National Marine Sanctuary System-wide regulations address terms and conditions for issuance of sanctuary permits. These regulations are available at 15 CFR Part 922 Subpart J and 15 CFR Part 922.48.

Photo 17: The new sanctuary mural at Fagatogo Market in Pago Pago provides another opportunity to increase public awareness of the sanctuary. (Left to right) Lelei Peau (AS DOC Deputy Director), Dan Basta (ONMS Director), Governor Togiola Tulafono, and Gene Brighouse (sanctuary Superintendent). Photo: NOAA National Marine Sanctuaries.

4.6 RESOURCE PROTECTION AND ENFORCEMENT ACTION PLAN

The primary objective of this action plan is to reduce existing and potential resource threats and to prevent adverse impacts to the ecosystem.

4.6.1 Overview

Links to Other Action Plans
4.1 Cultural Heritage & Community Engagement 4.2 Marine Conservation Science 4.3 Climate Change 4.4 Operations and Administration 4.5 Ocean Literacy 4.7 Partnerships & Interagency Cooperation 4.8 Program Evaluation

Links to Goals
Goal 1 Goal 2 Goal 6 Goal 7 Goal 8

As discussed in Chapter 3, by including the broad mandate "to protect, and where appropriate, restore and enhance natural habitats, populations, and ecological processes," the NMSA highlights its purpose to provide holistic protection of biodiversity in sanctuaries. Biodiversity encompasses all levels of organizational complexity in the sanctuary, from genetic diversity to species diversity to community diversity. Protecting biodiversity, maintaining ecological integrity, and allowing for sustainable use of sanctuary resources that are compatible with the primary goal of resource protection requires attention to how the component species interact and how those species and interactions are valued. It also requires accurately identifying, researching, and assessing the significance of specific resource issues and threats, and providing ongoing tracking of such issues. With timely and proper issue assessment and analysis, appropriate actions can be taken by sanctuary management to reduce the potential for negative impacts on sanctuary resources and qualities, and to maintain the public's appropriate use and enjoyment of the sanctuary.

Developing and implementing risk reduction protocols and emergency response plans, promoting responsible use of the resources, and achieving compliance with all sanctuary regulations can help achieve this objective. Given the web of territorial and federal jurisdictions relevant to sanctuary resources (see Chapter 3), sanctuary staff coordinate efforts with partner agencies to achieve mutual objectives in resource protection and enforcement. This action plan presents strategies and activities for addressing the sanctuary's resource protection needs.

4.6.2 Issues and Need for Action

As established in the Marine Conservation Science Action Plan, baseline assessments, habitat mapping, and ongoing long-term monitoring of all sanctuary units are priorities for sanctuary management. As these assessments are completed and monitoring data become available, sanctuary staff will use this information to analyze the status of sanctuary resources and develop tools such as condition reports. The next step is to synthesize available information on the status of resources to develop a "big picture" sense not only of the status and condition of individual ecosystem components, but also in terms of greater biodiversity. Since many sanctuary resources and resource threats are able to freely move across sanctuary boundaries, sanctuary management must further consider its progress toward biodiversity protection in a broader regional context. Sanctuary management must consider resource protection efforts not only in terms of individual

sanctuary units, but also in terms of the entire network of units that make up the sanctuary. Implementing resource protection also requires identifying and addressing specific resource threats, a number of which are identified below (see also Chapter 3's section on Anthropogenic Stressors). Finally, sanctuary regulations are an important resource protection tool that enables sanctuary management to restrict or prohibit harmful activities within sanctuary units. The regulations are described in brief at the end of this action plan and in detail in Chapter 2. Just as the non-regulatory activities described in this chapter require implementation, the regulations require enforcement.

4.6.2.1 Specific Resource Threats

In addition to the wide range of issues discussed in other action plans, this action plan focuses on existing and potential resource protection issues. Potential issues include those that have been identified in other coastal and marine areas but have yet to be considered current threats to sanctuary resources in American Samoa. In addition, they include threats that have already been identified in the sanctuary or surrounding region that have had relatively little impact thus far, but that could develop to have larger impacts in the future. Resource threats addressed in this action plan include introduced species; marine debris; anchor damage to sensitive habitats; land-based sources of pollution; and emergency response-related events (*e.g.*, vessel groundings or oil and fuel spills). In addition to addressing these threats, achieving compliance with sanctuary regulations is necessary to protect sanctuary resources. Effectively responding to hazardous spills or other emergencies and ensuring compliance with sanctuary regulations requires a series of coordinated activities among multiple agencies, vessel operations, and adequate staff and volunteer training.

Introduced Species

Any species (including eggs, seeds, spores, or other biological material capable of propagating that species) that is not native to an ecosystem is considered an introduced species. An invasive species is defined as a species (1) that is nonnative (or alien) to the ecosystem under consideration, and (2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order13112). Insular ecosystems are often more vulnerable to the effects of introduced species than are continental areas because of the smaller total population sizes, higher endemism, and species that have evolved longer in the absence of predators and thus are less likely to have developed defenses against them (Blackburn *et al.* 2004).

Scientists estimate that every day as many as 3,000 alien species are transported by ships around the world; however, not all transported species survive the trip or exposure to their new environment (MITSG 2004). Once established, these species have the potential to change the structure, pattern, and function of a biological community. Introduced species have harmed more than 45 percent of listed threatened or endangered species in the United States; the establishment of introduced species is second to habitat loss as the major threat to native species diversity (Government Accounting Office 2002; Kimball 2001; Wilcove *et al.* 1998). Some of the ecological impacts associated with introduced species in the marine environment include:

- Increased intra- or inter-species competition with native species for food and habitat space;
- Altering the gene pools of native species through hybridization or cross breeding;
- Replacement of a functionally similar native species (affects native species richness);
- Alteration of habitat or substrate;
- Spreading parasites or disease
- Altering predator/prey relationships; and
- Direct or indirect toxicity (*e.g.*, toxic diatoms).

Coles *et al.* (2003) found five non-indigenous or cryptogenic marine species within Fagatele Bay: a macroalgae (*Caulerpa serrulata*); a red seaweed (*Halymenia durvilleii*); a hydrozoan (*Plumularia strictocarpa*); an annelid worm (*Salmacina dysteri*); and a bryozoan (*Savignyella lafontii*). A total of 28 non-indigenous or cryptogenic marine species were identified at the 10 survey sites around Tutuila, none of which has been found to be invasive in other areas (Coles *et al.* 2003). At present, no native marine species appear to be threatened by the introduction of non-native species. However, new introductions are always possible. In addition, alterations in environmental conditions associated with climate change could favor non-native species currently present in American Samoa, thus presenting an increased threat to native species. Therefore, monitoring should be carried out to assess proliferation of existing alien species and to identify new introductions. If it is determined that an alien species is invasive, eradication measures should be undertaken, where possible.

Marine Debris

Photo 18: Marine debris lines the shoreline at Larsen Bay, the next bay East of Fagatele. Photo: Sarah Kinsfather.

Marine debris may be any object of wood, metal, glass, rubber, plastic, cloth, paper, or other solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of, or abandoned into the marine environment. Debris such as plastic bottles and trash can regularly be found along the shores of Fagatele Bay. In addition, the heavy fishing presence because of the cannery operations on Tutuila allows for the possibility of fishing-related marine debris. However, no studies have been conducted on the potential impacts of marine debris resulting from American Samoa fisheries on essential fish habitat. The Western Pacific Fishery Management Council is also concerned with "habitat impacts of marine debris originating from fishing operations outside the Western Pacific Region" (WPFMC 2009).

Even though marine debris has not been identified as a major concern for Fagatele Bay, threats associated with marine debris exist. The green sea turtle (*Chelonia mydas*) and the hawksbill turtle (*Eretmochelys imbricata*) are the most frequently found marine turtles in territorial waters, and are known to nest in American Samoa – hawksbills usually nest on isolated Tutuila beaches, while greens primarily nest at Rose Atoll (Craig ed. 2009). Marine debris poses a threat to these and other species though possible ingestion and entanglement. Lost fishing gear may pose an entanglement hazard or damage reef habitats if it becomes entangled on or in the fragile coral reefs (WPFMC-1 2008). Regular monitoring, and if possible removal, of marine debris is necessary to accurately assess this possible threat to sanctuary resources.

Anchor Damage to Sensitive Habitats

Even one misplaced anchor or swaying anchor chain can destroy or dislodge an array of delicate and slow-growing flora and fauna, which are critical to American Samoa's sanctuary ecosystems. While sanctuary staff have not conducted a detailed study on the effects of anchor-related damage to sanctuary resources, anchor damage has been noted in Fagatele Bay. In addition, a participant during the scoping phase of this management plan review stated that "anchor damage is a big issue," and another recommended that the sanctuary "establish and maintain mooring buoys to protect the reefs from anchor damage."

ONMS encourages recreational users to responsibly visit sanctuaries. Mooring buoys could provide better access to the sanctuary units and increase user safety, while greatly reducing the likelihood of anchor damage to fragile coral reef habitats. In other sanctuaries, concerns have been raised that mooring buoys impair marine resources by attracting boaters, divers, and fishermen to the areas. However, a comprehensive mooring buoy program can help minimize anchoring impacts to sensitive marine habitats while providing reasonable access to sanctuary sites and limiting resource use conflicts by directing access to specific locations. NOAA considers the benefits of mooring buoys to outweigh any concern about negative impacts that arose in other areas. Although mooring buoys are excellent management tools, other management programs must accompany a mooring buoy program, including education, outreach, and research and monitoring.

Land-Based Sources of Pollution

Coastal lands have the ability to directly affect adjacent marine resources. Land-based runoff is one of the biggest threats to these environments and often contains fresh water, sediment, pollutants, and debris. All of these stressors can be detrimental to marine organisms and the environment in which they live. According to the International Maritime Organization (IMO), land-based sources of pollution have been

Photo 19: Monitoring is needed to determine whether the Tutuila Landfill, located on Futiga Road upland from Fagatele Bay, is impacting area marine or freshwater. Photo: Sarah Kinsfather.

identified as one of the four greatest threats to the world's oceans (IMO 2000). There are concerns that degrading water quality as a result of land use changes within watersheds will have negative effects on marine resources (DiDonato *et al.* 2008). In addition to general water quality concerns, the Tutuila landfill facility is located directly above Fagatele Bay, where a freshwater stream emerges at the beach.

American Samoa's Coral Reef Advisory Group considers land-based sources of pollution a serious threat and has developed a Land-based Sources of Pollution Local Action Strategy. In addition, the AS-EPA coral reef monitoring program, in part, is designed to "assess the impacts of non-point source pollution on Tutuila's nearshore coral reefs" (Houk 2008). With the landfill directly above Fagatele Bay and a freshwater spring that surfaces at the bay shoreline, dedicated water quality monitoring is required for both marine and fresh water to evaluate whether the landfill has any effect. Establishing partnerships with relevant territorial and federal partners on water quality monitoring at all sanctuary units will provide baseline information necessary to detect changes or trends in watery quality.

Emergency Threats

Vessel groundings and cargo spills are relatively infrequent in the proposed sanctuary units. However, two groundings have been reported at Rose Atoll in recent decades. In October 1993, the 120-foot Taiwanese longline fishing vessel *Jin Shiang Fa* ran hard aground. Within weeks, it broke up on the reef and, as a result, 100,000 gallons of diesel fuel were discharged into the marine environment. Then, in June 2009, the sailing yacht *Paul Eric*, a 35-foot, 10-ton aluminum swing keel yacht, ran aground inside the reef at Rose Atoll. Although no hazardous materials were discharged, it took more than a week to organize a vessel to provide emergency response assistance, thus illustrating the need for a research vessel permanently stationed in American Samoa with the capacity to reach the farthest islands and atolls in the territory (see Activity O&A-4.1). Vessel groundings have also occurred as a direct result of natural disasters.

Natural disasters and events such as tropical cyclones, tsunamis, and coral bleaching also threaten the sanctuary's natural and cultural resources. However, the remote locations of some sanctuary units pose logistical challenges to effective response efforts. ONMS has designed and uses innovative emergency response tools to increase response capabilities related to resource protection emergencies. One of these tools is the Sanctuaries Hazardous Incident Emergency Logistics Database System (SHIELDS). SHIELDS is a comprehensive web-based tool that, in the event of a resource emergency, provides sanctuary and headquarters staff with immediate access to information about habitats and species at risk, any additional threats, resources available to help, notification contacts, maps, and agency jurisdictions. Sanctuary staff help contact key federal, state, and territorial agencies; mobilize assets for response; and ensure that sensitive sanctuary resources are protected.

During the scoping phase of this management plan review, participants noted that sanctuary management needs to develop an emergency response plan. Improving emergency preparedness and contingency planning is a high priority. However, the sanctuary currently lacks sufficient capacity related to contingency planning, identification of emergency response duties, and assessment of emergency needs related to naturally occurring events. Capacity must be enhanced

and efforts must be closely coordinated to effectively respond to resource emergencies (both natural and anthropogenic).

4.6.2.2 Enforcement

Enforcement is a critical resource management tool for national marine sanctuaries, as it ensures that the nation's natural and cultural marine resources of national significance are protected. Many enforcement challenges confront sanctuaries, including balancing public use with protection of habitats, natural, and cultural resources. Another local enforcement challenge is illustrated by this AS-EPA (2010c: 8) observation: "There is a lack of political and public will to enforce most environmental regulations. The regulations themselves are quite comprehensive, but are not seen as a priority for enforcement."

Enforcement was identified as a priority during the scoping phase of this management plan review. Specifically, scoping participants stated that there is a need for increased enforcement efforts, but it is believed that insufficient enforcement is caused by a lack of resources. It was also suggested that there needs to be increased monitoring and surveillance, more enforcement staff, and increased use of enforcement technologies. Village involvement in enforcement efforts was repeatedly emphasized as important.

Section 307 of the NMSA authorizes the Secretary of Commerce to enforce the act, delineates civil penalties and powers of authorized officers, and provides for recovery of penalties by the Secretary. NOAA OLE leads all NOAA enforcement efforts and works in concert with other federal, state, and territorial agencies via cooperative enforcement agreements. NOAA conducts enforcement operations in sanctuaries directly through OLE and through cooperative partnerships with other agencies authorized to enforce the NMSA and its associated regulations, including the U.S. Coast Guard, the U.S. Department of the Interior, and state and territory agencies. The sanctuary enforcement program focuses on providing a law enforcement presence to detect violations, deter unlawful activity, educate users, and investigate violations. In addition, the sanctuary relies heavily on "interpretive enforcement," which seeks voluntary compliance with sanctuary regulations primarily through education and outreach. This interpretive enforcement could be carried out in the sanctuary through programs such as COPPS. COPPS has been adopted by OLE as a national initiative. The goal of COPPS is to gain the greatest level of compliance through knowledge, understanding, and public support for sanctuary goals. COPPS emphasizes informing the public through educational messages and literature about behaving responsibly to prevent adverse impacts to resources. Partnering with the local communities through programs such as COPPS is essential to compliance with sanctuary regulations.[2]

In American Samoa, sanctuary enforcement is conducted through a fabric of partnerships with territorial and federal agencies, as well as with local communities. For example, OLE has a Joint Enforcement Agreement (JEA) with DMWR and has cross-deputized DMWR enforcement officers. The JEA specifies that the major program activity of the DMWR enforcement efforts should be directed toward NOAA major programs, and specifically identifies at-sea activities to "Monitor and investigate illegal Takes and other violations involving all marine life within the

[2] Additional information on OLE's COPPS initiative is available at http://www.nmfs.noaa.gov/ole/copps.html.

Fagatele Bay National Marine Sanctuary." Enforcement activities and regulatory compliance would not be possible without these agency and community partnership arrangements.

4.6.2.3 Relevant Issues Raised During Scoping

During public scoping meetings, a number of issues were raised pertaining to resource protection and enforcement. Many have already been addressed in the description of the issues provided above. They include (in summary):

- Need to develop emergency response plan;
- Identify methods to stop illegal activities, such as fishing (*e.g.*, Global positioning system [GPS], surveillance cameras);
- Need to increase enforcement efforts;
- Lack of enforcement caused by lack of sufficient infrastructure (vessels), fiscal and human resources;
- The territory does not have sufficient resources to maintain constant enforcement activities;
- Develop an undisclosed enforcement schedule;
- Involving local villages/aumaga in enforcement is necessary and important;
- Hire dedicated sanctuary enforcement staff;
- Deputize and fund other enforcement officers to enforce sanctuary regulations;
- Anchor damage is a big issue and mooring buoys should be established;
- Protect Fagatele Bay for food security;
- Address land-based activities and their seaward impacts (*e.g.*, development, land use, sedimentation, and run off);
- Concern that Rose Atoll Marine National Monument will offer less protection than Rose Atoll National Wildlife Refuge;
- Additional sanctuary units should address sufficient biological protection for: reef species assemblage and community structure, migratory/pelagic marine mammals and fish, migration and home range behaviors of resident organisms, and fish and invertebrate population dynamics (*e.g.*, recruitment, spawning, and larval sources);
- Consider changing Fagatele Bay zoning, including to a no-take zone;
- Do not use seasonal closures because they do not allow for sufficient recovery;
- Sanctuary units should include multiple-use zoning, with an enlarged "core reserve" area of full protection from extractive use, and an enlarged "buffer zone" for limited, multiple extractive and non-extractive uses.

4.6.3 Addressing the Issues – Strategies for this Action Plan

The strategies and associated activities in this action plan are intended to provide long-term ecosystem protection to sanctuary resources, while allowing public use compatible with the primary purpose of resource protection. As new resource protection issues and challenges emerge, or knowledge about existing issues alerts us to new concerns, sanctuary staff must be ready to respond appropriately in accordance with the sanctuary's mandate to provide long-term

resource protection. This strategy calls for sanctuary staff to consult with other agencies and the sanctuary advisory council on new issues and take appropriate action to address current and emerging issues of concern.

Seven strategies have been developed for achieving the desired outcome of reducing existing and potential resource threats, and preventing adverse impacts to the ecosystem. The strategies and activities are coded by the acronym for the action plan title, "Resource Protection and Enforcement" (RP&E). A summary of strategies and activities is provided in Table 4-8 at the end of this action plan (see p. 263).

- Strategy RP&E-1: Develop and disseminate education and outreach materials regarding all new regulations (including boundaries) within 1 year.
- Strategy RP&E-2: Conduct and facilitate research and monitoring regarding detection, prevention, ecosystem effects of, control and where feasible eradication of introduced species.
- Strategy RP&E-3: Reduce the effects of marine debris on sanctuary resources through targeted removal efforts and increasing public awareness of marine debris hazards.
- Strategy RP&E-4: Minimize anchoring impacts to sensitive marine habitats, particularly coral reef formations, while providing reasonable access to sanctuary resources.
- Strategy RP&E-5: Facilitate research and monitoring regarding the effect of land-based sources of pollution on sanctuary resources and develop outreach materials to share the results.
- Strategy RP&E-6: Minimize damage to sanctuary resources through coordinated emergency preparedness and contingency planning.
- Strategy RP&E-7: Protect sanctuary resources by achieving compliance with applicable laws.

Strategy RP&E-1: Develop and disseminate education and outreach materials regarding all new regulations (including boundaries) within 1 year.

Compliance with sanctuary regulations is a key component of sanctuary resource protection. A fundamental aspect of that compliance is user awareness. It is important that sanctuary users know (1) that they are in a national marine sanctuary, and (2) of the sanctuary's regulations. Since this management plan includes a proposal to revise sanctuary regulations at Fagatele Bay and to add new units to the sanctuary, sanctuary staff will develop and disseminate education and outreach materials designed to foster public awareness of any changes to the sanctuary resulting from this management plan review, including new sanctuary units and new and revised sanctuary regulations.

Activity RP&E-1.1: *Develop education and outreach materials about new and revised sanctuary regulations.*
Sanctuary staff will develop education and outreach materials designed to inform the general public and targeted user groups about new and revised sanctuary regulations (including regulations that establish new sanctuary units), as well as the rationale behind them. Complex regulatory language is not always an appropriate or effective means of communicating key concepts to a busy public. Thus, sanctuary staff will produce messages and talking points that convey key concepts about sanctuary changes.

Activity RP&E-1.2: *Disseminate education and outreach materials about new and revised sanctuary regulations.*
Sanctuary staff will widely distribute the education and outreach materials developed in Activity RP&E-1.1 to ensure that users are aware of the new regulations. This effort will be integrated with the outreach activities described in the Ocean Literacy Action Plan (Strategy OL-2), and as such will include communication mechanisms such as print, television, Internet, radio, and signage. Whenever possible, sanctuary staff will work with partners who can help disseminate the information to the public through such means as displays, information tables at events, and other public venues. Beyond the initial year of disseminating information on sanctuary changes, the materials developed in Activity RP&E-1.1 can be integrated into community-based interpretive enforcement efforts described in Activity CH&CE-2.4, which are to be developed within 3 years.

Strategy RP&E-2: Conduct and facilitate research and monitoring regarding detection, prevention, ecosystem effects of, control and where feasible eradication of introduced species.

The impacts of introduced species that become invasive threaten 36 percent of marine species globally, yet only 8 percent of the conservation studies published on marine systems have dealt with this topic (Lawler *et al.* 2006). Worldwide, invasive species are causing negative ecological and economic impacts. While not all introduced species will become invasive in a given environment, it is difficult, if not impossible, to identify which will have harmful impacts. So far, none of the introduced species found in Fagatele Bay has been considered to be invasive. Therefore, as a precautionary approach, a dedicated research and monitoring approach should be developed and implemented.

Activity RP&E-2.1: *Develop best management practices to prevent, control, and eradicate alien species within 3 years.*
Sanctuary staff will work with a sanctuary advisory council working group to develop best management practices that will define specific protocols and requirements for preventing, controlling the spread of, and where possible eradicating alien species. These practices will include strategies for a rapid risk assessment, possible containment methods, and a provision for quickly accessing funding for alien species control or eradication efforts. The advisory council working group would include numerous territorial and federal agency representatives; thus, the best management practices could be applied in all territorial waters.

Activity RP&E-2.2: *Monitor existing alien species occurrences and conduct surveillance to detect new occurrences on an annual basis.*
Coles *et al.* (2003) found five alien species within Fagatele Bay. Monitoring and surveillance of these species has not taken place on a regular basis, nor has there been a specific effort to identify alien species in the other proposed sanctuary units in American Samoa. Maintaining careful records of alien species distributions through regular monitoring of known infestations and surveillance to detect new occurrences are essential to obtaining an accurate picture of ecosystem health.

Activity RP&E-2.3: *Develop partnerships with local resource agencies and other research organizations to conduct research on the ecosystem effects of alien species.*
Sanctuary staff will initiate or support research on alien species detection and documentation of their ecological effects. By working with various partners, the sanctuary is working toward a better understanding of the effects of alien species on coral reef ecosystems for the entire Samoan archipelago.

Strategy RP&E-3: Reduce the effects of marine debris on sanctuary resources through targeted removal efforts and increasing public awareness of marine debris hazards.

Completely preventing marine debris from entering sanctuary boundaries is virtually impossible. However, routine monitoring and removal will allow sanctuary staff to detect trends in the amount and types of marine debris within the sanctuary, as well as any resulting resource damage. In addition, education and outreach programs could assist future generations in preventing debris from entering the marine environment.

Activity RP&E-3.1: *Develop marine debris monitoring datasheets within 1 year.*
Development of a standardized datasheet to record the amounts and types of debris, locations of debris, resulting damage to resources, and other relevant data will allow sanctuary staff to better analyze data and detect trends, as the same information would be recorded for all sanctuary units in a consistent manner. Sanctuary staff will work with local residents, ONMS headquarters staff, and NOAA's Marine Debris Program to develop a comprehensive, yet concise, marine debris monitoring datasheet that can be used by both sanctuary staff and volunteers.

Activity RP&E-3.2: *Develop and implement a marine debris assessment and monitoring program within 2 years.*

Sanctuary staff will develop a marine debris monitoring program for reef and coastal areas to ensure consistent input of information to help inform management decisions. Using a standardized marine debris monitoring datasheet (see Activity RP&E-3.1), this effort will help identify the amount and types of debris, as well as any resulting damage to resources. The program will detail actions such as regularly scheduled monitoring of sanctuary units, criteria for monitoring debris related to special events (*e.g.*, natural disaster or cargo spills), and outline partnerships, including with NOAA's Marine Debris Program, to provide assistance in these efforts. This program will also be the basis for engaging villagers and youth groups in marine debris monitoring and beach maintenance described in Activity CH&CE-2.3.

Activity RP&E-3.3: *Develop and implement marine debris education and outreach materials within 2 years.*
Awareness of the impacts of marine debris must be increased. Most people are not aware that much of the shore-based marine debris comes from careless disposal of garbage, such as cigarette lighters and other plastics. Sanctuary staff will develop outreach materials, possibly including printed materials, public service announcements, and others, to explain the impacts of marine debris. The information will educate the public on marine debris issues and encourage behavior that will reduce debris along beaches, coastal areas, reef tracts, and in the open ocean. This outreach will be coordinated with other efforts as described in the Ocean Literacy Action Plan (*e.g.*, Activity OL-4.5) as well as with NOAA's Marine Debris Program.

Strategy RP&E-4: Minimize anchoring impacts to sensitive marine habitats, particularly coral reef formations, while providing reasonable access to sanctuary resources.

All anchoring within sanctuary units would be prohibited except in emergencies. However, a mooring buoy system would be designed and deployed to provide an alternative to users who wish to anchor their boats. Sanctuary management would commit resources to comprehensive education and outreach programs that alert users and the public about the new regulation and the need to protect the fragile coral habitat from the impacts of anchors and anchor chains. In addition, sanctuary management would prioritize habitat monitoring for anchor damage (during routine scientific dives), and enforcement related to mooring buoy usage.

Activity RP&E-4.1: *Develop a mooring buoy strategic plan within 2 years.*
Sanctuary staff will develop a mooring buoy system strategic plan. The strategic plan will include an assessment of the need for mooring buoys at all sanctuary units and the number of buoys needed per location; an assessment of current mooring buoy technologies, including an analysis of vessel size limits; mooring buoy siting criteria; and a determination of costs for implementation (purchase and deployment) and maintenance. Sanctuary management will request the advisory council to form a mooring buoy working group within 1 year after the management plan is released. Aside from advisory council members, potential working group members may include representatives from local agencies, the Coral Reef Advisory Group, village and community members, and other interested parties.

Activity RP&E-4.2: *Conduct site assessments and recommend mooring buoy locations within 3 years.*
Site assessments are conducted to determine habitat suitable for deploying mooring buoys. Assessments will include surveys of habitat health, proximity to habitats key to research and monitoring efforts, and use by the public, and will address all siting criteria (from the mooring buoy strategic plan in Activity RP&E-4.1). Based on the assessment results, sanctuary staff will recommend mooring buoy locations for further discussion among sanctuary management and the sanctuary advisory council.

Photo 20: Mooring buoys have historically been a part of resource protection efforts in Fagatele Bay National Marine Sanctuary. Photo: Mike Smith.

Activity RP&E-4.3: *Install mooring buoys within 5 years.*
Based on the recommendations developed in Activity RP&E-4.1 and 4.2, sanctuary management will install mooring buoys at select locations.

Strategy RP&E-5: Facilitate research and monitoring regarding the effect of land-based sources of pollution on sanctuary resources and develop outreach materials to share the results.

Regular water quality monitoring is needed at all sanctuary units. Information should be made available to the public about the potential impacts of land clearing and other land-based activities on marine resources. Sanctuary staff does not currently have the capacity to conduct the monitoring, so partnerships will be developed to facilitate not only the monitoring, but also to help relay to the public monitoring results and general messages about threats to marine resources associated with land-based activities.

Activity RP&E-5.1: *Within 1 year, develop partnerships to monitor, and if necessary improve, the water quality of all sanctuary units.*
Sanctuary staff will work with local and federal agencies to develop successful partnerships regarding water quality within sanctuary units. A partnership with the AS-EPA would facilitate regular water quality monitoring and, if necessary, improvements – particularly with respect to possible nutrient and bacteria levels associated with land clearing and development.

Activity RP&E-5.2: *Assess threats to sanctuary resources posed by the Tutuila landfill facility.*
Sanctuary staff will work with U.S. Geological Survey and AS-EPA to assess any potential threats posed by the Tutuila landfill, which is located above Fagatele and Larsen Bays. Actions will be coordinated with other efforts as described in the Partnerships & Interagency Cooperation Action Plan (P&IC-2.1).

Activity RP&E-5.3: *Support and facilitate the development of education and outreach materials regarding land-based sources of pollution annually.*
Working with partners, sanctuary staff will work to annually develop distinct outreach materials to better inform the public about marine resources threats associated with land-based activities. Information will be widely distributed. Sanctuary staff will use partnerships to get the information out to the public through such means as displays, information tables at events, and other public venues. Outreach will be coordinated with other efforts as described in the Ocean Literacy Action Plan (Activities OL-2.3 and 4.5).

Strategy RP&E-6: Minimize damage to sanctuary resources through coordinated emergency preparedness and contingency planning.

A coordinated response to emergencies, in a manner that minimizes resource damage, is necessary in light of recent ship groundings and devastating natural disasters. Mechanisms exist to access policies, regulations, contingency plans, numerous NOAA databases, GIS data and maps, as well as charts and images that provide on-demand information for making critical decisions about environmental tradeoffs during a response. Information for American Samoa must be incorporated into these mechanisms to facilitate resource protection in the event of an emergency.

Activity RP&E-6.1: *Develop an emergency response plan within 3 years.*
Sanctuary staff will develop an emergency response plan to help guide damage assessment and emergency response within sanctuary units and broader American Samoa. The emergency response plan will identify procedures and protocols for responding to an emergency within the established Incident Command System (ICS) for the region, as well as non-ICS emergencies such as severe storm damage or coral bleaching events. Sanctuary management will request the advisory council to form an emergency response working group within 3 years after the management plan is released. Aside from advisory council members, potential working group members may include representatives from the U.S. Coast Guard, federal and territorial agencies, the Coral Reef Advisory Group, village and community members, and other interested parties.

Activity RP&E-6.2: *Incorporate appropriate American Samoa information into SHIELDS and RUST within 4 years.*
SHIELDS is a system of web-based contingency plans and tools, hosted on a secure Intranet site, which provides resource managers and their co-trustees efficient access to critical information for making decisions about environmental tradeoffs during an incident response. The Resources and UnderSea Threats (RUST) database, which is part of SHIELDS, is a response tool that allows for identification of potential oil spill sources, as well as other potential threat associated with corroding vessels. Sanctuary staff will incorporate appropriate information that is available for American Samoa into both the SHIELDS and RUST databases.

Strategy RP&E-7: Protect sanctuary resources by achieving compliance with applicable laws.

Compliance with sanctuary regulations is paramount. The sanctuary's enforcement approach focuses on two specific components: (1) the use of interpretive enforcement as a means to inform

the public and encourage voluntary compliance, and (2) the legal enforcement of regulations. All of these efforts require partnering with territorial and federal agencies, as well as local communities.

Activity RP&E-7.1: *Develop necessary interagency enforcement agreements within 2 years.*
Sanctuary staff will work to establish or expand interagency agreements regarding enforcement of sanctuary regulations in American Samoa. For example, staff will work with NOAA OLE to expand the JEA with DMWR to include enforcement in additional sanctuary units, and to formalize a partnership with the U.S. Coast Guard (through a memorandum of agreement or other means) to provide surveillance, particularly in remote sanctuary units.

Activity RP&E-7.2: *Create an interagency Law Enforcement Task Force within 1 year.*
Sanctuary staff will develop an interagency law enforcement task force consisting of federal law enforcement partners (including federally cross-deputized local enforcement officers) and sanctuary management. The task force will discuss monthly reports of all sanctuary enforcement activities, as outlined in OLE's JEA with DMWR, among other things. As a result of the sensitive nature of law enforcement issues, this task force will be composed exclusively of federal employees and federally cross-deputized local law enforcement and will not be directly associated with the sanctuary advisory council public process. However, the task force will provide periodic reports to the advisory council to inform and involve sanctuary stakeholders.

Activity RP&E-7.3: *Investigate the feasibility of using remote enforcement technologies and make determinations within 3 years.*
Enforcement capabilities used to monitor activity and detect violations within sanctuary units will include traditional strategies such as vessel and aircraft patrols. However, the application of emerging technologies will also be necessary to assure the comprehensive coverage of this vast area. Though Vessel Monitoring Systems are currently being used, the potential use of other technological capabilities, such as satellite based surveillance, remote sensing, and unmanned aircraft (drones), will need to be researched further to evaluate whether these technologies are practical and feasible, and if so, how they may be used.

Activity RP&E-7.4: *Assess the need to promulgate NMSA fishing regulations in federal waters of sanctuary units.*
Sanctuary managers will assess the need to promulgate fishing regulations under the authority of the NMSA in federal waters of the proposed sanctuary units. Decisions about promulgating these fishing regulations are pending action by the Western Pacific Regional Fishery Management Council and NOAA Fisheries in federal waters.

Table 4-8: Summary of Strategies and Activities for the Resource Protection and Enforcement Action Plan.

STRATEGIES AND ACTIVITIES	
Strategy RP&E-1: Develop and disseminate education and outreach materials regarding all new regulations (including boundaries) within 1 year.	
Activity RP&E-1.1:	Develop education and outreach materials about new and revised sanctuary regulations.
Activity RP&E-1.2:	Disseminate education and outreach materials about new and revised sanctuary regulations.
Strategy RP&E-2: Conduct and facilitate research and monitoring regarding detection, prevention, ecosystem effects of, control and where feasible eradication of introduced species.	
Activity RP&E-2.1:	Develop best management practices to prevent, control, and eradicate alien species within 3 years.
Activity RP&E-2.2:	Monitor existing alien species occurrences and conduct surveillance to detect new occurrences on an annual basis.
Activity RP&E-2.3:	Develop partnerships with local resource agencies and other research organizations to conduct research on the ecosystem effects of alien species.
Strategy RP&E-3: Reduce the effects of marine debris on sanctuary resources through targeted removal efforts and increasing public awareness of marine debris hazards.	
Activity RP&E-3.1:	Develop marine debris monitoring datasheets within 1 year.
Activity RP&E-3.2:	Develop and implement a marine debris assessment and monitoring program within 2 years.
Activity RP&E-3.3:	Develop and implement marine debris education and outreach materials within 2 years.
Strategy RP&E-4: Minimize anchoring impacts to sensitive marine habitats, particularly coral reef formations, while providing reasonable access to sanctuary resources.	
Activity RP&E-4.1:	Develop a mooring buoy strategic plan within 2 years.
Activity RP&E-4.2:	Conduct site assessments and recommend mooring buoy locations within 3 years.
Activity RP&E-4.3:	Install mooring buoys within 5 years.
Strategy RP&E-5: Facilitate research and monitoring regarding the effect of land-based sources of pollution on sanctuary resources and develop outreach materials to share the results.	
Activity RP&E-5.1:	Within 1 year, develop partnerships to monitor, and if necessary improve, the water quality of all sanctuary units.
Activity RP&E-5.2:	Assess threats to sanctuary resources posed by the Tutuila landfill facility.
Activity RP&E-5.3:	Support and facilitate the development of education and outreach materials regarding land-based sources of pollution annually.
Strategy RP&E-6: Minimize damage to sanctuary resources through coordinated emergency preparedness and contingency planning.	
Activity RP&E-6.1:	Develop an emergency response plan within 3 years.
Activity RP&E-6.2:	Incorporate appropriate American Samoa information into SHIELDS and RUST within 4 years.

STRATEGIES AND ACTIVITIES	
Strategy RP&E-7: Protect sanctuary resources by achieving compliance with applicable laws.	
Activity RP&E-7.1:	Develop necessary interagency enforcement agreements within 2 years.
Activity RP&E-7.2:	Create an interagency Law Enforcement Task Force within 1 year.
Activity RP&E-7.3:	Investigate the feasibility of using remote enforcement technologies and make determinations within 3 years.
Activity RP&E-7.4:	Assess the need to promulgate NMSA fishing regulations in federal waters of sanctuary units

4.6.4 Addressing the Issues – Strategies from other Action Plans

A number of strategies from other action plans either directly or indirectly help to address the issues identified in this Resource Protection and Enforcement Action Plan:

- Strategy CH&CE-2: Develop volunteer programs that increase site visibility while engaging resource users and promoting local stewardship.
- Strategy CH&CE-4: Inventory and assess maritime heritage resources within the sanctuary and American Samoa.
- Strategy MCS-1: Assess and prioritize scientific activities over the life of the management plan.
- Strategy MCS-2: Continue to assess baseline conditions and enhance research, monitoring, and characterization programs throughout the life of the management plan.
- Strategy CC-1: Complete Climate Smart Sanctuary certification standards within 3 years.
- Strategy CC-2: Partner to identify and implement strategies to maximize the resiliency of sanctuary coastal and marine resources within 5 years through implementation of the Sanctuary Climate Change Plan.
- Strategy CC-3: Partner to target research and monitoring efforts to identify, and where appropriate respond to, climate change impacts at sanctuary units within 5 years.
- Strategy O&A-5: Track and, where necessary, permit activities occurring within the sanctuary.
- Strategy OL-2: Increase outreach to communities in American Samoa and abroad.
- Strategy OL-3: Increase ocean literacy through development and implementation of formal education programs and materials in American Samoa.
- Strategy P&IC-1: Cultivate the AS DOC partnership.
- Strategy P&IC-2: Support cooperation and coordination among agencies and organizations throughout the life of the management plan.
- Strategy P&IC-3: Promote international, national, and local agency collaborations to increase capacity building and foster networks that will improve management effectiveness.

4.6.5 Addressing the Issues – Regulations

In addition to non-regulatory activities, sanctuary regulations help achieve overarching resource protection in terms of maintaining biodiversity and sustainability, as well as address specific issues, and establish zones of enhanced protection at areas of high biological or cultural value. Sanctuary regulations in summary prohibit:

- Taking, damaging, destroying, or possessing certain sanctuary resources;
- Possessing or using poisons, explosives, and certain other devices;
- Possessing or using certain types of fishing gear in prohibited zones;
- Operation of vessels:
  - Within 200 feet of vessels displaying a dive flag;
  - In a manner that causes damage to the sanctuary;
- Diving operations from a vessel not flying the international code flag alpha "A";
- Depositing or discharging material or matter into sanctuary waters;
- Disturbing, dredging, or otherwise altering the seabed;
- Ensnaring, entrapping, or fishing for any sea turtle;
- Using or discharging explosives or weapons (with exceptions for valid law enforcement).

The full suite of sanctuary regulations is available at 15 CFR Part 922 Subpart J.

Photo 21: Diver above coral (Porites) that was fractured by dynamite. Dynamite, prohibited by sanctuary regulations, is used to stun or kill fish for either food or the tropical fish trade. Photo: Kip Evans.

4.7 PARTNERSHIPS AND INTERAGENCY COOPERATION ACTION PLAN

The primary objective of this action plan is to foster and facilitate cooperation and coordination of planning and management actions.

4.7.1 Overview

Links to Other Action Plans
4.1 Cultural Heritage & Community Engagement 4.2 Marine Conservation Science 4.3 Climate Change 4.4 Operations and Administration 4.5 Ocean Literacy 4.6 Resource Protection and Enforcement 4.8 Program Evaluation

Fully and successfully carrying out the sanctuary mission and achieving ocean conservation in American Samoa necessitates sanctuary partnerships with local and federal agencies. By consistently working together to achieve management goals of the sanctuary in American Samoa, success can be reached as agency coordination: (1) maximizes limited resources, (2) minimizes the risks of working in isolation, (3) fosters stewardship that takes ecosystem effects into account, (4) achieves greater stakeholder involvement, and (5) builds strong community support for ecosystem conservation. Through partnerships, sanctuary management will leverage opportunities to: develop public awareness, education, stewardship, and volunteer programs; increase research and enforcement; enhance community economic opportunities; and maintain sanctuary trails.

Links to Goals
Goal 7

Since it was designated in 1986, the sanctuary has had a strong relationship with its territorial partner AS DOC, other local government agencies, Pacific regional offices and organizations, and federal and international agencies operating in American Samoa. Collectively, these partners (along with many communities and nongovernmental agencies) work together to achieve mutual resource protection goals and leverage support for marine conservation in the sanctuary and territory as a whole. Existing partnerships are described in the bullets below.

In American Samoa the sanctuary co-management relationship with AS DOC via a memorandum of agreement (MOA) has led to:

- Renovation and reconstruction of the ASG-Convention Center to include a new sanctuary visitor center and sanctuary offices;
- Leadership in community and village engagement during the management plan review process;
- A relationship with LBJ Hospital on the Hyperbaric Wound Care Project; and
- Community development of trail and site services for Fagatele Bay.

All of the partnerships below are greatly valued by sanctuary managers and staff. Specific examples of recent partnerships developed to facilitate achievement of sanctuary goals are highlighted below.

Local Partnerships

- ASDOE Division of Curriculum – collaborative work in marine science program development and integration of materials into the school system;
  - In 2010, sanctuary staff hosted a "Dive into Education" ocean science literacy workshop in American Samoa. Dive into Education is a marine science education program aimed at providing teachers with resources and training to support ocean literacy in America's classrooms. More than 100 teachers from grades kindergarten through 12 participated in the 2-day event. During the 2010 workshop, 40 percent of participants indicated that they had low or very low knowledge about the local sanctuary, and 44 percent had low or very low knowledge of the National Marine Sanctuary System as a whole. A well-developed partnership with ASDOE could increase teacher awareness of the sanctuary while promoting student internships and mentorships through participation and personal interactions with staff, ASCC affiliated student groups (Gear Up and Upward Bound), and *Le Tausagi*.

Photo 22: ASDOE, AS DOC and Fagatele Bay National Marine Sanctuary selected five teachers to participate in a teacher training program as follow-up to the 2010 Dive Into Education workshop: (left to right) Rosita Magalasin of Pava'ia'i Elementary; Rhonda Huang and Jane Lang of Coleman Elementary, and Tina Miles and Makerita Lam Yuen of Lupelele Elementary. Photo: NOAA National Marine Sanctuaries.

- ASCC – sanctuary staff provide presentations and serve as guest lecturers;
  - Engaging ASCC in management initiatives and sanctuary activities is a critical component of this program. In addition to giving guest lectures, sanctuary staff frequently assist with ASCC field trips for marine science and natural resource science students. Most recently, sanctuary staff offered swimming and snorkeling lessons at Larsen Bay and Fagatele Bay. In addition, sanctuary staff mentor student interns from the Marine Options Program (MOP). MOP is a certificate awarding program that requires students to complete selected coursework and complete a hands-on project or internship, combining academic requirements with practical experience in an area of marine interest of the student's choice. In the future, it may be necessary to establish an MOA between ASCC and the sanctuary to formalize this arrangement.
- LBJ Tropical Medical Center – hyperbaric wound care project;
  - Territory interest in obtaining a hyperbaric chamber for treatment of dive-related injuries started in 2008, based on a sanctuary-local hospital model developed in Thunder Bay, Michigan. Having a safety net on Tutuila could increase dive-related tourism and marine research in the territory. In addition to treating dive-related injuries, a hyperbaric treatment facility would serve the territory's medical treatment needs for wound care, carbon monoxide poisoning, and several other disorders. Diabetes is epidemic in American Samoa and hyperbaric treatments are a proven tool to combat non-healing wounds that often result from diabetes. Hyperbaric treatment could reduce the number of diabetes-related amputations in the territory and in turn improve the quality of life for its citizens. The sanctuary is working with LBJ Hospital to acquire a hyperbaric chamber and develop a hyperbaric oxygen therapy clinic in American Samoa.
- AS Visitors Bureau – marketing and promotion of the sanctuary as a tourist attraction;
  - Since the AS Visitors Bureau was established in 2009, bureau and sanctuary staff have developed a positive partnership based on the bureau's keen interest in promoting the sanctuary to visitors. Through this partnership, bureau staff have offered to provide Fagatele Bay Trail brochures to cruise ship visitors entering the Port of Pago Pago, feature sanctuary articles in its monthly newsletter, and include the sanctuary in marketing such as tourism-related trade shows within the nation, the Pacific, and worldwide.
- AS Department of Port Administration – collaboration on the development of sanctuary outreach opportunities at port facilities;
  - Through this important partnership, sanctuary managers will showcase marine conservation outreach at port facilities such as the Pago Pago International Airport and the Port of Pago Pago. This outreach can inform territory residents and visitors alike of the underwater treasures that are our front yards and livelihood as a people and place.
- Church youth group gatherings, Boy Scouts, and summer school environmental discoveries camps – collaborations on community programs;
- AS Governor's Coral Reef Advisory Group – joint work on coral reef conservation for the territory;

- *Le Tausagi* environmental education group – collaboration on annual environmental event planning and implementation of activities;
- Governor's Office and AS Arts Council – joint work on the Preserve America Program; and
- DMWR – sanctuary monitoring and enforcement.

Regional/International Partnerships

- Sea Education Association & Affiliated Connections in American Samoa & Samoa – collaborations to provide regional students with experiential learning opportunities at sea;
    - The Sea Education Association (SEA), headquartered in Woods Hole, Massachusetts, is an educational institution dedicated to exploration, understanding, and stewardship of the oceans and to studying the relationships between humans and the oceans. SEA offers students an interdisciplinary, experiential learning-based curriculum that provides challenging voyages of scientific discovery, academic rigor, seamanship, and personal growth both on shore and at sea aboard tall ships. Participating students conduct field-based ocean science with modern instrumentation used under the supervision of professional oceanographers. One exciting program that SEA has under development is Sustainability in Polynesian Island Cultures and Environments (SPICE). Originally conceived for French Polynesia, the SPICE concept applies equally well in American Samoa and would create opportunities for more intensive long-term partnerships built around cooperative educational programs. A collaboration with SPICE would reveal in concrete ways the broader social and economic benefits of sanctuaries in local communities and demonstrate how programs in one special place can inform and connect people across the wider world. During a 2010 reconnaissance trip to American Samoa, SEA staff recommended a 2012 mission to serve the needs of both the sanctuary and SEA with a 3-week opportunity and possible link to Samoa. The project will benefit marine science and education interests and capacity across the Samoan archipelago.
- ONMS Pacific Islands Region (PIR) – local sanctuary staff are working with staff from the Papahānaumokuākea Marine National Monument and Hawaiian Islands Humpback Whale National Marine Sanctuary on joint programs to develop a key Migratory Species Program and to develop a PIR Strategic Plan to brand the "Pacific Experience of Special and Hidden Treasures";
- Two Samoa's Promise – a partnership with the Secretariat of the Pacific Regional Environment Programme, Conservation International, and the Western Samoa Ministry of Natural Resources & Environment (MNRE);
- United Nations Development Program and MNRE – collaborations to develop climate change adaptation programs in American Samoa; and
- All Islands' Coral Reef Coordinating Committee – sanctuary staff serve in an advisory capacity to AS CRAG and help review materials.

Federal Partnerships

- National Park of American Samoa – collaborate on vessel and general operations support, and trail maintenance (draft MOA in development);
  - Since the Fagatele Bay trail was established in 2007, the National Park of American Samoa has been an excellent sanctuary partner in development, maintenance, and improvement of hiking areas to and around Fagatele Bay. This partnership also supports the sharing of resources, such as use of the sanctuary's R/V *Manumā* to support park activities in Manu'a.
- U.S. Fish & Wildlife Service – collaborate through the Rose Atoll Marine National Monument Intergovernmental Committee (through the Intergovernmental Committee Charter);
- NOAA National Marine Fisheries Service
  - Pacific Islands Regional Office – collaborate on fisheries, ESA, MMPA management and compliance issues;
  - Pacific Islands Fisheries Science Center – collaborate on fisheries, coral, and protected species science and monitoring activities;
- NOAA OLE and NOAA Fisheries Pacific Islands Regional Office – enforcement (via MOA);
- NOAA Coral Reef Conservation Program – collaborate through sanctuary staff serving on the Priority Setting Group; and
- ONMS – Superintendents Team/Leadership Team.

This action plan addresses existing and potential new partnerships and interagency cooperation to conserve sanctuary resources in American Samoa. It also describes the operational framework for enhancing interagency coordination and providing broad stakeholder involvement in managing American Samoa's sanctuary resources.

4.7.2 Issues and Need for Action

Pooling resources among partners to help one another meet mutual objectives can help maximize limited fiscal, human, and other administrative resources needed for resource protection. Sanctuary managers and staff need to work with partners and cooperate with other agencies to better protect sanctuary natural and cultural resources in American Samoa. Partners working together to achieve common goals also need effective coordination and communication among one another to not only collectively, but also effectively and efficiently address resource protection, education, outreach, research, monitoring, and enforcement.

Collaborative mechanisms are needed to facilitate this coordination and cooperation and to provide opportunities for active stakeholder and community participation (including input from villages adjacent to sanctuary units). A variety of formal and informal mechanisms are available toward this end. The utility and value of different mechanisms must be assessed and the best mechanism for the given partnership or project pursued. Once a mechanism is selected, all parties to the agreement must work to remain aware of and abide by its terms. Maintaining

awareness of the terms of agreements among partners is especially important given that locally, government agencies have a history of high staff turnover.

4.7.2.1 Relevant Issues Raised During Scoping

Scoping comments included a number of issues relevant to partnerships and interagency cooperation:

- Clarify the co-management relationship between AS DOC and the federal government;
- Promote integration of all American Samoa MPA sites;
- Collaborate on and improve partnerships for management and enforcement;
- Partner or improve partnerships with:
  - Education agencies and organizations: ASCC (for materials, curriculum), ASDOE, specific classes with a connection to Fagatele Bay;
  - Civic organizations: school PTAs (*e.g.*, fundraise to take students to the sanctuary), boys/girls groups, youth groups, church groups;
  - US-EPA (on water quality, landfill runoff);
  - The AS Tourism Bureau;
  - DMWR and U.S. Coast Guard (*e.g.*, enforcement, emergency response);
  - Village councils;
  - The village at Fagatele Bay;
  - The Nature Conservancy;
  - NPAS (on education and interpretive strategies); and
  - The Samoan Studies Institute to provide all materials in Samoan.
- Work closely with existing territorial programs and agencies, such as:
  - DMWR and their existing MPA efforts (20 percent No-Take and community fisheries management program); and
  - The Office of Samoan Affairs to work with villages.

4.7.3 Addressing the Issues – Strategies for this Action Plan

The strategies and associated activities in this action plan are intended to foster inter-agency, private sector, and community partnerships that ultimately protect sanctuary resources. Since the sanctuary was established in 1986, several new opportunities and alliances have been bridged among communities, territorial agencies, the region, and federal government that open up enhanced and new partnerships in American Samoa, namely with private sector, civic groups, quasi-government offices such as the AS Visitors Bureau, and LBJ Tropical Medical Center.

An essential focus of this action plan is the need for sanctuary staff to build a much more cohesive approach to marine resource management with local and federal partners than has occurred in the past within the territory. This strategy also calls for new partnerships that enhance resource protection, advocacy, stewardship, and marine conservation in the territory and ONMS Pacific Islands Region. Through such partnerships, sanctuary staff can bridge

opportunities to coordinate on ocean protection and stewardship on a large marine spatial scale, across the Pacific.

This strategy also calls for sanctuary staff to consult with other agencies and the sanctuary advisory council on new issues and take appropriate action to address current and emerging issues of concern.

Strategies have been developed for achieving the desired outcomes of:

- Working in concert with other agencies, institutions and organizations;
- Avoiding duplicating efforts of other agencies and community groups;
- Aligning opportunities to improve community well being and protect sanctuary resources;
- Creating a Pacific hub for marine science learning and stewardship;
- Maximizing partnerships to facilitate the sanctuary's ability to identify, understand, and protect sanctuary resources; and
- Implementing innovative programs involving federal, state, and private entities in cooperative efforts to protect and restore natural, cultural, and historic resources in American Samoa.

The strategies and activities are coded by the acronym for the action plan title, "Partnerships & Interagency Cooperation" (P&IC). A summary of strategies and activities is provided in Table 4-9 at the end of this action plan (see p. 276).

- Strategy P&IC-1: Cultivate the AS DOC partnership.
- Strategy P&IC-2: Support cooperation and coordination among agencies and organizations throughout the life of the management plan.
- Strategy P&IC-3: Promote international, national, and local agency collaborations to increase capacity building and foster networks that will improve management effectiveness.

Strategy P&IC-1: Cultivate the AS DOC partnership.

The original 1986 sanctuary designation established AS DOC as a sanctuary co-manager. The sanctuary's relationship with AS DOC is important for territorial links to opportunities, as well as regionally in recent Two Samoa's efforts, and nationally in efforts such as the U.S. Coral Reef Task Force. Operation of the sanctuary system in American Samoa would not be possible if AS DOC were not supporting or assisting in sanctuary efforts. However, the AS DOC role has not been clearly defined and understood by other agencies on island or abroad. This strategy aims to clearly define the roles, responsibilities and priorities that the AS DOC relationship can build for the network of sanctuary units in American Samoa.

<u>Activity P&IC-1.1</u>: *Promote and support the relationship with AS DOC throughout the life of the management plan.*

Ensuring consistent communication between sanctuary managers and AS DOC will help align AS DOC as a co-manager. In development of the sanctuary visitor center and communications materials, sanctuary staff should ensure all materials recognize the co-management relationship with AS DOC so that other local, regional, and federal agencies understand this partnership and its importance to the sanctuary and ONMS.

Activity P&IC-1.2: *Hold annual reviews of prior MOA amendments with AS DOC.*
Before the annual MOA amendment with AS DOC is initiated, it is necessary for sanctuary managers and AS DOC to discuss and review mutual priorities, program areas, and areas for improvement and enhancement.

Activity P&IC-1.3: *Support AS DOC coral reef conservation efforts that relate to sanctuary resources throughout the life of the management plan.*
Under the AS DOC umbrella, sanctuary staff participate in the AS Coral Reef Advisory Group. Sanctuary staff provide important support to AS DOC's role in the CRAG via active attendance and participation and providing counsel in an advisory capacity that promotes territory-wide coral reef conservation.

Activity P&IC-1.4: *Support opportunities to collaborate with the AS Coastal Management Program.*
AS DOC is the host agency of the AS Coastal Management Program. This program addresses land-use permitting, community-based management of wetlands, non-point source pollution, and building public awareness around coastal issues. These issues, though land-based, are equally important to and may impact the sanctuary. As the managers of the landward side of the land-sea interface, the Coastal Management Program is a critically important sanctuary partner. Sanctuary staff and Coastal Management Program staff have a positive working relationship, but should assess whether there are additional opportunities to collaborate toward mutual goals. This assessment will be conducted on an annual basis.

Strategy P&IC-2: Support cooperation and coordination among agencies and organizations throughout the life of the management plan.

Sanctuary staff have worked with several agencies since 2008 that have opened new opportunities to collaborate and facilitate achievement of sanctuary goals (outlined in Chapter 1). These new opportunities are highlighted in this action plan's overview. Sanctuary staff intend to continue, enhance, and where necessary formalize collaborations to help leverage resources and facilitate progress toward mutual goals.

Activity P&IC-2.1: *Develop interagency agreements, grants, and MOAs as needed to carry out specific program priorities.*
Cooperative projects will be pursued with agencies that allow for ease in sharing resources and in-kind assistance and support, as appropriate. Formal agreements required for specific program areas will be developed as needed. Collaborative agency efforts that may benefit from formal and other informal agreements are described in the following action plans:

- Cultural Heritage & Community Engagement;
- Climate Change;
- Marine Conservation Science;
- Operations and Administration;
- Ocean Literacy; and
- Resource Protection and Enforcement.

Activity P&IC-2.2: *Participate in territorial resource protection meetings and forums to ensure the primary goal of sanctuary resource protection is achieved.*
Being an active member and participant at several resource protection forums allows sanctuary staff to share information and activities in and around sanctuary units as well as bridge opportunities to collaborate on common goals.

Activity P&IC-2.3: *Investigate and pursue community and private-sector collaborations throughout the life of the management plan.*
American Samoa's limited area allows for closer community ties and levels of engagement than in other places in the continental U.S. or Hawai'i. Groups such as Rotary Club, Lions Club, and Women's Aglow, among others, are important icons known in the territory for civic activities, fund raising for community programs and projects, and more.

Strategy P&IC-3: Promote international, national, and local agency collaborations to increase capacity building and foster networks that will improve management effectiveness.

Collaboration at the international, national, and local levels is needed to promote information sharing, relationship building, and adaptive use of management tools for conservation and resource management. These partnerships can provide a regional and global context to better understand the significance of traditional knowledge in resource management, the need for scientific and cultural research, and the development of management models that could be applied throughout the Pacific and beyond.

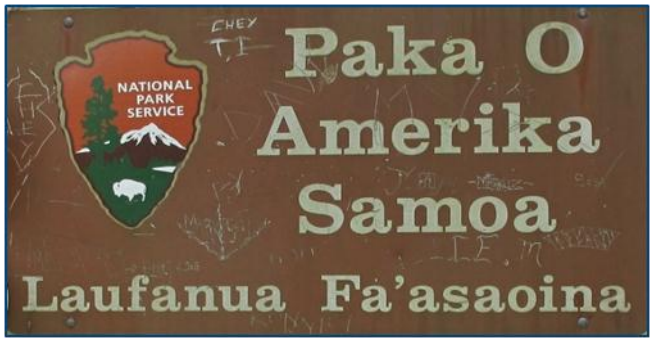

Photo 23: The National Park of American Samoa is one of the sanctuary's key federal partners (park sign from Tutuila). Photo: Sarah Kinsfather.

Activity P&IC-3.1: *Enhance communication and cooperation with federal agencies.*
Having overlapping and complementary jurisdictional authority with other federal agencies requires inter-agency consultation and collaboration. Sanctuary staff will work to enhance these efforts with the U.S. Fish & Wildlife Service regarding management of Rose Atoll Marine National Monument, the National Park of American Samoa (particularly with regard to the park and proposed sanctuary units at Ta'u), and the U.S. Coast Guard for surveillance of remote proposed sanctuary units at Rose, Swains, and Ta'u.

Activity P&IC-3.2: *Network with other marine protected areas in the Pacific.*
Sanctuary staff will foster and promote relationships with marine protected area managers and constituents in Hawai'i and the Pacific that face impacts of climate change, enforcement, surveillance, and other challenges common to coral reef ecosystem management. Through this regional collaboration, participating organizations could share information on subjects such as coordinated management plan development, mitigation and response strategies to deal with climate change, enforcement, incorporating traditional knowledge, research, and outreach about the importance of coral reef ecosystems to the world. Networking with other marine protected areas in the Pacific is essential for promoting collaborations and to establish the role of the Pacific in the overall global context of marine conservation. Efforts will also be made to promote exchanges within the Pacific Region to an international audience.

Activity P&IC-3.3: *Support the bid for World Heritage Site status.*
In 2007, Fagatele Bay National Marine Sanctuary was included on the new U.S. World Heritage Tentative List as a site with outstanding universal value for both its natural and cultural heritage. The U.S. Tentative List was submitted to the United Nations Educational, Scientific and Cultural Organization World Heritage Center for consideration in February 2008. The sanctuary staff will continue to support the bid for World Heritage designation across agencies to ensure a high level of communication and coordination.

Table 4-9: Summary of Strategies and Activities for the Partnerships and Interagency Cooperation Action Plan.

STRATEGIES AND ACTIVITIES	
Strategy P&IC-1: Cultivate the AS DOC partnership.	
Activity P&IC-1.1:	Promote and support the relationship with AS DOC throughout the life of the management plan.
Activity P&IC-1.2:	Hold annual reviews of prior MOA amendments with AS DOC.
Activity P&IC-1.3:	Support AS DOC coral reef conservation efforts that relate to sanctuary resources throughout the life of the management plan.
Activity P&IC-1.4:	Support opportunities to collaborate with the AS Coastal Management Program.
Strategy P&IC-2: Support cooperation and coordination among agencies and organizations throughout the life of the management plan.	
Activity P&IC-2.1:	Develop interagency agreements, grants, and MOAs as needed to carry out specific program priorities.
Activity P&IC-2.2:	Participate in territorial resource protection meetings and forums to ensure the primary goal of sanctuary resource protection is achieved.
Activity P&IC-2.3:	Investigate and pursue community and private-sector collaborations throughout the life of the management plan.
Strategy P&IC-3: Promote international, national, and local agency collaborations to increase capacity building and foster networks that will improve management effectiveness.	
Activity P&IC-3.1:	Enhance communication and cooperation with federal agencies.
Activity P&IC-3.2:	Network with other marine protected areas in the Pacific.
Activity P&IC-3.3:	Support the bid for World Heritage Site status.

4.7.4 Addressing the Issues – Strategies from other Action Plans

Virtually every strategy in this management plan includes activities that indicate the need to work with partners to address shared issues. One major exception is the Operations and Administration Action Plan, as no partners (aside from AS DOC in its role as co-administrator of the sanctuary) are involved in implementing the strategies in that plan.

4.7.5 Addressing the Issues – Regulations

No sanctuary regulations are associated with the issues in the Partnerships & Interagency Cooperation Action Plan. Sanctuary regulations are available at 15 CFR Part 922 Subpart J.

4.8 PROGRAM EVALUATION ACTION PLAN

The primary objective of this action plan is to effectively and efficiently incorporate performance measurement into sanctuary operations to determine the degree to which management actions are achieving sanctuary goals.

4.8.1 Overview

Links to Other Action Plans

4.1 Cultural Heritage & Community Engagement
4.2 Marine Conservation Science
4.3 Climate Change
4.4 Operations and Administration
4.5 Ocean Literacy
4.6 Resource Protection and Enforcement
4.7 Partnerships & Interagency Cooperation

As part of an effort to improve overall management of sanctuaries, ongoing and routine performance evaluation is a priority for ONMS. Both site-specific and programmatic efforts are under way to better understand ONMS's ability to meet stated objectives and to address the issues identified in this management plan. Beyond these principal goals, performance evaluation has many other benefits, including:

Links to Goals

Goal 1
Goal 2
Goal 3
Goal 4
Goal 5
Goal 6
Goal 7
Goal 8
Goal 9

- Highlighting successful (as well as less than successful) efforts of site management;
- Keeping the public, Congress, and other interested parties apprised of sanctuary effectiveness;
- Helping managers identify resource gaps so they may better manage their sites;
- Improving accountability;
- Improving communication among sanctuary sites, stakeholders, and the public;
- Fostering the development of clear, concise and, whenever appropriate, measurable outcomes;
- Providing a means for sanctuary managers to comprehensively evaluate their sites in both the short and long terms;
- Fostering an internal focus on problem-solving and improved performance;
- Providing additional support for the resource-allocation process; and
- Motivating staff with clear policies and a focused direction.

Evaluating performance is now a part of the regular ONMS management cycle. In addition, a process for integrating a performance evaluation system has been implemented in recent years. Figure 4-3 depicts the ONMS Performance Measure Logic Model, which outlines the ONMS approach to measuring performance. As represented by the large arrow in Figure 4-3, measures are developed to provide information on results over time, from the near term (within 1 year or so) to the long-term (over the span of 10 years or more). The performance measures are the yardstick ONMS uses to measure progress toward its goals and objectives. They set specific, time-conditional targets for large, thematic management categories that are addressed across multiple sanctuary sites or ONMS headquarters branches.

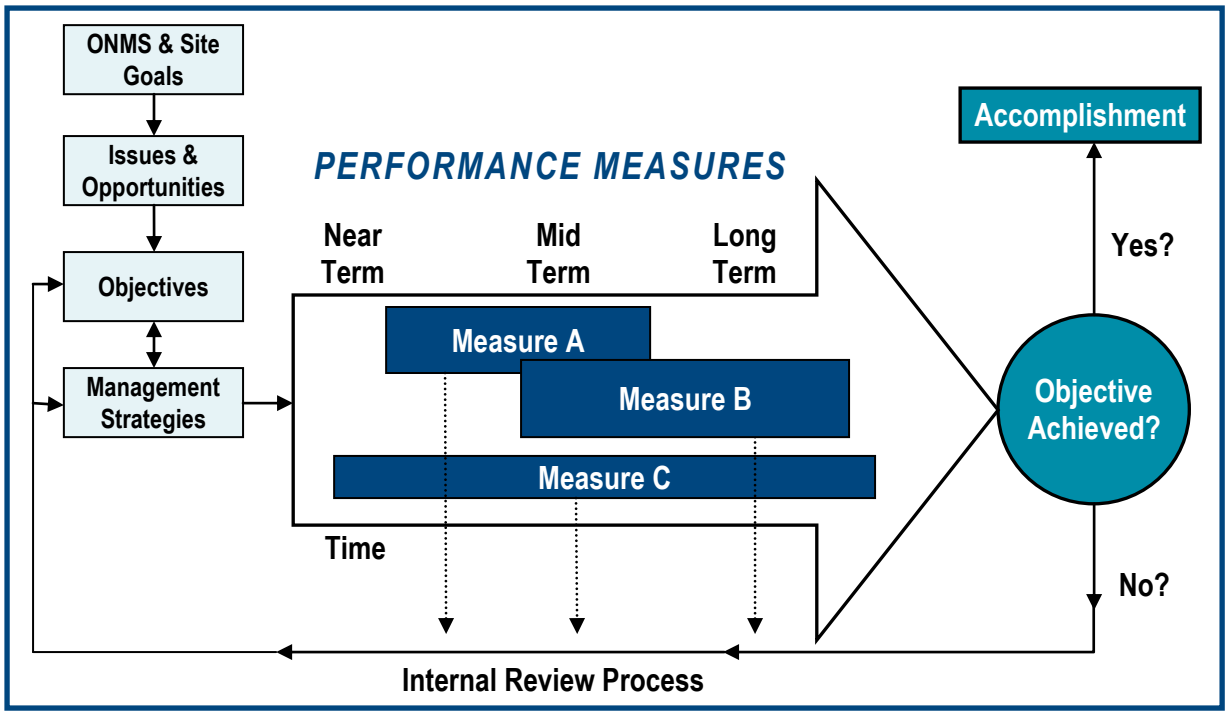

Figure 4-3: ONMS Performance Measure Logic Model.

ONMS develops both program-wide and site-specific performance measures (with the latter designed in part to comport with the former). Program-wide performance measures assess progress toward achievement of the national program goals.[3] Currently, there are 21 ONMS program-wide performance measures composed of short-term (annual to 5 years) and mid-term (5 to 10 years) outputs, and long-term (10 or more years) outcomes.[4]

As measures are monitored over time, data are collected on progress toward achievement of outcomes and the production of outputs (or products). Achievements in meeting outputs or products produced are reported as accomplishments; inabilities to achieve management actions or produce outputs are also reported, but as areas falling short of target. In these areas, staff will work to identify the issues preventing management from reaching targets (represented in Figure 4-3 by the arrow running along the bottom of the graphic). This internal review is one of the primary benefits of performance evaluation, as it provides an opportunity for staff to think critically and carefully about why particular strategies are not meeting stated targets and what needs to be altered to do so.

[3] Program-wide performance measures and goals are presented in the ONMS strategic plan, which is available at http://sanctuaries.noaa.gov/management/strategic.html.
[4] More information about program-wide performance evaluation can be found here: http://sanctuaries.noaa.gov/management/effective.html.

Periodic reporting on the effectiveness of sanctuary management, as evaluated by the performance measures described in this action plan, will be conducted. There will be opportunities for public comment on the sanctuary's perception of its performance, as well as ideas on how to improve the effectiveness of management, when evaluation is on the agenda at sanctuary advisory council meetings.

4.8.2 Issues and Need for Action

Up until the past few years, very little had been done to measure management performance at sanctuary sites or across the system. Not measuring performance renders it difficult to articulate important information about sanctuary successes and failures, namely the reasons behind these successes or failures. Information about sanctuary successes can be used to help inform the public and sanctuary constituents about valuable sanctuary programs and achievements. Information about unsuccessful efforts helps sanctuary management make necessary adjustments to improve performance.

4.8.2.1 Relevant Issues Raised During Scoping

During public scoping, it was noted that the sanctuary should include more measurable objectives under all goals to better assess the effectiveness of sanctuary activities and incorporate effectiveness monitoring to assess the impact of specific management activities.

4.8.3 Addressing the Issues – Strategies for this Action Plan

The strategies and associated activities in this action plan are intended to outline the means and level of support necessary for sanctuary managers and staff to successfully measure sanctuary performance over time. One strategy and three activities have been developed for achieving the desired outcome of effectively and efficiently incorporating performance measurement into sanctuary operations to evaluate the degree to which the management actions are achieving sanctuary goals. The strategy and activities are coded by the acronym for the action plan title, "Program Evaluation" (PE). A summary of strategies and activities is provided in

Table 4-16 at the end of this action plan (see p. 286).

- PE-1: Measuring sanctuary performance over time.

Strategy PE-1: Measuring sanctuary performance over time.

Meaningful evaluation requires the ability to monitor, evaluate, provide feedback, and then assess what is working and what needs to be changed in terms of strategies and activities. Sanctuary staff limited the number of performance measures contained here because it takes time and effort to track the information necessary to report on each performance measure. These measures, while not comprehensive, are representative of all the planned sanctuary activities outlined in the management plan. The sanctuary superintendent is responsible for tracking all the performance measures and reporting the results of the performance evaluation. The task of gathering specific information for various measures is delegated to sanctuary staff.

All performance measures for this management plan are found in a series of six tables (one for each of the other seven action plans, except for the Partnerships & Interagency Cooperation Action Plan[5]) provided after the activities below.

Activity PE-1.1: *Monitor and evaluate performance measures consistently over time.* Sanctuary staff will conduct routine performance evaluations to collect and record data on sanctuary performance over time. In some cases, identifying the baseline may be the first order of action so that subsequent reporting is based on concrete information. Using these data, staff will evaluate effectiveness by (1) evaluating progress toward achievement of each action plan's desired outcomes, and (2) assessing the role or added value of those outcomes in the overall accomplishment of sanctuary goals and objectives. Progress toward the achievement of targets will be assessed on an annual basis.

Activity PE-1.2: *Report out on results of performance monitoring and evaluation.* Performance data may be presented in a site-specific annual report or the State of the Sanctuary Report explaining the assessment of each measure, how it was assessed, who conducted the assessment, and next steps. Based on this report, sanctuary staff, in cooperation with the advisory council, will identify accomplishments as well as work to identify management actions that may need to be adjusted or changed to better meet their specified targets. In addition, advisory council meetings may provide opportunities for the public to comment on the sanctuary's perception of its performance, ways the sanctuary could be more effective, and methods for improving performance measurement.

Activity PE-1.3: *Assess adequacy and validity of performance measures and targets.* During implementation of the prior two activities in this strategy, sanctuary staff will also assess the performance measures and targets themselves to evaluate their adequacy and validity (if, for instance, they are too ambitious or unrealistic given current site capacities). Measures and targets will subsequently be adjusted as necessary and appropriate.

4.8.4 Performance Measures

Following the ONMS Performance Logic Model, the performance measure tables on the following pages provide: (1) the relevant ONMS goals; (2) relevant sanctuary goals; (3) the action plan objective; (4) the strategy or strategies for which performance measures will be tracked; (5) the performance measures; and (6) an explanation of how performance will be measured.

[5] Since the overall aim of partnerships and interagency cooperation is to help implement the strategies and activities in other action plans and achieve the sanctuary goals, no separate performance measures are provided specifically for partnerships and interagency cooperation.

Table 4-10: Performance Measures for the Cultural Heritage and Community Engagement Action Plan.

AP	ONMS Goal(s)	Sanctuary Goal(s)	Strategy(ies) Measured	Performance Measure(s)	How Measured
Cultural Heritage & Community Engagement	*CH&CE Primary Objective: Promote stewardship through active engagement of sanctuary communities while incorporating Samoan culture and protecting cultural heritage and maritime heritage resources.*				
	(3) Enhance nation-wide public awareness, understanding, and appreciation of marine and Great Lakes ecosystems and maritime heritage resources through outreach, education, and interpretation efforts.	(2) Interpret, protect, and preserve historic and cultural resources. (6) Enhance public understanding, appreciation, and the need for protection and wise use of the natural, cultural, and historic resources through outreach and education.	CH&CE-4: Inventory and assess maritime heritage resources within the sanctuary and American Samoa.	Identify and nominate cultural and/or maritime heritage resources eligible for nomination to the National Register of Historic Places within 5 years. (CH&CE – 4.4)	Annual assessment of number of eligible cultural and maritime heritage resources identified and percentage of eligible resources nominated.

Table 4-11: Performance Measures for the Marine Conservation Science Action Plan.

AP	ONMS Goal(s)	Sanctuary Goal(s)	Strategy(ies) Measured	Performance Measure(s)	How Measured
Marine Conservation Science	*MCS Primary Objective: to improve ecosystem-based management by providing a strong foundation of science and increasing knowledge of sanctuary marine ecosystems*				
	(4) Investigate and enhance the understanding of ecosystem processes through continued scientific research, monitoring, and characterization to support ecosystem-based management in sanctuaries and throughout U.S. waters.	(5) Support, promote, and coordinate research, monitoring, ecosystem characterization, and traditional knowledge that increases understanding and improves management decision making throughout the Samoan Archipelago.	MCS-2: Continue to assess baseline conditions and enhance research, monitoring, and characterization programs throughout the life of the management plan.	Monitor ecological and environmental indicators of shallow-water reef habitats, including indicators of climate change, on an annual basis. (MCS – 2.2)	At end of year 2 issue report on quantitative baseline survey results regarding coral, algae, fish and invertebrates in all sanctuary units. Generate subsequent annual survey reports with comparisons to baseline and discussion of indicators and trends observed.
			MCS-3: Interpret and communicate the results of scientific activities taking place in and around the sanctuary throughout the life of the management plan.	Compile relevant scientific publications and make them available on the sanctuary website on an annual basis. (MCS – 3.3)	Annual assessment of number of relevant publications issued each year and percentage of these publicly accessible on the sanctuary website.

Table 4-12: Performance Measures for the Climate Change Action Plan.

AP	ONMS Goal(s)	Sanctuary Goal(s)	Strategy(ies) Measured	Performance Measure(s)	How Measured
Climate Change	*CC Primary Objective: to minimize and mitigate the impact from climate change events on coastal and marine ecosystems in sanctuary units.*				
	(1) Identify, designate, and manage sanctuaries to maintain the natural biological communities in sanctuaries and to protect and, where appropriate, restore and enhance natural habitats, populations, and ecological processes, through innovative, coordinated, and community-based measures and techniques.	(1) Protect, preserve, and where appropriate enhance the marine environment and the associated biological communities, biodiversity and ecological integrity.	CC-1: Complete Climate Smart Sanctuary certification standards within 3 years.	Complete all standards for Climate Smart Sanctuary certification within 3 years. (CC – 1)	At end of year 3 assess completion status of Climate Change Site Scenario, Climate Change Plan and formation of Climate Smart Sanctuary Local Review Team.
	(4) Investigate and enhance the understanding of ecosystem processes through continued scientific research, monitoring, and characterization to support ecosystem-based management in sanctuaries and throughout U.S. waters.	(5) Support, promote, and coordinate research, monitoring, ecosystem characterization, and traditional knowledge that increases understanding and improves management decision making throughout the Samoan Archipelago.			

Table 4-13: Performance Measures for the Operations and Administration Action Plan.

AP	ONMS Goal(s)	Sanctuary Goal(s)	Strategy(ies) Measured	Performance Measure(s)	How Measured
Operations and Administration	*O&A Primary Objective: to outline the means and level of support necessary to successfully achieve sanctuary goals and implement the strategies and activities detailed in the other action plans.*				
	(5) Facilitate human use in sanctuaries to the extent such uses are compatible with the primary mandate of resource protection, through innovative public participation and interagency cooperative arrangements.	(8) Facilitate, to the extent compatible with the primary objective of resource protection, public and private recreational uses of the sanctuary not prohibited pursuant to other authorities.	O&A-5: Track and, where necessary, permit activities occurring within the sanctuary.	100% of permits are issued correctly and in a timely manner, per the "Performance Evaluation Manual for the ONMS" section on measuring permitting performance. (O&A – 5.1)	Annually assess: (1) the number of permit applications submitted, (2) the time taken to process each application and notify the applicant of permit approval or denial, and whether this time complies with that outlined in the ONMS National Permitting Guidelines , (3) the percentage of permits issued or denied prior to applicant's planned activity date, and (4) whether each permit recorded in the OSPREY permit record database meets the associated criteria in the ONMS Performance Evaluation Manual.
	(7) Build, maintain, and enhance an operational capability and infrastructure that efficiently and effectively support the attainment of the NMSP's mission and goals.				

Table 4-14: Performance Measures for the Ocean Literacy Action Plan.

AP	ONMS Goal(s)	Sanctuary Goal(s)	Strategy(ies) Measured	Performance Measure(s)	How Measured
Ocean Literacy	*OL Primary Objective: to cultivate an informed public and enhance ocean stewardship by increasing public awareness, understanding, and appreciation of sanctuary resources in American Samoa.*				
	(3) Enhance nation-wide public awareness, understanding, and appreciation of marine and Great Lakes ecosystems and maritime heritage resources through outreach, education, and interpretation efforts.	(6) Enhance public understanding, appreciation, and the need for protection and wise use of the natural, cultural, and historic resources through outreach and education.	OL-3: Increase ocean literacy through development and implementation of formal education programs and materials in American Samoa.	Retrofit the Hawaiian "Navigating Change" curriculum to make it applicable to American Samoa and the Samoan Archipelago within 4 years.	Annually assess progress toward retrofitting the curriculum at end of years 1-3, and at end of year 4 assess whether this project is complete.
			OL-4: Develop creative programs for student participation that encourage learning about sanctuary resources and ocean stewardship.	Organize, host and support 12 school trips to the sanctuary visitor center on an annual basis. (OL – 4.4)	Upon opening of the visitor center, annual assessment of number of school trips to this facility the sanctuary has hosted and supported that year.

Table 4-15: Performance Measures for the Resource Protection and Enforcement Action Plan.

AP	ONMS Goal(s)	Sanctuary Goal(s)	Strategy(ies) Measured	Performance Measure(s)	How Measured
Resource Protection and Enforcement	*RP&E Primary Objective: to reduce existing and potential resource threats, and to prevent adverse impacts to the ecosystem*				
	(1) Identify, designate, and manage sanctuaries to maintain the natural biological communities in sanctuaries and to protect and, where appropriate, restore and enhance natural habitats, populations, and ecological processes, through innovative, coordinated, and community-based measures and techniques. (4) Investigate and enhance the understanding of ecosystem processes through continued scientific research, monitoring, and characterization to support ecosystem-based management in sanctuaries and throughout U.S. waters.	(1) Protect, preserve, and where appropriate enhance the marine environment and the associated biological communities, biodiversity and ecological integrity. (5) Support, promote, and coordinate research, monitoring, ecosystem characterization, and traditional knowledge that increases understanding and improves management decision making throughout the Samoan Archipelago.	RP&E-2: Conduct and facilitate research and monitoring regarding detection, prevention, ecosystem effects of, control and where feasible eradication of introduced species.	Monitor spread of introduced species annually and, if the threat of invasive species actualizes, implement a response plan within 6 months. (RP&E – 2)	Annual report on introduced species monitoring efforts conducted in sanctuary units and their results, including identification of invasive threats posed. In years in which an invasive threat is identified, report will include assessment of length of time taken to develop response plan after initial identification of the threat.
			RP&E-4: Minimize anchoring impacts to sensitive marine habitats, particularly coral reef formations, while providing reasonable access to sanctuary resources.	Install mooring buoys in appropriate locations, within 5 years. (RP&E – 4.3)	At end of year 5 assess completion status of mooring buoy installation in all locations recommended by sanctuary staff per RP&E – 4.2.
			RP&E-6: Minimize damage to sanctuary resources through coordinated emergency preparedness and contingency planning.	Increased Fagatele Bay National Marine Sanctuary participation in regional emergency response planning efforts. (RP&E – 6)	Assess completion status of sanctuary emergency response plan, and of entering appropriate American Samoa information into SHIELDS and RUST databases, at end of years 3 and 4, respectively.

Table 4-16: Summary of Strategies and Activities for the Program Evaluation Action Plan.

STRATEGIES AND ACTIVITIES	
Strategy PE-1: Measuring sanctuary performance over time.	
Activity PE-1.1:	Monitor and evaluate performance measures consistently over time.
Activity PE-1.2:	Report out on results of performance monitoring and evaluation.
Activity PE-1.3:	Assess adequacy and validity of performance measures and targets.

4.8.5 Addressing the Issues – Strategies from other Action Plans

The purpose of the Program Evaluation Action Plan is to evaluate the effectiveness of the various strategies contained within the other action plans. No strategies in other action plans are geared toward performance measurement and, thus, none are listed here.

4.8.6 Addressing the Issues – Regulations

There are no sanctuary regulations associated with the issues in the Program Evaluation Action Plan. Sanctuary regulations are available at 15 CFR Part 922 Subpart J.

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5.0 ENVIRONMENTAL CONSEQUENCES

5.1 INTRODUCTION

This chapter describes the overall potential impacts of the proposed sanctuary alternatives on the natural and human environment compared to no action. A discussion of cumulative projects and impacts is presented in Chapter 6. Four alternatives in addition to the no action alternative, as described in Chapter 2, are evaluated in this chapter.

Chapter Organization

Each resource analyzed in this chapter includes the methods used for impact analysis (section 5.1.1) and a discussion of factors used to determine the significance of direct and indirect impacts per 40 CFR 1508.8 (section 5.1.2). Direct impacts are those that are caused by the alternatives and occur at the same time and place. Indirect impacts are those caused by the alternatives that occur later or are farther removed in distance from the alternative. Section 5.1.3 discusses natural and human resources typically addressed under NEPA that are not covered in this EIS.

A summary of current conditions and threats is provided under No Action (section 5.2). The impact analysis for the four alternatives (sections 5.3 – 5.6) occurs on three levels: the set of actions proposed for each of the alternatives that impact the resources; the physical, biological, and cultural resources and human uses impacted; and the specific locations where these impacts occur. Due to the multiple levels on which the analysis occurs, section 5.1.4 explains the organization of the analysis, designed to limit repetition and provide a clear assessment of the location- and resource-specific impacts. This analysis also separates the non-regulatory action (*i.e.*, management plan update), which is common for all alternatives and is discussed as part of Alternative 1, from the alternative-specific regulatory actions. Section 5.1.5 provides a summary table of the impacts by resource and by alternative, showing the highest level of impact for each resource.

Scope of Analysis

The impact analysis for No Action describes the impacts of the status quo, where a management plan review was conducted but the 1984 Fagatele Bay National Marine Sanctuary Management Plan remains the guiding document of the sanctuary. No Action results in a no impact determination. This does not suggest that there are not significant impacts presently occurring and would continue to occur; rather, choosing No Action will not result in any additional impacts.

Selecting Alternative 1 would allow for an update of the 1984 management plan, including the development of eight new action plans, but would not expand the sanctuary to include additional units. The sole regulatory action of Alternative 1 is the addition of the management permit.

Analysis of this alternative is primarily confined to impacts within Fagatele Bay and assumes that ongoing activities and uses would continue at current levels.

Alternatives 2 – 4 include new sanctuary units, as well as a number of new and revised regulatory changes. The impact analyses for these alternatives extend to all of these units and are measured against No Action. A beneficial impact determination means that an alternative management regime would result in actions that reduce detrimental effects on the natural environment or improve socioeconomic conditions compared to No Action. All other impacts are considered significant, significant but mitigable to less than significant, less than significant, or no impact, based on the degree to which the alternative increases the detrimental effect on the natural environment or worsens socioeconomic conditions. Text supporting these conclusions is presented, and mitigations are listed for all significant impacts, where mitigation is appropriate.

5.1.1 Impact Methodology

The nature of existing conditions in the waters surrounding the islands of Tutuila, Aunu'u, Ta'u, Swains, and Rose Atoll is interpreted from available literature, summarized in Chapter 3. Where sufficient location-specific information is available, these data are primarily utilized. Where location-specific data are lacking, general conditions for the islands are utilized with appropriate qualifications. For the most part, location-specific physical and biological conditions are available; however location-specific data for human uses, including fishing, have not been available. For activities and actions proposed within or intended to improve management of the existing and proposed sanctuary units, the methodology used to determine whether effects on the physical and biological environment, and human environment would occur is as follows:

5.1.1.1 Water Quality and Habitats

The impacts to water quality will be addressed from both land-based sources and vessel discharge. The impacts to habitat, with specific attention to coral reefs, occur from both poor water quality (*e.g.*, pathogens, sedimentation) and physical damage (*e.g.*, ship groundings, destructive fishing gear). The methodology used to determine how a sanctuary alternative would impact water quality and habitats is described below.

- Review and evaluate ongoing and past human uses to identify the action's potential effect on water quality and habitats, emphasizing nearshore waters and coral reef habitats
- Review and evaluate human uses within the area of the proposed sanctuaries to identify their potential to beneficially or negatively affect the ecosystem and its component parts within the sanctuaries
- Assess the compliance of each activity within the plan with applicable federal and territorial water quality standards, programs and policies to protect surface water quality (such as EPA Region IX Surface Water Preliminary Removal Goals, point and nonpoint source discharge permit requirements under the Clean Water Act [CWA], and Coastal Zone Management Act [CZMA])

- Review available literature on the anthropogenic causes of coral reef and associated habitat degradation, assess the level these are occurring under No Action and evaluate if each alternative affects the anthropogenic causes

5.1.1.2 Biological Resources

Biological resources within the proposed sanctuary units include marine plants, corals, benthic invertebrates, fish, mobile invertebrates, sea turtles, marine mammals and seabirds. These resources are discussed under the subsections *Target and Non-Target Fish and Invertebrate Resources* and *Special Status Species*. The methodology used to determine how a sanctuary alternative would impact these biological resources is described below.

- Review and evaluate existing and past human uses, with specific attention to corals and nearshore, highly valued fishery resources, to identify the action's potential impact on biological resources
- Review and evaluate each alternative, identifying its potential to negatively affect the ecosystem and its component parts within the proposed sanctuary, including damage to the coral reef and associated habitats, excessive disturbance of marine life, presence of introduced species, and depletion of species and associated ecosystem effects from directed harvest;
- Assess the compliance of each alternative with applicable federal, state, or local regulations, including DMWR regulations, ESA, and MMPA
- Review and evaluate ecosystem qualities, including species richness, densities, and other metrics against pristine and heavily-used habitats

5.1.1.3 Fisheries

The methodology for assessing potential impacts on fishing activity is dependent on the details of a given fishery. Existing federal regulation restrict large-scale commercial fisheries from operating within 50 nm of the archipelago, while small-scale artisanal, recreational and subsistence fishing usually occurs close to shore in the shallow coral reef habitat, and nearshore banks. For purse seine and longline fishing fleets, the potential impact will be based on a comparison of existing regulatory restrictions to fishery restrictions proposed in each of the alternatives. For nearshore fisheries, because customary marine tenure is generally honored, the impacts will primarily be location-specific and impact fishers from those villages adjacent to proposed sanctuary units. Where catch and effort data is unavailable for a given village, impacts will be based on archipelago-wide data sets. The methodology used to determine how a sanctuary alternative would impact these biological resources is described below.

- Review and evaluate current trends in nearshore fishing methods, effort, and reported landings, using location-specific information where available, to identify the action's potential impact on individual fisheries
- Review and evaluate fishery resource status (*i.e.*, health of fishery stocks) to identify the action's potential impact on the sustainability of individual fisheries
- Assess existing regulations to determine the impact of the proposed action

- Consider the action's potential to impart transfer effects (shifting of location or fishery method) and the resulting impact to each fishery

5.1.1.4 Maritime Heritage and Cultural Resources

The method for assessing potential impacts on cultural resources involves identifying sensitive cultural resources within proposed sanctuary boundaries, identifying project activities that could affect those resources, and determining the type and magnitude of potential direct and indirect impacts on those resources.

The impact methodology includes reviewing cultural resources reports, public meetings, discussions with subject matter experts, and archival records to identify cultural resources in the water or on adjacent lands to proposed sanctuary boundaries. In addition, the National Register of Historic Places (NRHP) and territory inventories of historic places were reviewed for prehistoric and historic resources. Maritime heritage and cultural resources are regulated through a number of laws, beginning with the National Historic Preservation Act (NHPA), which is the basis for a process that considers the effects of federal undertakings on cultural and historic resources. Depending on the resources identified, the following legislation could also apply within the proposed sanctuary units:

- Abandoned Shipwreck Act of 1987 (PL 100-298; 43 USC 2101-2106);
- Sunken Military Craft Act (H.R. 4200, Title XIV, Sec. 1401-1408);
- Preserve America Executive Order (2003);
- National Marine Sanctuaries Act (16 USC 1431-1441);
- American Antiquities Act of 1906 (16 USC 431-433);
- Archaeological and Historic Preservation Act of 1974 (16 USC 469-469c);
- Archaeological Resources Protection Act of 1979, as amended (16 USC 470aa-mm); and
- Historic Sites, Buildings, Objects, and Antiquities Act of 1935 (16 USC 461-467).

5.1.1.5 Tourism and Recreation

The methodology for assessing potential impacts on tourism and recreation is dependent on the extent and scope of the existing non-consumptive tourism and recreation uses in American Samoa. Impacts to recreational fishing are considered as part of the analysis of fisheries. The current level of tourism and recreation and the existing infrastructure and organization to support these human uses were reviewed, including historic and current location-specific data when available. When location-specific data were not available, general information about tourism and recreation in the Pacific islands region was used. The methodology used to determine how a sanctuary alternative would impact tourism and recreation is described below.

- Review and evaluate historic and current trends in tourism and recreation in American Samoa, using location-specific information where available, to identify the action's potential impact on American Samoa as a whole

- Review and evaluate the recent American Samoa Tourism Master Plan (Resort Consulting Associates 2010)
- Review and evaluate existing infrastructure and organization for tourism and recreation (*i.e.*, dive shops, hotel space, recreational vessels, land-based access to sanctuary units);
- Assess existing access to American Samoa (*i.e.*, air flight frequency and cruise ship regularity) for outside tourists
- Assess existing access to the sanctuary units considered for inclusion in the alternatives (*i.e.*, distance and access to individual units)

5.1.1.6 Research

As one of the goals of this sanctuary is to "support, promote, and coordinate research, monitoring, ecosystem characterization," the methodology for assessing impacts to research relates specifically to how the sanctuary's actions provide for or limit the ability for future research activities. The analysis does not address how research itself impacts other sanctuary resources. The methodology used to determine how an alternative would impact research activities is described below.

- Assess the types of potential research activities that can occur without a permit
- Assess the quality and availability of proposed sanctuary units identified for various types of research
- Assess the ongoing activities within and around the proposed sanctuary units that may interfere with various research activities, including the safety of researchers and their equipment

5.1.1.7 Human Health and Safety

The impact analysis evaluates the degree to which people within proposed sanctuary waters are protected from dangerous activities and hazardous materials. Where relevant, analysis of human health and safety is included under other human uses (*e.g.*, fishing, tourism and recreation). The methodology used to determine how an alternative would impact human health and safety is described below.

- Reviewing and evaluating existing and past baseline activities to identify the action's potential to use hazardous material, to generate hazardous waste, or to release hazardous material within proposed sanctuary waters
- Reviewing and evaluating each project activity and alternative to identify the action's potential to use hazardous material, to generate hazardous waste, or to release hazardous material within proposed sanctuary waters
- Comparing the location of each activity and alternative with baseline data on known or potentially contaminated areas
- Assessing the compliance of each activity and alternative with applicable federal or location-specific hazardous or nonhazardous waste regulations, guidelines, management plans, spill response and contingency plans, and pollution prevention plans

5.1.1.8 Socioeconomics

For activities proposed within the sanctuary or intended to improve management of the sanctuary, the methodology used to determine how an alternative would impact socioeconomic resources and environmental justice is described below.

- Review and evaluate ongoing and past activities to identify the action's potential to affect socioeconomics within American Samoa
- Review and evaluate activities within the area of the proposed sanctuaries, identifying their potential to affect resources contributing to socioeconomics within American Samoa
- Assess whether or not each activity is consistent with federal or territorial laws, regulations, and policies
- Review and evaluate the potential disproportionate effects on low-income or minority populations and the potential for increased adverse health risks to children

5.1.2 Factors Considered in Determining Significance of Impacts

To determine whether an impact is significant, CEQ regulations also require the consideration of context and intensity of potential impacts (40 CFR 1508.27). Context normally refers to the setting, whether local or regional, and intensity refers to the severity of the impact. Also, an EIS should include a discussion of the possible conflicts between the proposed sanctuary alternatives and the objectives of federal, regional, state, and local land use plans and policies for the area concerned (40 CFR 1502.16 C).

Impacts are defined in the following categories:

- Significant;
- Significant but mitigable to less than significant;
- Less than significant;
- No impact; and
- Beneficial impact.

5.1.2.1 Water Quality and Habitats

A project alternative's impact on water resources and benthic habitats are considered to be significant based on the extent to which the alternative would result in any of the following:

- Degrade water quality in a manner that would reduce the existing or future beneficial uses of the water;
- Substantially increase risks associated with human health or environmental hazards;
- Reduce the availability of, or accessibility to, one or more of the beneficial uses of a water resource;
- Alter water movement patterns in a manner that would adversely affect the uses of the water within or outside the project region;

- Be out of compliance with existing or proposed water quality standards or require an exemption from permit requirements in order for the project to proceed;
- Substantially increase the risk to cause mortality to living habitat (corals, coralline algae), with specific concern for the rarity of the habitat and its ability for natural restoration; or
- Impart any risk to the degradation of isolated habitats where repopulation of associated species is limited due to this isolation.

In addition, all proposed activities that may affect water quality or habitats protected under the CWA, CZMA, or other federal or territorial law will only proceed after compliance with applicable laws, including, as necessary, consultation, receipt of permits, and compliance with all permit terms and conditions.

5.1.2.2 Biological Resources

Impacts on biological resources were characterized based on the sensitivity, significance, or rarity of each resource that would be adversely affected by the proposed sanctuary alternatives. In the marine environment, shallow water resources, in general, are more vulnerable to human impact and are more important to the ecosystem as a whole than deepwater resources (Wilkinson 2002). The sanctuary units were specifically included in each of the alternatives because of public concern for the resource health, unique cultural value, and the significance of the extensive and healthy coral reefs across the archipelago, which occur primarily in waters shallower than 98 feet (30 meters). Both land animals and deepwater species rely on the coral reef for a variety of needs at different life stages.

Factors considered in determining whether an alternative would have a significant impact on biological resources include the extent or degree to which its implementation would do any of the following:

- Cause the take of a highly sensitive resource, such as a threatened, endangered, or special status species;
- Result in a jeopardy biological opinion by the USFWS or NOAA;
- Reduce the population of a sensitive species, as designated by federal and territorial agencies, or a species with regional and local significance by reducing numbers; altering behavior, reproduction, or survival; or destroying or disturbing habitat;
- Conflict with American Samoa's Coastal Management Program policies;
- Introduce or increase the prevalence of invasive species;
- Cause long-term loss or impairment of a substantial portion of local habitat; or
- Conflict with other agency policies or regulations in place to protect, conserve, and manage biological resources.

5.1.2.3 Fisheries

Because quantitative information is generally available for commercial fisheries, and is not for recreational, subsistence and small-scale artisanal fisheries, criteria determining the significance

of an action on fisheries is different based on the type of information available. In addition, customary marine tenure is usually honored for nearshore fisheries, effectively altering how these fisheries are impacted. Finally, revenue loss, which is a factor for significance, is addressed under socioeconomic impacts, and not in the specific analysis for fisheries. With these factors in mind, impacts are considered to be significant according to the extent to which they result in the following:

- Limit harvest of fishery resources in an area considered high value for this use;
- Limit or prohibit the use of a preferred gear type;
- Close an area to fishing in which alternate areas are unavailable or substantially less productive; or
- Cause the decline in total fishing activity across the territory.

5.1.2.4 Maritime Heritage and Cultural Resources

Section 106 of the NHPA requires federal agencies to consider the effects of their actions on properties listed on or eligible for listing on the NRHP. Regardless of formal evaluations, NOAA treats all cultural resources and potential components of cultural landscapes as though they are eligible. An adverse effect on a historic property, as defined by the NHPA, is not necessarily a significant impact under NEPA. While mitigation under the NHPA does not necessarily negate the adverse nature of an effect, mitigation measures under NEPA can reduce the significance of an impact. NHPA and NEPA compliance are separate and parallel processes, and the standards and thresholds of the two acts are not precisely the same. Section 106 and its implementing regulations, 36 CFR Part 800, state that an undertaking has an effect on a historic property (*i.e.*, NRHP-eligible resource) when it could alter those characteristics of the property that qualify it for inclusion on the NRHP. An undertaking is considered to have an adverse effect on a historic property when it diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

Section 106 adverse effects include, but are not limited to, the following:

- Physical destruction, damage, or alteration of all or part of the property;
- Isolation of the property or alteration of the character of the property's setting when that character contributes to the property's qualifications for the NRHP;
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or changes that may alter its setting;
- Neglect of a property, resulting in its deterioration or destruction; and
- Transfer, lease, or sale of a property without provisions to protect its historic integrity.

Sites that do not contain the characteristics listed above are not considered sensitive.

5.1.2.5 Tourism, Recreation, and Research

Factors considered in determining whether or not an alternative would have a significant impact on tourism, recreation, and research include the extent or degree to which each alternative would result in the following:

- Disrupt public use of the beach, ocean, or land-based resources, or interfere with the public's access to the sea;
- Prevent long-term use or impede or discourage existing activities;
- Conflict with existing or planned human uses and activities within or around the unit;
- Conflict or be incompatible with the objectives, policies, or guidance of State plans; or
- Conflict with other agency regulations regarding compatible wildlife-dependant uses.

5.1.2.6 Human Health and Safety

Criteria to determine the significance of impacts associated with human health and safety are based on the level of ongoing or potential hazards associated with expected or promoted sanctuary activities. Impacts are considered to be significant according to the extent to which they result in the following:

- Cause a change in user behavior that increases the potential of safety risks;
- Discharge or deposit unauthorized waste into the proposed sanctuary or in an area outside the proposed sanctuary that could migrate into the proposed sanctuary and affect its resources (including onshore runoff);
- Expose the public to any hazardous conditions through release or disposal;
- Increase the likelihood for spills or releases of oil, fuel, or hazardous substances from operations within the proposed sanctuary; or
- Cause oil, grease, or other waste material to be visible.

5.1.2.7 Socioeconomics

The impacts from the alternatives will disproportionately affect the villages adjacent to the proposed sanctuary units. Specifically, cultural traditions employ the tenet of customary marine tenure, where the marine resources in the nearshore belong to the adjacent villages. As such, restrictions at sanctuary units will primarily affect the associated village. The primary issues that will be addressed in this analysis are the impacts to the local fisheries, to the adjacent villages from sanctuary presence, and the overall impact to the economy from an increased sanctuary presence, including additional funding and employment. Factors considered in determining whether an alternative would have a significant impact on socioeconomics and environmental justice are the extent or degree to which implementation would change the following:

- Employment and total income on American Samoa;
- Value of coral reefs in American Samoa;
- Tourism and recreation;

- Any social, economic, physical, environmental, or health conditions so as to disproportionately affect any particular low-income or minority group; or
- Disproportionately endanger children in areas on Tutuila, Aunu‘u, Ta‘u, and Swains Islands.

5.1.3 Resources not Analyzed

Of the resources commonly analyzed during the NEPA process, Table 5-1 provides a list of those not addressed in this EIS and the rationale as to why the action would not affect these resources.

Table 5-1: Resources not Analyzed.

Resource	Rationale
Noise	With the exception of research vessel noise (which is negligible and occurs under No Action), none of the alternatives include activities that would alter the level of noise in the environment.
Land Use	With the exception of the impacts that some land use practices have on water quality (and will be covered therein), activities that occur on land are restricted to the construction and operation of the visitor center, which is part of No Action.
Air	With the exception of research vessel exhaust (which is negligible and occurs under No Action), none of the alternatives include activities that would alter the level of airborne pollution in the environment.
Marine Traffic and Transportation	With the exception of boating safety requirements, which are part of No Action and required by USCG regulations, none of the alternatives impact vessel traffic, air or land transportation.
Utilities	With the exception of the utility requirements for the new sanctuary visitor center (which is part of No Action), none of the alternatives include activities that require or impact utilities.
Visual	With the exception of the ongoing construction of the sanctuary visitor center (which is part of No Action), none of the alternatives will impact visual resources.
Communication Infrastructure	None of the alternatives will affect submarine cables.

In addition to the categories of resources listed in Table 5-1, a number of natural and cultural resources discussed in Chapter 3 Affected Environment will not be impacted by any of the proposed actions. These resources are included in Chapter 3 to provide the public with a complete picture of the land and sea ecosystems of American Samoa, and specifically the proposed action areas.

Physical features discussed in Chapter 3 *Affected Environment*, such as geological formations and oceanic conditions (i.e. currents, tides, and climate), are beyond the scope of plausible effects as their status and equilibrium are largely independent of human imposed boundaries and policies. Seagrass and mangrove habitats do not occur within the proposed boundaries of the sanctuary, and would experience no impact over that occurring under no action. Biological resources mentioned in Chapter 3, including seabirds and the flying fox, are not expected to experience direct impacts from the proposed actions as their habitats are primarily outside the proposed sanctuary boundaries. There are no expected adverse impacts to the aquaculture industry, which currently occurs only on land. As such these resources will not be analyzed in this chapter.

In addition, the intertidal zone and the subtidal zone are overarching terms which encompass physical resources as well as habitat of the biological resources considered in this section. These terms are generally too broad to allow for a discussion of impacts. Instead, their components (*e.g.*, coral structures) and the resources living within them (*e.g.*, reef fish) are analyzed. Plankton, although not explicitly mentioned, is discussed in terms of larval connectivity.

As described in Section *5.1.1 Impact Methodology*, site-specific information for each of the proposed units is provided in Chapter 3. The analysis of this chapter relies predominantly on the information provided in these sections, unless site-specific information is lacking. All of the resources described in these sections are considered in the following analysis.

5.1.4 Organization of Alternative Analysis

The periodic review of the management plan, as required under the NMSA, is considered under No Action, in which the original management plan is maintained as the primary guiding document of the sanctuary (section 5.2). A revision of the 1984 management plan, including new sanctuary goals (section 1.4.2) and new action plans (Chapter 4), is part of Alternatives 1 - 4. These aspects of this joint DMP/DEIS are not relevant for the No Action analysis. Additional actions under Alternatives 1 – 4, including proposed new sanctuary units and new regulations, are described in Chapter 2. The analyses presented in this chapter differentiate the review/revision of the management plan from the regulatory actions of designating new sanctuary units and implementing new regulations. An assessment of the impacts from the implementation of the new action plans is presented as part of

Organizational Structure of Impact Analysis

Alternative Action

Physical and Biological Environment
- Water Quality and Habitat
- Target and Non-Target Fish and Invertebrate Resources
- Special Status Species

Human Environment
- Fisheries
- Marine Heritage and Cultural Resources
- Tourism and Recreation
- Research
- Human Health and Safety

Socioeconomic Environment

Alternative 1, with impacts specific to physical and biological resources in Fagatele Bay, and human uses and socioeconomic impacts only as they relate to the management of Fagatele Bay. For Alternatives 2 – 4, impacts of the management plan as it relates to the additional units are presented under the first action analyzed, *Action: Inclusion of Additional Units into Sanctuary Network*.

Within each alternative (sections 5.3 - 5.6), impacts are analyzed by regulatory action or action type (*e.g.*, vessel discharge, fishery regulations). Each action is further analyzed in the context of three main categories (see text box). The first category is the physical and biological environment which is further broken down and analyzed under the subsections of 1) water quality and habitat, 2) target and non-target fish and invertebrate resources, and 3) special status species. The second category is the human environment which is broken down into 1) fisheries, 2) maritime heritage and cultural resources, 3) tourism and recreation, 4) Research, and 5) Human Health and Safety. The final category of analyzes the socioeconomic environment, specifically focusing on the economic benefits or impacts of the human uses, including changes in revenues due to the action. Location specific analyses (*e.g.*, Muliāva, Aunu'u Island) are detailed where appropriate.

It should be noted also that the first action analyzed under each alternative is inclusion of the individual units. This is primarily an administrative function, with most of the associated impacts analyzed as part of the analysis of the revised management plan. It is therefore only briefly covered, with no subheadings. Furthermore, the complexity of the impact analysis for the remaining actions (or sets of actions) dictates which subheadings will be used. While all resources and uses were considered, categories and subcategories are omitted if they were found to not be impacted by the action.

5.1.5 Summary of Impacts

This section provides a summary of potential impacts of the proposed sanctuary expansion alternatives on the natural and human environment compared to no action (Table 5-2). While Alternative 1 updates the 1984 management plan, this is an administrative action, and the strategies and activities outlined in Chapter 4 could be implemented without updating the management plan. As such, there are few direct impacts associated with Alternative 1 compared to No Action, and beneficial impact determinations are considered to be minor. Overall, the proposed expansion of Fagatele Bay National Marine Sanctuary to two sanctuary units (Alternative 2) or a network of five or six sanctuary units (Alternatives 3 and 4) would result in beneficial impacts on the physical and biological resources compared to No Action or Alternative 1. Each subsequent alternative provides more protection for marine resources through both increasing the total size of the sanctuary and proposing additional regulations. As such, Alternative 4 provides the greatest benefit to physical and biological resources. Most of the impacts to the human environment are beneficial, including providing additional protection for cultural resources, new opportunities for research and improving health and safety within the sanctuary units. Some adverse impacts to fisheries result from harvest and other use restrictions at the sanctuary units. These are primarily mitigated to less than significant through collaboration with the associated villages that have led to agreement regarding these restrictions and

cooperative management between the village and the sanctuary. Under Alternatives 3 and 4, the discharge prohibition may cause adverse impacts to some land-based activities adjacent to proposed sanctuary units, including agriculture, piggeries, and some utilities. These operations would need to limit polluted runoff from entering sanctuary waters. For example, the wastewater treatment facility that services all of Aunu'u Village currently discharges untreated wastewater onto the nearshore reef. While impacts to marine resources and other human uses appear minimal, this activity could be in violation of the discharge prohibition. Adverse economic impacts, specifically the loss of revenue due to fishery restrictions, are expected to be small due to the diminishing level of nearshore fisheries over the past 50 years, and the small size of reef area that is closed to all fishing. Economic impacts to human uses that generate polluted runoff, including the above-mentioned wastewater treatment plant, could be significant, through the cessation of operations or substantial fines levied by the NMSA. Overall, impacts to the entire economy are expected to be beneficial due to the increase in management activity across the territory, including additional employment opportunities through the sanctuary system.

Beneficial impacts to the ecosystem of the proposed expansion of the sanctuary (Alternatives 2-4) would result by strengthening the management of human activities, restricting activities with the potential to cause damage to the ecosystem, and fostering cooperative management with the associated villages compared to No Action. Alternatives 3 and 4 would have the additional benefit compared to No Action, of providing a network of sanctuary units that increase the overall connectivity of marine protected areas across the archipelago, while providing specific protections for those units (Muliāva and Swains Island) which are isolated from sources of larval recruitment and could therefore be more vulnerable to overfishing and habitat damage. Alternatives 3 and 4 create a number of no-take areas, increasing the potential for multiple naturally balanced ecosystems to serve as reservoirs for recruitment of species to areas where resource extraction is permitted, both within and outside sanctuary boundaries.

Beneficial impacts on the preservation of cultural and historical resources and marine water quality in Alternatives 2 to 4 would be expected compared to No Action, as discharge and cultural resource protection regulations will be supported by both civil and criminal penalties. The expansion of the sanctuary to include additional units is expected to result in beneficial impacts on raising awareness and preserving American Samoa culture, compared to no action, through cooperative management, the use of traditional ecological knowledge in resource management, and an emphasis on education and outreach. Cooperative management with the NPAS and the USFWS at the Ta'u Island and Muliāva units, respectively, under Alternative 4 will provide additional resources for education and outreach, research and resource protection. Despite restrictions on commercial and non-commercial fishing in Alternatives 3 and 4, beneficial impacts on socioeconomic conditions and intrinsic (non-use) values of the natural resources from the sanctuary expansion would be expected compared to no action.

The proposed expanded sanctuary would have no impact on most non-extractive activities occurring at all of the proposed units, such as rescue, emergency response, exercises of the armed forces, activities related to human health, safety, or environmental justice concerns. In addition, there would be no impacts from research vessels and other maritime traffic on the

management of hazardous material and waste. The proposed sanctuary expansion is not expected to result in potential impacts on the limited cruise ship industry and other recreational ocean uses, including sport fishing, snorkeling and diving.

The expanded sanctuary would significantly impact the artisanal and subsistence fishing of specific villages in Alternatives 3 and 4, as a result of the increased area in no-take zones at Fagatele Bay and Aunu'u Island as well as through gear restrictions and the prohibition on the take of certain species. In all practicality, the cultural practice of customary marine tenure (*i.e.*, village stewardship of nearshore marine resources) throughout American Samoa limits the impacts of these no-take areas to the specific village adjacent to the proposed sanctuary unit. Impacts to resource harvest, whether commercial, artisanal, or subsistence, which would reduce revenue from fisheries by an estimated $11,572, are mitigated through the cooperative design of no-take areas between ONMS and the respective village. Thus, the socioeconomic impact on the entire American Samoan fishing industry is less than significant, while the overall socioeconomic impacts are beneficial. Table 5-2 provides a summary of these potential resource impacts. Detailed impacts analyses are found in the following sections of this chapter.

Table 5-2: Summary of Potential Resource Impacts.

Resource	No Action	Alternative 1	Alternative 2	Alternative 3A and 3B	Alternative 4	
					A	B
Physical and Biological Environment						
Water Quality and Habitats	○ Status quo maintained; water quality and habitats of bay in good condition; landfill leaching concern	○ Same as No Action	+ Benthic habitat and discharge protections provide comprehensive protection at Muliāva	+ Improved mechanisms to address land-based pollution; benthic habitat protections extended to 6 units	+ Additional protection for mesophotic reefs	+ Same protections as Alternative 4A
Biological Resources (Fish, Invertebrates, and Special Status Species)	○ Status quo maintained; reduction of large fish species remains	+ Ocean Literacy and Resource Protection and Enforcement Action Plans may improve compliance for Sanctuary users	+ Secondary benefit to biological resources from habitat protection; increased resources from joint management	+ Increased protection for vulnerable species (giant clams, corals) and a greater diversity of habitats	+ Protection for vulnerable fish species; increased protection at Muliāva	+ No-take zone provides highest protection for Muliāva
Human Environment						
Fisheries	○ Status quo maintained; fishing remains allowed	○ Same as No Action	⊙ No restriction of fishing opportunities; anchoring and discharge prohibitions imparts minimal inconvenience to vessels within Muliāva	⊙ No-take zones restricts 3.7% of coral habitat; gear and species harvest restrictions limit some activities	⊙ 12 nm no-take zone at Muliāva and large reef fish prohibition limits some fishing, e.g., recreational fishing for giant trevally	⊙ Similar to Alternative 4A, with a greater lost fishing opportunity at Muliāva (50nm no-take zone)
Maritime Heritage and Cultural Resources	○ Status quo maintained; minimal threats to few resources in Bay	+ Cultural Heritage and Community Engagement Action Plan provides minor benefits.	+ Same as Alternative 1	+ Benthic habitat and cultural resource regulations extended to 5 or 6 units; cultural fishing activities preserved	+ Ta'u unit expansion provides full protection for *Taisamasama*	+ Same as Alternative 4A

Resource	No Action	Alternative 1	Alternative 2	Alternative 3A and 3B	Alternative 4	
					A	B
Tourism and Recreation	○ Status quo maintained; public access difficulties remain	○ Same as No Action	○ No additional opportunities or restrictions	+ Resource protection of added units improves ecosystem for non-consumptive activities	+ Same as Alternative 3	+ Same as Alternative 3
Research	○ Status quo maintained; focus remains only on Bay	○ Marine Science Conservation Action Plan would provide minimal differences from status quo under Alternative 1	+ Increased opportunities through Marine Conservation Science Action Plan	+ Increased opportunities through Aunu'u Research Zone	+ Addition of mesophotic reefs to research zone	+ Same as Alternative 4A
Human Health and Safety	○ Status quo maintained; current boating regulations protect users	○ Same as No Action	○ New regulations have minimal impact on health and safety	+ Safe boating regulations extended to 5 or 6 units	+ Same protections as Alternative 3	+ Same as Alternative 4A
Socioeconomic Environment						
Economics and Revenue	○ Status quo maintained	+ New Management Plan would likely increase sanctuary budget and economic opportunities	+ Increase non-use value of Rose Atoll reefs; additional funds for management	+ Increased funding and employment opportunities offset small losses in fisheries revenue. Potential significant impact to land-based operations that create polluted runoff.	+ Increased funding offset lost fishing opportunities at Muliāva	+ Same as Alternative 4A

LEGEND:

○ = No impact
⊙ = Less than significant
+ = Beneficial impact
N/A = Not applicable

5.2 NO ACTION

For this analysis, No Action has no impact on the physical, biological, cultural or historical resources within the existing sanctuary. It also has no impact on socioeconomic or human uses within the sanctuary. This does not imply that impacts do not occur, only that there will be no additional impacts under No Action.

Taking no action would result in no change of the current management regime of the sanctuary. The existing management plan/environmental impact statement (U.S. Department of Commerce 1984) contains a full analysis of the environmental and socioeconomic impacts of each alternative discussed therein. As compared to each of the alternatives, taking no action would result in no additional environmental or socioeconomic impacts to those already associated with the operation of the sanctuary. To the extent that future decisions would be made under the existing management regime, these decisions either would be conducted and reviewed for their NEPA compliance under the existing environmental impact statement or would be reviewed under a separate NEPA analysis before a decision is made.

Ultimately, No Action does not fulfill the purpose and need described in Chapter 1. Changes in management, threats, and public involvement of marine resources provide strong rationale to increase the scope of sanctuary management. As stated in the Purpose and Need, "A new management plan is needed to provide effective conservation and management of sanctuary resources. The revised management plan will reflect new scientific information and understanding, advancements and collaboration in managing marine resources, and new resource management issues that have developed over the past 25 years."

5.2.1 Physical and Biological Environment

Water Quality and Habitats

The Fagatele-Larsen watershed is not considered an impaired water body as water quality is within AS-EPA established standards. The watershed is categorized as pristine (not developed), with an ocean shoreline fully supporting aquatic life but with insufficient data to evaluate any remaining designated uses (AS-EPA 2010). Water quality in the bay is considered good, with low nutrient levels and good water clarity (NMSP 2007). Current sanctuary regulations prohibit discharge in Fagatele Bay.

While land-use activities around the bay remain a concern, including potential leaching from the Futiga landfill and land clearing for agriculture, these uses do not appear to have a negative effect on water quality (NMSP 2007; M. Tuionoula 2010). No contaminants have been identified that may negatively affect either water quality or benthic habitat. Boating activities within the bay are limited, and are not considered a threat to water quality, although anchor damage from boat-based fishing has caused selected habitat loss on the reef (NMSP 2007). Mooring buoys, installed within the outer bay in 2006, eliminate the need for anchoring. Despite these localized impacts, habitat quality in the bay is considered good (NMSP 2007). In addition, overall habitat

quality has continually improved since the destruction caused by the 1979 crown-of-thorns starfish outbreak. Destructive, illegal fishing practices and increased frequency of coral bleaching events are the primary threats to the bay's benthic habitat.

Target and Non-Target Fish and Invertebrate Resources

Overall, living marine resources in the bay are in good condition, including high biodiversity, minimal impact from introduced species, and healthy numbers of most fish species. Current regulations prohibit the harvest of or damage to marine plants, corals and invertebrates, and restrict most fishing to the outer part of the Fagatele Bay. Fishing in the inner bay is limited to traditional baskets and throw nets, although because there is no *atule* run in Fagatele Bay, these techniques are less relevant and are likely never employed within the sanctuary. In the deeper waters of the outer bay, boat-based fishing is expected to occur at low levels due to the limited number of personal vessels in American Samoa, although location-specific fishery data is not available. While the sanctuary condition report rates most resources in good condition and fishing effort is believed to be low, evidence of a reduction in numbers and size of large, predatory fish (*e.g.*, groupers, snappers, Māori wrasse) from both legal and illegal fishing has caused a fair or poor rating for these living resources (NMSP 2007). Because large apex predators are generally the first species to be experience overfishing in the coral reef ecosystem (DeMartini *et al.* 2008), this threat would remain under No Action. Low levels of giant clams have also been reported in the bay, in spite of regulations that prohibit their harvest. Because giant clams may be depleted across Tutuila due to overharvesting in the 1990s (Sabater 2010) but remain important culturally (*e.g.*, *Fa'alavelave* events), the threat of continued illegal take in the bay will continue. In addition, their removal requires breaking up the substrate, also prohibited under current regulations, which causes localized habitat damage.

While current regulations should protect the threatened resources of the bay, the bay's remote location, in addition to a difficult access route from land, limits the ability to monitor both legal and illegal fishing activity. Enforcement of fishing regulations is difficult because part of the bay remains open to pole-and-line fishing, and violations must be directly observed. Poaching at night by blast-fishing and spearfishing within the shallow reef habitat is the most significant threat (NMSP 2007).

Special Status Species

Humpback whales, spinner dolphins and sea turtles occur within the bay, although none are permanent residents, and whales occur in the Samoan archipelago only during the austral winter. These species are currently protected by existing sanctuary regulations, as well as through territorial regulations (*i.e.*, sea turtle and marine mammal sanctuary) and federal statutes (*i.e.*, ESA and MMPA). There have been no reports of poaching or vessel interactions within the boundaries of the sanctuary, and few reports throughout the American Samoa EEZ waters.

5.2.2 Human Environment

Fisheries

Fishing in Fagatele Bay would continue to be restricted to the outer bay. Because of the difficulty in accessing the bay, most fishing is expected to be boat-based. Access to the bay would remain unchanged. The low population levels of some species of groupers and snappers, possibly due to overfishing, may affect the quality of fishing and level of catch. Illegal poaching at night remains difficult to address.

Maritime Heritage and Cultural Resources

Current regulations include a prohibition on removing, damaging, or tampering with any historical or cultural resource. Ancient bait cups carved into the rock along the bay's shoreline are one of the few known marine archaeological resources in the territory (Van Tilburg 2007). Cultural and historic resources that occur at sanctuary units proposed under Alternatives 2, 3, and 4 may experience impacts as they will continue to not be under the protection of ONMS and accompanying regulations. However, because these resources are under the protection or oversight of Article 3 of the Bill of Rights in the American Samoa Revised Constitution, American Samoa Code Annotated and the Historic Preservation Office, protection is still provided under No Action, just not under the NMSA and associated regulations.

Tourism and Recreation

Fagatele Bay is one of the prime tourist sites in American Samoa for snorkeling, and an excellent location for SCUBA, sport fishing (in the outer bay) and scenic boat tours including whale watching. Fagatele Bay is designated by the American Samoan Master Tourism Plan as a possibly "compelling reason for potential visitors to choose American Samoa as their vacation destination," (Resort Consulting Associates, 2010). Nevertheless, tourism and recreational use of Fagatele Bay will not likely increase without significant changes in access, signage, and ideally services provided near the bay (Resort Consulting Associates, 2010).

5.2.3 Socioeconomic Environment

Under No Action, no new regulations would be proposed for the sanctuary and the boundaries would remain the same. The projected construction expenditures for the new ONMS building would marginally increase employment and income for the duration of construction, thus resulting in a short-term beneficial impact. Because the ONMS building is included under No Action, new staff positions, including a visitor center coordinator and facilities maintenance contractors, would likely be created to operate the ONMS building resulting in long-term beneficial impacts on employment and income. These positions would be filled locally. Additionally, long-term beneficial impacts for research and education would likely occur in the sanctuary from the operation of the ONMS building and the new research vessel, marginally increasing income in the area from purchases of supplies, fuel, vessel repairs, and employment.

Because no new restrictions are being proposed, there would be no direct adverse impacts on population, employment and total income, recreation or tourism. However, the coral reef systems at Larsen Bay, Aunu'u Island, Ta'u Island, Swains Island, and Rose Atoll would continue to receive minimal protection which could lead to declines in populations of targeted marine species, lowering the non-use value of these reefs.

Since the construction of the ONMS facility would not occur in an area with low income groups, No Action would not result in any disproportionate impacts on environmental justice populations. Similarly, No Action would not result in any disproportionate impacts on children as the ONMS facility would not impact schools, parks, or other areas where children are gathered. However the education opportunities provided by the ONMS facility would have a beneficial impact on children.

5.3 ALTERNATIVE 1: UPDATE SANCTUARY MANAGEMENT PLAN

Each of the proposed alternatives of this action includes a revision of the 1984 management plan to reflect the eight action plans presented in Chapter 4 and summarized below. Alternative 1 updates the management plan, but does not expand the sanctuary with additional units. The single regulatory change of Alternative 1 is the addition of a management permit. This regulatory action is administrative in nature and does not by itself have any impact of the quality of the human environment. The appropriate NEPA analysis would be conducted on a case-by-case basis for the issuance of the superintendent's permit or any management permit to a third party. The analysis for Alternative 1 addresses impacts only as they relate to the management plan revision presented in this document. The current conditions, threats, and protections presented under No Action apply for Alternative 1 as well, and will not be repeated.

While the review of the management plan is required by the NMSA, and is considered a federal action requiring NEPA analysis, it is important to note that the proposed management plan itself does not specifically enable any of the activities listed in the action plans to occur. Activities could take place in the sanctuary without this revision, and activities could continue to occur under the current management plan. However, a revised management plan would update existing non-regulatory programs, call for new programs to be developed, and include a process to consider future regulatory actions[1]. Management concerns and resource threats described in Chapter 3 and in the analysis of No Action could be improved through the implementation of the non-regulatory strategies and activities described below. For example, if the low densities and small size of the giant clam and apex predators are due to illegal harvest, the Cultural Heritage & Community Engagement, Resource Protection and Enforcement, and Ocean Literacy Action Plans could provide non-regulatory measures to improve their condition. Nevertheless, given their currently depleted levels, their cultural importance (*e.g.*, *Fa'alavelave* events), and the difficulties in enforcement existing regulations, these species would remain vulnerable. The

[1] The proposed regulatory actions are only relevant to additional sanctuary units proposed in Alternatives 2 -4. If additional regulatory actions are initiated, the appropriate NEPA analysis and formal public input would occur at appropriate times in the future.

Cultural Heritage & Community Engagement, Resource Protection and Enforcement, and Ocean Literacy Action Plans could provide non-regulatory measures to address existing issues and improve overall fishing conditions, although illegal poaching at night would remain difficult to address.

Taken together, NOAA expects that the strategies and activities included in these action plans would have some positive environmental effects by increasing protection of resources both directly and through interagency cooperation in research and management, and by reaching more people and expanding the stewardship message of the sanctuary. The potential environmental consequences of the proposed activities considered in the action plans are described in more detail below. However, despite these likely positive effects, detailed analyses of these plans are not possible. Most of the action plans provide general guidelines but are not highly specific or detailed in nature. This combined with the fact that these action plans could be implemented regardless of whether No Action or any of the alternatives is chosen limits the ability to differentiate impacts to the natural or human environment among these alternatives. Alternative 1 will have no direct impacts to the human and socioeconomic environment, as no new regulations are proposed that would limit or expand current human activities, and additional funding for sanctuary management beyond that described under No Action is uncertain without the sanctuary expansion proposed under Alternatives 2, 3, and 4.

5.3.1 Cultural Heritage and Community Engagement Action Plan

The Cultural Heritage & Community Engagement Action Plan considers activities to promote stewardship through active engagement of sanctuary communities while incorporating Samoan culture and protecting cultural and maritime heritage resources. This action plan presents strategies and activities designed to preserve and perpetuate the relationships between society and the traditions, culture, and history, as they relate to the sanctuary, in ways that recognize and share multiple cultural values and knowledge systems for the benefit of all. Strategies include the development of a cultural heritage outreach and preservation program (CH&CE-1), volunteer programs (CH&CE-2), enhancement of the advisory council (CH&CE-3), and inventorying maritime heritage resources (CH&CE-4). The activities within these strategies primarily describe the process to fulfill the objectives of this action plan through the establishment of issue-specific operation plans, working groups, partnerships and volunteer programs, as well as developing advisory council protocols, outreach materials and visitor center activities. The development of a volunteer tour guide training program (Activity CH&CE-2.2) will likely benefit natural and cultural resources as well as visitor experiences, through increased awareness and appropriate behavior, particularly as the promotion of the sanctuary attracts more tourists. Field surveys are discussed as a major aspect of *Strategy CH&CE-4: Inventory and assess maritime heritage resources within the sanctuary and American Samoa*, but details on the methods and level of effort are limited. These activities are not expected to impact the use or health of sanctuary resources, while increased knowledge of the existing maritime heritage resources is the first step in providing appropriate protection. Due to the limited description of each activity, and the unknown level of participation, socioeconomic impacts cannot be analyzed. Overall, the Cultural Heritage & Community Engagement Action Plan will improve both the overall protection of

sanctuary resources and the enjoyment of by sanctuary users, providing a beneficial impact to these resources.

5.3.2 Marine Conservation Science Action Plan

The Marine Conservation Science Action Plan directly supports the NMSA's purpose "to support, promote, and coordinate scientific research on, and long-term monitoring of, the resources of these marine areas" (16 U.S.C. 1431(b)(5)) and is a central pillar for the mission of ONMS. Activities outlined in this action plan will improve ecosystem-based management by providing a strong foundation of science and increasing knowledge of the marine ecosystems of the sanctuary. The focus of this action plan includes activities to: assess baseline conditions and enhance scientific programs, assess and prioritize scientific activities, and interpret and communicate the results. Many of these activities would occur within existing facilities and would not significantly change the use of those facilities or increase traffic. Other activities described in this action plan could impact sanctuary resources, although most do not provide enough detail to analyze potential impacts at this time. For example, Activity *MCS-2.4: Support and Enhance PacIOOS* implies that sensors may be permanently installed within sanctuary units, but the type of sensor, placement and method of installation is not provided. Under this scenario, if an activity proposed under this action plan would violate an existing regulation (*e.g.*, altering the seabed), a scientific permit would be required, at which time additional details could be provided and proper NEPA analysis would be completed. In addition, Activity *MCS-1.2: Within 2 years, develop a Sanctuary Science Plan to coordinate, prioritize, and manage sanctuary scientific activities* acknowledges the lack of details for the scientific activities that will occur over the next five to ten years. The proposed *Sanctuary Science Plan* will serve as a more detailed plan, focusing on in-water research and monitoring activities, and will provide critical information, including the amount and type of research that may occur on an annual basis, as well as specific research projects and protocols. The Marine Conservation Science Action Plan provides an overview of the information needs and general activities to improve sanctuary management, coordinate research, and inform the public, with the expectation of an overall beneficial impact to both the natural environment and the human environment. However, this action plan has little to no potential to meet the threshold for significance when considered alone.

5.3.3 Climate Change Action Plan

The Climate Change Action Plan supports the Climate Smart Sanctuary Initiative of ONMS as well as NOAA's Climate Goal to "*understand climate variability and change to enhance society's ability to plan and respond*." While climate change is a global issue, with a high degree of uncertainty for specific impacts on a given location, ONMS has incorporated climate change research at all of its sanctuaries as a means to provide a geographically broad and systematic approach to protecting marine resources and developing coastal community resiliency. While the primary objective for this management plan is to minimize the impact from climate change events on coastal and marine ecosystems at sanctuary units in American Samoa, the level of uncertainty regarding the impacts of climate change makes the initiation of specific actions unwarranted. Understanding this, the sanctuary has developed *Strategy CC-3: Partner to target research and monitoring efforts to identify, and where appropriate respond to, climate change*

impacts at sanctuary units within five years, which includes conducting basic research and monitoring that will aid in determining whether specific actions are appropriate to reduce stress from climate change and ocean acidification (Activity CC-3.3). In addition, this action plan provides a process in which the sanctuary will partner with other agencies to conduct targeted research and monitoring, implement mitigation strategies, and promote public awareness, as well as completing standards for certification. These activities and partnerships are intended to lead to an overall beneficial impact to both the natural environment and the human environment. However, this action plan has little to no potential to meet the threshold for significance when considered alone.

5.3.4 Operations and Administration Action Plan

The Operations and Administration Action Plan outlines the means and level of support necessary to successfully achieve the sanctuary goals and implement the strategies and activities detailed in the other action plans. This action plan describes the day-to-day operational and administrative activities, and the manner in which budget and staffing are organized to efficiently implement programs of the sanctuary system in American Samoa. Financial and administrative needs, human resources and organizational capacity, physical infrastructure and facilities, vessel operations, and permit approval and tracking are the primary activities associated with this action plan. This administrative framework also would ensure that sanctuary management activities are coordinated between disciplines at the sanctuary and with activities administered at the ONMS level. All these activities are required for the proper functioning of the sanctuary. The benefits from additional funding, personnel, and resources imparted to the entire American Samoa economy are discussed as part of each of the alternatives. Many of these activities would occur within existing facilities and would not significantly change the use of those facilities or increase traffic. Therefore, the activities would have little to no potential to significantly affect the quality of the human environment. As future infrastructure (*e.g.*, the construction of new or renovation of existing facilities) is considered to meet the goals and objectives of this action plan, the appropriate environmental review of the alternatives under consideration would be conducted before decisions are made.

5.3.5 Ocean Literacy Action Plan

The Ocean Literacy Action Plan considers activities to develop, support and implement education and outreach programs. The plan encourages public involvement in resource protection, increases knowledge about American Samoa's marine resources, and creates an informed public. Education includes formal and semi-formal programs for learners of all ages, while outreach consists of informal programs and materials designed for the broader audiences of sanctuary visitors and constituents, including sanctuary user groups. The intent is also to nurture exiting partnerships with enhanced programs and develop new relationships to further marine conservation, build local capacity and reach all audiences in American Samoa and abroad. In addition to this effort, sanctuary staff will implement a robust communication effort and public interface, which will allow for various levels of support for and participation in activities related to the sanctuary units.

These types of activities in this action plan would not be significantly affected by the choice of alternatives. Although Strategy OL-1 discusses the opening of a sanctuary visitor center, this is an ongoing project and will be located in an existing facility. The types of activities contemplated under this plan would most likely occur within existing facilities and would not significantly change the use of facilities or increase traffic. Therefore, the activities would have little to no potential to significantly affect the quality of the human environment.

Only one of the described activities, *Activity OL-2.5: Research and implement telepresence technologies and tools to increase public understanding of American Samoa's marine ecosystems within 5 years*, may require construction or other disturbance within the sanctuary. This may include the installation of cameras, hydrophones, or other recording technology, in addition to supporting structure to protect and maintain these devices. To the extent that any activity is considered under this plan that would change the use of existing facilities or occur in the natural environment outside facilities, then an appropriate environmental review under NEPA would be conducted, as necessary, depending on the anticipated impact of the activity. Taken alone, the Ocean Literacy Action Plan has little potential to meet the NEPA threshold for significance. Regardless, implementation of the activities proposed in this plan is expected to increase awareness about the marine resources, which could lead to beneficial impacts on the quality of the natural and human environments associated with the sanctuary.

5.3.6 Resource Protection and Enforcement Action Plan

The Resource Protection and Enforcement Action Plan updates the *Surveillance and Enforcement Program* section of the 1984 sanctuary management plan, that expand to a much broader set of threats to sanctuary resources, including strategies to address impacts to sanctuary resources from introduced species, marine debris, anchoring, land-based pollution. While these strategies are new to the management plan, sanctuary staff have been addressing all of these issues since original designation. These activities are central to the mission of the sanctuary, and result in beneficial impacts to the environment. The activities described under each of the strategies consist of the development of plans, protocols and best management practices, forming partnerships and agreements, developing education and outreach materials, conducting assessments of threats and potential new technology and information management. These activities are primarily administrative in nature, designed to assist sanctuary managers in being proactive and respond quickly and appropriately and safely to threats to sanctuary resources. They would most likely occur within existing facilities and would not significantly change the use of facilities or increase traffic, and would have little to no potential to significantly affect the quality of the human environment. *Strategy RP&E-4: Minimize anchoring impacts to sensitive marine habitats, particularly coral reef formations, while providing reasonable access to sanctuary resources* indicates that mooring buoys will be installed within sanctuary units in order to minimize anchor damage from boat-based users. The installation of mooring buoys could have a localized impact on the benthic habitat, although this could be minimized by site assessment (Activity RP&E-4.2) and appropriate placement (*e.g.*, sandy habitat). Overall, the installation of mooring buoys would have a potential short-term impact, while providing long-term benefits to the natural and cultural resources of the sanctuary. To the extent that this or any other activity considered under this plan could impact sanctuary resources, appropriate

environmental review under NEPA would be conducted, as necessary. Overall, the strategies and activities outlined in this action plan would have a beneficial impact to both the natural environment and the human environment.

5.3.7 Partnerships and Interagency Cooperation Action Plan

As with the Operations and Administration Action Plan, the Partnerships & Interagency Cooperation Action Plan is fundamental to each of the other action plans. Partnerships and interagency coordination are keys to success for many of the strategies and activities within this management plan. This action plan includes activities to develop partnerships with local and federal agencies as well as the community to maximize the limited resources, minimize the risk of working in isolation, and fully implement constituency cooperation within the Territory to successfully achieve ocean conservation. Through partnerships, roles responsibilities and relationships would be clarified, and opportunities would be leveraged to develop public awareness and volunteerism, education, stewardship, increased research, enforcement, community economic opportunities, and consideration as a World Heritage Site. Partnerships and interagency cooperation would have beneficial impacts on the quality of the human environment and make efforts and environmental protection and management at the sanctuary more effective and efficient. The types of activities contemplated under this plan would occur within existing facilities and would not significantly change the use of facilities or increase traffic. Therefore, the activities would have little to no potential to significantly affect the quality of the human environment.

5.3.8 Program Evaluation Action Plan

The Program Evaluation Action Plan is an internal process in which performance measures will be developed for each of the other action plans, with regular evaluation to determine the degree that they are achieving sanctuary goals. While this is a critical element to effective and efficient management, these activities are primarily administrative in nature and would have little to no potential to significantly affect the quality of the human environment.

5.4 ALTERNATIVE 2: DESIGNATION OF MULIĀVA (ROSE ATOLL MARINE NATIONAL MONUMENT)

In addition to updating the Fagatele Bay National Marine Sanctuary management plan as described in Alternative 1, Alternative 2 would designate the marine waters of the Rose Atoll Marine National Monument as part of the American Samoa National Marine Sanctuary. The proposed unit, Muliāva, would not include the land or waters of the Rose Atoll National Wildlife Refuge, comprised of 20 acres of land and 1,600 acres of lagoon located in the center of the monument, nor would it replace the legal designation of the monument as described in Proclamation 8337. Existing federal fishery regulations designate all waters shallower than 50 fathoms (300 feet) surrounding Rose Atoll as no-take (50CFR665.99), which includes a narrow band of water adjacent to the inner boundary of this 13,448 square mile (34,830 square km) proposed unit. ONMS is awaiting NMFS action on the WPFMC recommendations within the boundaries of the monument (including commercial fishing prohibition) through the fishery

management process. Fishing regulations at the Fagatele Bay unit would remain the same as that under No Action and would not apply to the Muliāva unit. As such, no new fishing regulations are proposed for Alternative 2.

Eight existing regulations and five new regulations are proposed under this alternative and would be in effect at both units. Four existing fishing regulations specific to Fagatele Bay will not be analyzed in this alternative. The two regulatory actions that would have the greatest impact under Alternative 2 are 1) a prohibition on anchoring, and 2) a prohibition on discharge into sanctuary waters of any substance that could damage sanctuary resources. This discharge prohibition would provide for an exception at Muliāva for vessels that have a USCG- approved Type I or Type II MSD. The other prohibitions are common to the sanctuary system, and their impacts are discussed briefly.

A management permit is also proposed under this alternative. As this is an administrative action, it is discussed as part of Action 1, the inclusion of Muliāva into the sanctuary network.

5.4.1 Action: Inclusion of Additional Unit (Muliāva) into Sanctuary Network

5.4.1.1 Physical and Biological Environment

Rose Atoll is a remote, near-pristine, coral reef ecosystem surrounded by deep oceanic waters. The lagoon and reefs to the extreme low waterline of the perimeter reef are part of the Rose Atoll National Wildlife Refuge, which is under the jurisdiction of the USFWS. The refuge is closed to the public. Due to its remote location and the existing protection provided by Proclamation 8337, there are few anthropogenic threats in the area. The existing 50-fathom no-take zone around Rose Atoll enhances the protection of the atoll. The incorporation of this unit into the sanctuary system protects the atoll's associated pelagic and deep reef habitat, providing a well-established organizational structure capable of carrying out the research, monitoring, and enforcement necessary to execute an ecosystem management approach that can address the range of global, regional and local threats facing coral reef and oceanic ecosystems. The Partnerships & Interagency Cooperation Action Plan, and specifically *Activity P&IC-3.1: Enhance communication and cooperation with federal agencies*, will endeavor to collaborate and avoid duplicating management, research and other efforts with the USFWS and NOAA Fisheries in the management of Rose Atoll and the surrounding waters. This multi-level of protection is warranted due to the high value of this fragile reef ecosystem in light of the numerous global and regional threats. The inclusion of the Muliāva unit will provide immediate, long-term beneficial impacts to physical and biological resources, which through improved collaboration with the USFWS, USCG, DMWR, and NOAA Fisheries, could provide comprehensive protection and management of the entire ecosystem.

In compliment to the existing regulations which allow the Director to issue permits for research, education, and salvage activities, Alternative 2 incorporates a management permit. The management permit will provide a mechanism for allowing otherwise prohibited activities that will assist in managing the sanctuary, either by ONMS or third parties. This permit provides protection for the sanctuary's physical, biological, and historical resources by ensuring that no

activity may cause long-term or irreparable harm to the resources of the sanctuary. As such, the direct long-term beneficial impact on sanctuary resources results in an overall beneficial impact to the unit. It is important to note that each permit decision undergoes NEPA review on a case by case basis to ensure that environmental review standards and procedures for assessing and analyzing potential environmental impacts are followed.

5.4.1.2 Human Environment

Rose Atoll is physically isolated and the National Wildlife Refuge (NWR) is not currently open to the public. While the proposed sanctuary boundaries extend to within 20 miles of Ta'u, vessels currently berthed in the Manu'a Islands have limited range and are not known to operate at such distances (Interagency Meeting Notes 31 August 2009). Proclamation 8337 already prohibits commercial fishing, and the remoteness of the area limits non-commercial, sustenance, and artisanal harvesting, which remain allowable. Despite the rich, isolated marine environment that would be attractive to eco-tourists, the atoll would take 5 to 10 hours via boat to reach from Tutuila, and 4 to 8 hours from Ta'u, the closest island. According to the American Samoa Tourism Master Plan (Resort Consulting Associates 2010), there are possibly several boats on Tutuila that would be able to transport passengers safely and comfortably to Rose Atoll for tourist and recreational activities. However, the distance and time required to reach the atoll and the restrictions on access of the shallow reef and land would discourage many tour operators. Inclusion of this unit as part of the sanctuary is likely to have no impact on human uses, including fishing, tourism, and recreational opportunities. Conversely, the inclusion of these waters would provide a well-established organizational structure capable of conducting and partnering with other agencies on appropriate research and education activities, programs in which ONMS has extensive experience and capacity. Inclusion of the Muliāva unit would provide a benefit for research and education activities. While Alternative 2 does not overlay the Rose Atoll NWR, the management permit provides a mechanism for USFWS to conduct research within the surrounding pelagic waters. This additional permit will facilitate and improve cooperation while promoting ecosystem-based management. In addition, the regulatory action of adding this permit type is administrative in nature and does not by itself have any impact of the quality of the human environment.

5.4.1.3 Socioeconomic Environment

Under Alternative 2, monument waters seaward of the Rose Atoll NWR would be managed as part of the sanctuary, increasing its overall size. Some of the socioeconomic impacts under Alternative 2 would be similar to those described under No Action. There would be short-term beneficial impacts for employment and total income from construction of the ONMS building. The operation of the ONMS building would require creating staff positions, thus resulting in long-term beneficial impacts on employment and income. Currently, funding is available and allocated to the sanctuary system to designate the marine areas of Rose Atoll Marine National Monument as part of the sanctuary, among other management needs. While these funds may continue to be provided for future management of the area as a monument (under No Action and Alternative 1), it is likely that under Alternative 2, these available funds would be allocated in a manner that would provide greater socioeconomic benefit to the American Samoa economy. This

would likely include additional local staff positions and programs that are sited within the territory.

While the "use" value of Rose Atoll has been estimated at $0.00/m^2 of reef, its non-use value has been estimated to be $16.89/ m^2 of reef (Spurgeon *et al.* 2004). While these reefs occur both within and outside the proposed unit, ONMS experience in research and education and outreach will likely improve its non-use value through greater scientific and public understanding. Additionally, long-term beneficial impacts for research and education would likely occur in the sanctuary from the operation of the ONMS building and the new research vessel.

Restrictions that limit use can protect this higher value reef habitat while imparting little to no socioeconomic impacts, ultimately providing beneficial socioeconomic impacts. No adverse impacts on population, employment and total income, fisheries, or tourism and recreation would be expected. As with Alternative 1, Alternative 2 would not result in any disproportionate impacts on environmental justice populations or children.

5.4.2 Action: Discharge Prohibition

5.4.2.1 Physical and Biological Environment

Water Quality and Habitats

Water quality would be preserved and potentially improve, where possible, at Fagatele Bay and Muliāva. While current sanctuary regulations prohibit discharge in Fagatele Bay, and the CWA requires Type I MSDs on all recreational vessels equipped with toilets (33 USC 1322), this prohibition could be a substantial deterrent if ONMS desires to issue civil penalties for any land-based pollution entering sanctuary waters. As described in Chapter 3, land-based activities that affect water quality can include sedimentation and runoff from agricultural activities, soil erosion, runoff from coastal development, and non-compliant piggery operations that discharge animal waste into streams that ultimately flow into near-shore waters and embayments. The discharge prohibition would apply to both land-based discharges into streams upland from all sanctuary units and boat-based discharges within and outside of sanctuary waters. The Partnerships & Interagency Cooperation Action Plan would provide an opportunity to manage both point and non-point source pollution in these watersheds to reduce current and prevent future pollution of the sanctuary waters. Management of discharges would reduce the level of pollutants, including nitrogen, phosphorus, and other organic matter, into the bay resulting in a beneficial impact to water quality.

Impacts to water quality at the Muliāva unit would be limited for a variety of reasons, particularly due to the distance from land-based pollution, the oceanic conditions at the unit diluting any vessel discharge, and the existing prohibition on commercial fishing and closure of Rose Atoll NWR to the public which limits the number of vessels with reason to travel this distance. There is no permanent human presence on Rose Atoll, so land-based pollution entering marine waters is not an issue. Nevertheless, vessel discharges can introduce pathogens into the environment that can contaminate higher marine life and pose a human health risk from their

contamination (Herz and Davis 2002). Any vessel operating in the area, including research vessels operating in and near the shallow waters of the Muliāva unit, would be required to either retain their waste water or process waste water through a USCG-approved Type I or Type II MSD, minimizing the introduction of pathogens into the sanctuary. Under Alternative 2, research vessels, military vessels, ocean liners, and private yachts would be the primary vessels operating in the area. Overall, given the oceanographic conditions and the few vessels that operate in these waters, the prohibition will provide a slight benefit for water quality at the Muliāva unit.

Target and Non-Target Fish and Invertebrate Resources and Special Status Species

Any improvement of water quality would improve the overall health of the coral reef habitat, fish and invertebrate species, as well as turtles and marine mammals, or at least limit the exposure of hazardous substances, including pathogens, excess nutrient and turbidity. While coral disease in American Samoa does not appear to be directly linked to water quality (Aeby *et al.* 2006), the variety and distribution of disease is higher on Tutuila, possibly because it is a high island with a high human population, causing relatively greater runoff and siltation (Work *et al.* 2008). Additionally, coralline algae disease may be more prevalent at locations down current from the contaminated waters of Pago Pago Harbor (Brainard *et al.* 2008). If contaminated waters from Pago Pago Harbor are definitively determined to affect coral health in Fagatele Bay, ONMS will have the authority to work with the relevant parties to address this issue. Revising the discharge regulation provides a minor beneficial impact to the living marine resources of the sanctuary.

5.4.2.2 Human Environment

The discharge prohibition will present a small to insignificant inconvenience to vessels operating within Fagatele Bay, as an existing regulation already prohibits discharge. Also, the bay is small and vessel operators could wait to discharge waste water until they leave the vicinity of the sanctuary. The inconvenience is proportional to number of vessels operating in the area, which is believed to be small due to the limited number of private vessels on Tutuila. Approximately 30 pleasure vessels anchor in Pago Pago Harbor during the cyclone season (NMSP 2007). Because the Muliāva unit encompasses over 13,000 square miles of ocean, it could create an unnecessary burden to prohibit all vessel discharge within sanctuary boundaries. While impacts to vessels transiting through the Muliāva unit would be less than significant, as they could postpone any discharge until after leaving the sanctuary unit, research vessels operating for extended periods of time within the unit would be required to interrupt operations and transit up to 100 mile round trip whenever their bilge reached capacity. Providing the exception of allowing discharge from a Type I or II MSD eliminates this burden, as large vessels, including research vessels, are equipped with appropriate MSDs. Proclamation 8337 prohibits commercial fishing within the boundaries of the monument and proposed sanctuary unit and Rose Atoll NWR is closed to the public. As such, there is no need for commercial fishing or wildlife tour vessels to operate within the Muliāva unit. Thus, the discharge prohibition is expected to have less than significant impact on human uses at the Muliāva unit.

5.4.2.3 Socioeconomic Environment

Similar to the impacts described to the Human Environment, the existence of Proclamation 8337 and the Rose Atoll NWR have already emplaced use restrictions to the proposed unit and vessel traffic to the island is minimal. Thus few vessels will be incurring costs associated with the implementation of MSDs and the restrictions of discharge will pose a less than significant socioeconomic impact. Because a discharge prohibition is already in effect for Fagatele Bay, this action will have no impact on the socioeconomic for boaters operating within the bay.

Benthic Habitat Protection Regulations for Alternative 2

- No anchoring, and use a mooring buoy where available
- No disturbing the benthic community by dredging, filling, dynamiting, bottom trawling, or otherwise altering the seabed*
- Prohibition on the release of introduced species from within or into sanctuary waters
- Prohibition on abandoning any structure, material, or other matter on or in the submerged lands of the sanctuary
- Prohibition on deserting a vessel aground, at anchor, or adrift in the sanctuary.
- Prohibition on leaving harmful matter aboard a grounded or deserted vessel in the sanctuary
- Prohibition on removing, damaging, or tampering with any historical or cultural resource*

**Existing 15CFR922 Subpart J regulation*

5.4.3 Action: Anchoring Prohibition and Other Benthic Habitat Protection

Seven sanctuary-wide regulations aimed at the protection of benthic habitat are proposed for Alternative 2. Two of these regulations are currently in effect for Fagatele Bay (see text box). In addition to these, five regulations common across the sanctuary system are also included. While each of these regulations reinforces the protection of benthic natural and cultural resources currently protected by other laws, they strengthen protection through both additional enforcement capabilities, as well as through education and outreach initiatives.

5.4.3.1 Physical and Biological Environment

Water Quality and Habitat

Due to the steep bathymetry of the reef habitat within the Muliāva unit, proposed sanctuary waters are generally too deep for anchoring. The narrow band of reef on the seaward side of Rose Atoll NWR drops so steeply that any anchored vessel would be at risk of drifting aground. In addition, the 40 meter wide channel in the northwestern corner of the atoll that leads to the 1,600 acre lagoon provides much safer base for research operations for both people and natural resources. The anchoring restriction would be relevant for Fagatele Bay, as anchoring has been known to occur here and localized habitat damage may be due to anchoring (NMSP 2007). Mooring buoys were installed in 2006 to eliminate the need to anchor, and damaged corals have shown signs of recovery. In Fagatele Bay, the current regulation that prohibits damaging of invertebrates protects corals, as does the prohibition on altering the seabed. These existing regulations and conditions limit the overall beneficial impact of this regulation on habitat, but

clarification of the regulation in conjunction with *Strategy RP&E-1: Develop and disseminate education and outreach materials regarding all new regulations (including boundaries) within 1 year* should improve user compliance, limiting damage to the benthic habitat from anchoring. In addition, *Strategy RP&E-4: Minimize anchoring impacts to sensitive marine habitats, particularly coral reef formations, while providing reasonable access to sanctuary resources* will install mooring buoys at appropriate locations based on usage and habitat sensitivity, minimizing future adverse impacts from anchoring to coral reefs. Thus, the anchoring prohibition reinforces and facilitates safe operating procedures, and would have a minor beneficial impact on the habitat of Fagatele Bay and the shallow reef habitat of Muliāva.

The prohibition on abandoning structures, deserting vessels, and leaving harmful matter aboard deserted or grounded vessels provide some protection for water quality within the sanctuary units. Abandoned vessels can leak oil and other contaminants into the water, while rusting hulls leach iron, which can lead to blooms of blue-green algae that can overtake the natural balance of algae, as has been observed at Rose Atoll 17 years after the *Jin Shiang Fa* shipwreck (PIFSC 2010). This unnatural condition may also contribute to an increase in coral disease (Brainard *et al.* 2008). Abandoned vessels, either on land or on the reef, can be moved great distances in heavy storms, breaking coral and releasing fuel and oil on board as they break apart across the reef. The prohibition on disturbing the seabed provides a blanket habitat protection from future unforeseen uses.

Incorporating these regulations at both sanctuary units makes available various legal remedies under NMSA, including civil penalties for violations and assessment of response costs and monetary damages for injuries to sanctuary resources. Section 312 of the NMSA provides for the protection of sanctuary resources by making any person who destroys, causes the loss of, or injures any sanctuary resource liable for the amount equal to the amount of response costs and damages resulting from the destruction, loss, or injury. The recovered amounts would then be used to reimburse any agency that conducted a response action, with remaining monies used to restore, replace, or acquire the equivalent of any sanctuary resource. For these reasons, the implementation of habitat protection regulations across all sanctuary units will have a beneficial impact on habitat.

Target and Non-Target Fish and Invertebrate Resources

In addition to the benefits fish and invertebrates gain from the protection of water quality and habitat, the prohibition on the release of introduced species is an important safeguard to maintain natural ecosystems. Across the world, introduced species outcompete native species for habitat and resources, reducing their total numbers and historic range (Albins and Hixon 2008). Introduced species can be released accidentally from vessels, either through ballast water or hull fouling, mariculture operations, and scientific experiments, with thousands of alien species transported by ships around the world every year (MITSG 2004). While it appears that non-native marine species have yet to become invasive, harming native species and their environment (Coles *et al.* 2003), promulgating this regulation provides a mechanism to monitor potential vectors and work with the appropriate agencies and user groups in minimizing this risk. This could include working with the USCG and the Pago Pago Harbor Port Authority to develop best

management practices for tankers, container ships and fishing vessels through *Strategy RP&E-2: Conduct and facilitate research and monitoring regarding detection, effects on ecosystem, prevention, control, and where feasible eradication of introduced species*. While introduced species are not currently a problem in American Samoa, this remains one of the largest threats to coral reef ecosystems. Incorporating this regulation and related protection strategies will have a beneficial impact on the biological resources of the sanctuary.

Special Status Species

These habitat protection actions have little direct impact to special status species. As with other biological resources, sea turtles, marine mammals and seabirds benefit from healthy and vibrant ecosystems. In addition to these indirect benefits, special status species are more likely to become entangled or trapped in derelict nets and abandoned structures than fish or invertebrates. This threat is minimized through the regulations prohibiting abandoning structures or other matter, deserting vessels, leaving harmful material aboard a grounded or deserted vessel. For these reasons, the habitat protection regulations described above are expected to have a minor beneficial impact on special status species.

5.4.3.2 Human Environment

Fisheries

Based on local knowledge, anchoring is not part of normal operations for almost all boat-based fishing in American Samoa (Wearing 2011). Commercial, recreational and charter fishing are dominated by pelagic trolling and bottomfishing, with little to no longline fishing occurring within 50 nm of any islands due to the large vessel exclusion area fishery restriction (50 CFR 665.817). Fishermen targeting bottomfish species tend to drift while fishing in nearshore waters, including the outer reef of Fagatele Bay, while those targeting pelagic species troll back and forth across fishing grounds (Wearing 2011). Most artisanal, nearshore fishing is not conducted from boats (Craig *et al.* 2008). As described under No Action, mooring buoys in Fagatele Bay minimize the potential impact to fisheries at this unit. Because waters shallow enough to safely anchor at Rose Atoll occur almost exclusively within the boundaries of the National Wildlife Refuge (which is not included under Alternative 2), anchoring is unlikely to occur within the boundaries of the unit, regardless of vessel type. Vessels in distress would be allowed to enter the NWR and anchor if human safety were a concern. In addition, the 50-fathom no-take zone and prohibition on commercial fishing (Proclamation 8337) already reduce potential fishing activity, thus limiting the impact the anchoring prohibition has on potential fisheries in the Muliāva unit. The other regulations included in this set of actions would have no impact on the prosecution of fisheries. Based on this analysis there would be no impact on fisheries from this set of actions.

Maritime Heritage and Cultural Resources

Alternative 2 extends the protection for historical and cultural resources currently in effect for Fagatele Bay to Muliāva. As there are no identified historical or cultural resources within this

unit[2], no additional protection is imparted from this regulation. Protections imparted by this action already described for habitat would provide a similar beneficial impact for historical and cultural resources in the Fagatele Bay unit.

Tourism, Recreation, Research and Other Vessels

Mooring buoys installed in Fagatele Bay in 2006 are available to potential dive operations and research vessels, eliminating any need for anchoring, reducing the threats to benthic habitat in the bay. As Rose Atoll NWR is not open to the public, recreational and tourism vessels are not permitted to enter the shallow waters. Research vessels that need to anchor as a necessary part of their protocol could obtain a scientific permit from ONMS and anchoring exemptions could be stipulated in the permit. Cruise ships, tankers and freighters generally traverse deep waters and ship channels en route to Pago Pago Harbor, and should not be anchoring in the nearshore habitat. Military vessels rarely operate in the vicinity of the proposed units, but are nevertheless exempted from these regulations while conducting their activities. The prohibition on the release of introduced species could require compliance with specific preventative protocol for research vessels prior to entering sanctuary waters, particularly when working within the isolated Muliāva unit. This may create a minor burden for research activities, although many programs already have adopted strict protocols. For these reasons, the anchoring prohibition and other benthic habitat protections are expected to have no impact on dive charter, research, and other vessels operating within the boundaries of the Fagatele Bay and Muliāva units.

5.4.3.3 Socioeconomic Environment

As mentioned, the existence of Proclamation 8337 and the Rose Atoll NWR have already emplaced use restrictions to the proposed unit and vessel traffic is minimal. Furthermore, as the proposed Muliāva unit includes almost entirely pelagic habitat, these benthic regulations are less relevant and thus will not cause a socioeconomic impact. Mooring buoys already exist and are utilized within Fagatele Bay which provides for an ease of transition into the new regulation. There will be no cost to the boaters as a result of switching from anchoring to mooring. The anchoring prohibition has little impact on nearshore artisanal fishing as most of the practices are not boat-based. Most commercial fishing vessels operate in the pelagic environment and do not anchor. There will be no impacts on the tourism industry as outlined above under “Tourism, Recreation, Research and Other Vessels”.

Coral habitat and the associated use-value and non-use values will be increased as a result of increased benthic protection, which will result in a healthier coral ecosystem. These beneficial impacts will be proportional to historic level of benthic disturbance activity in each sanctuary unit. The insignificant impacts on boat use and tourism combined with the positive impacts from increased benthic protection create an overall beneficial impact for this sector. Revenue loss from any human uses is not expected.

[2] Three cultural resources have been identified within the boundaries of the Rose Atoll NWR.; a Navy survey marker, a 1920 concrete monument posting American Samoa's claim to the Atoll, and a 19th c. *fale* foundation.

5.4.4 Other Actions

The five remaining regulatory actions of Alternative 2 are existing regulations of the sanctuary, and will only be analyzed as they relate to the Muliāva unit. Three relate to safety measures, one relates to vandalism and theft of sanctuary property, and the last provides additional protection for sea turtles and marine mammals. The first four regulations do not impart impacts on physical or biological resources, and are intended to make the human activity within the sanctuary safer. The fifth provides an additional mechanism to protect special status species currently protected under federal and territorial law, and has no impact on human uses.

Other Regulations for Alternative 2

- Divers must display dive flag when diving from a vessel
- Vessels must not exceed 3 knots within 200 feet of a dive flag
- Vessels must operate in a safe manner so not to strike or damage sanctuary resources
- No damaging or removing sanctuary signs or markers
- No ensnaring, entrapping or fishing for sea turtles or marine mammals

5.4.4.1 Physical and Biological Environment

Operating a vessel in a safe manner should reduce the potential for running aground a reef flat or reef crest, although there is very little shallow water habitat in the Muliāva unit. While already prohibited under territorial and federal law, the regulation for the protection of sea turtles and marine mammals provides an additional legal mechanism for prosecution, which could dissuade this activity in the sanctuary. In general, promulgating these regulations will likely impart no impact to the physical or biological resources of the sanctuary.

5.4.4.2 Human Environment

The boating and dive flag regulations are intended to provide a safe environment for divers and snorkelers. As recreational diving is unlikely to occur within the Muliāva unit, and research divers generally have well-defined safety protocols, these regulations will likely have no impact on any human uses. The regulation related to sanctuary property makes vandalism and theft a federal crime, punishable by a substantial fine. As it is unlikely that signs or markers will be placed within the Muliāva unit, this action will have no impact on human uses.

5.4.4.3 Socioeconomic Environment

Because these regulations primarily complement safe and legal behavior, no socioeconomic impacts are expected from the creation of these regulations.

5.5 ALTERNATIVE 3: MULTI-VILLAGE SANCTUARY UNIT EXPANSION

Alternative 3 has two sub-alternatives; 3A adds four new sanctuary units, while 3B adds five new units. Both of these sub-alternatives include a number of unit-specific and sanctuary-wide regulations. These are;

- Harvest restrictions and prohibitions, including species-specific harvest, commercial fishery restrictions at the Swains Island unit, no-take zones at the Fagatele Bay and Aunu'u Island units, and a notification requirement to access fishing grounds in the Multi-Use zone of the Aunu'u Island unit;
- Operational restrictions within the sanctuary, including gear restrictions, boating restrictions, anchoring prohibition, discharge prohibition, abandon vessel prohibition, benthic habitat and cultural resources protections; and
- General resource protection restrictions, including protected species protection, intentional or accidental release of introduced species prohibition, and ONMS property protection (signage, *etc.*).

Because the difference between the sub-alternatives is solely whether Ta'u unit will be included as part of the sanctuary network, impacts for Alternative 3A will primarily be discussed in section 5.5.1, while a few specific impacts as they relate to Ta'u will be addressed in other sub-section, as appropriate. Alternative 3A will not be covered as a separate alternative.

5.5.1 Action: Inclusion of Additional Units into Sanctuary Network

5.5.1.1 Physical and Biological Environment

In addition to the inclusion of the Muliāva unit discussed in Alternative 2, Alternative 3 would expand the network of sanctuary units to Larsen Bay, Aunu'u Island, and Swains Island (Alternative 3A), and including Ta'u Island (Alternative 3B) as described in Chapter 2. The expansion of the Muliāva unit to provide sanctuary management for the Vailulu'u Seamount highlights both its physical (the only hydrothermally active seamount in the EEZ), and biological importance (multiple diverse and unusual faunal communities). Each of these units was selected individually for their high natural and cultural resource value, healthy ecosystems and community support for designation. Collectively, they were selected for their connectivity that improves overall resiliency of coral ecosystems across the archipelago, or their inherent vulnerability due to their relative isolation, as well as for capturing the diversity in habitats and biological resources across the archipelago. For example, preserving Larsen Bay as a complement to Fagatele Bay provides additional security for the habitats and species that occur in both bays. When they are protected in only a single location, rare and unique habitats and species are vulnerable to natural disasters or human mishap. Furthermore, protecting organisms in Larsen Bay adds to the genetic diversity of species in different microhabitats and can increase the abundance of local populations. Both of these processes increase the overall resilience of coral reef ecosystems.

As such, inclusion of these units within the sanctuary system will provide additional regulatory protection, human and financial resources for management, and will improve public awareness of their natural resource value and develop cooperative ways to maintain their ecosystem health. The larger presence the sanctuary would have in American Samoa, in conjunction with actions and strategies outlined in the Resource Protection and Enforcement, Ocean Literacy, Partnerships & Interagency Cooperation, and Cultural Heritage & Community Engagement Action Plans, will foster increased awareness, collaboration and public regard for the marine resources both within and outside proposed sanctuary boundaries. This action is expected to have a beneficial impact on the physical and biological resources at each of the sanctuary units.

Per the request of the National Park Service (Lehnertz 2011), Alternative 3A does not include a sanctuary unit at Ta'u. While the giant corals would remain unprotected, the nearshore waters along the southern shore, which includes *Taisamasama*, are currently managed by the NPAS. Existing Park Service regulations prohibit damage or destruction of park resources, while allowing for traditional subsistence use in these marine waters (16 U.S.C. 410; 36 CFR 2.1). Under Alternative 3B, the giant corals that occur in the nearshore waters along the southwestern coast as well as the deep offshore waters along the southern coast would be protected through inclusion in the sanctuary network. Because Ta'u is a steep volcanic island with narrow offshore bank areas, the seafloor drops steeply, sometimes almost vertically, to abyssal depths less than 0.6 miles (1 km) offshore (Brainard *et al.* 2008). Surveys conducted in the shallow waters of this nearshore habitat indicate high habitat complexity, with moderate to high live coral cover, particularly along the eastern portion of the south shore. Biomass and species complexity for invertebrates and reef fish is similar, with low values for most of the coastline, but high values along the eastern portion (Brainard *et al.* 2008; Kendall and Poti in prep.). While the deepwater habitats in Ta'u's offshore waters have yet to be surveyed, recent discoveries of deep-water habitats with similar physical and biological characteristics in the Northwestern Hawaiian Islands indicate high levels of biodiversity and endemism (Kosaki 2011). Areas of steep banks with high currents, as occur along Ta'u's southern shore, are known preferred habitats for deep-water bottomfish species and precious corals (Kelley et al. 2006; Grigg 1993). Including the offshore waters offers an opportunity for NOAA to conduct technical SCUBA diving surveys, as is ongoing in the Papahanaumokuakea Marine National Monument, which is beyond the current capacity of the NPAS. The inclusion of the offshore waters also provides a buffer zone for the valuable natural and cultural resources within the marine waters of the NPAS. Many of the regulations proposed for Alternative 3 protect shallow water resources (*e.g.*, corals, giant clams) or relate to shallow water activities (*e.g.*, anchoring, diving) and would provide minor protection for these deep waters. A few of the proposed regulations would offer indirect benefit to these valuable sanctuary-adjacent resources – prohibitions on vessel discharge, leaving a vessel adrift, prohibition on the release of introduced species, and possibly the prohibition on the use of fixed nets. Vessel activity is expected to be very low in these waters, and due to high water exchange, any vessel discharge would dissipate quickly. Nevertheless, onshore winds or currents could carry pathogens and toxins released in these offshore waters to the nearshore reef, negatively impacting corals and associated organisms. This same deterrent would be in effect for abandoned vessels and release of introduced species. Both of these threats could impact nearshore resources as described in Alternative 3. The buffer zone would provide a deterrent and enforcement capabilities that could protect these high-valued reef resources.

Because this alternative adds four (3A) or five (3B) units to the system, with all of them except Muliāva completely within territorial waters, and one (Ta'u Island) adjacent to the NPAS, the value of the management permit described in Alternative 2 will likely provide a greater benefit for sanctuary management. The management permit will allow for both the sanctuaries office and partner agencies to coordinate, monitor and track activities with minimal administrative burden. The management permit provides a mechanism for ONMS to collaborate and share resources with territorial and other federal agencies, including DMWR, NOAA Fisheries, USFWS, and NPAS. It also will provide guidance for what type of management activities are appropriate and should be allowed within a sanctuary. As such, management activities will become more efficient in responding to ecosystem needs as well as monitoring all management activities conducted within each sanctuary unit, providing a beneficial impact to physical and biological resources.

5.5.1.2 Human Environment

Inclusion of these units will likely have beneficial impacts to cultural and historic resources, as sanctuary regulations will provide a strengthened layer of protection. Additionally, cultural practices such as customary marine tenure are incorporated into the management of these units, thereby helping preserve American Samoa culture. The strategies and activities identified in the Cultural Heritage & Community Engagement Action Plan are likely to improve both protection and perpetuation of American Samoan culture at the individual units and across the territory.

Fishing, tourism and recreation do not occur in the southern waters of Ta'u Island (Spurgeon *et al.* 2004; Pederson 2000). Within the NPAS boundaries (extending 0.25 miles offshore along Ta'u's southern coast), only subsistence fishing is permitted and only if "conducted in the traditional manner and by traditional methods (P.L. 100-571)." The culturally important site of *Taisamasama* occurs in the nearshore waters of southern shore. Under Alternative 3B, increased protection of this site could result from improved awareness through the sanctuary's Cultural Heritage & Community Engagement, and Ocean Literacy Action Plans. While not within the proposed sanctuary boundaries of Alternative 3, the inclusion of these offshore waters provides a minor beneficial impact to the awareness and protection of *Taisamasama*.

While not currently the case with the Fagatele Bay National Marine Sanctuary, sanctuaries across the U.S. generally increase recognition of their unique and remarkable natural and cultural resources, which lead to increased tourism opportunities. The American Samoa Tourism Master Plan (Resort Consulting Associates 2010) indicates that marine recreational opportunities should be a strategic focus to increase overall tourism in the territory. As Fagatele Bay, Larsen Bay, Aunu'u Island, and Ta'u Island have recognized marine resources attractive to eco-tourists and local recreational opportunities, their inclusion would provide protection to the natural resources while not restricting non-consumptive activities. This could result in a beneficial impact on tourism, specifically scuba diving and snorkeling, and other recreational opportunities. Although Rose Atoll has healthy, vibrant and complex natural habitats highly valued by eco-tourists, and its inclusion would likely increase potential user awareness, the remote location, lack of resources on the islands, and that it is a NWR currently closed to public use are steep barriers to

future use. Swains Island also has highly valued eco-tourism resources, and although it is extremely remote and currently has no infrastructure for eco-tourism, the island is large enough to sustain dozens of inhabitants, maintaining the possibility of developing eco-tourism in the future. Nevertheless, the inclusion of these two units in the sanctuary network will likely have no impact on tourist or recreational visits within the next five to ten years.

5.5.1.3 Socioeconomic Environment

The inclusion of the five additional units under Alternative 3B increases the sanctuary from a single remote and relatively unknown presence to a network that extends across the entire archipelago, promoting direct participation from three villages on Tutuila and Aunu'u, and all villages of the Manu'a Islands, as well as increasing visibility and participation across the territory's primary and secondary schools. The inclusion of these units will likely increase overall scientific activity, particularly in areas with mesophotic reefs, as this habitat has become a key interest of NOAA (Puglise et al. 2009). Excluding Ta'u from this network under Alternative 3A would diminish the overall benefit, particularly to the Manu'a Island group. In addition to the community support for designation, Larsen Bay was specifically included to provide a natural replicate to research being conducted at Fagatele Bay. A research zone at Aunu'u Island was included because of the healthy continuum of shallow to deep-water coral reef habitat. While the sanctuary has recently obtained a vessel to conduct research and monitoring, scientists often charter local private vessels to conduct their work, as many as fifteen times per year for some vessel owners (Wearing 2011). Thus, inclusion of these additional units will have a beneficial impact on both scientific understanding and economic opportunities across the archipelago.

Expanding the sanctuary to five or six units would have both beneficial and adverse impacts on employment and income within the individual villages and across American Samoa. Adverse impacts include revenue lost from nearshore fisheries, with an estimated loss of $11,572 (discussed in detail in section 5.5.4). Limited data is available to determine the number of jobs within the six units that rely directly or indirectly on the coral reef ecosystems. While it is likely that employment and income would be negatively affected by sanctuary-wide regulations proposed under Alternative 3 because of some loss of the subsistence and artisanal fishery, the consensus from the villages and ASG is that the sanctuary would have a positive overall effect on jobs and income. Beneficial impacts include additional employment opportunities created for the management of sanctuary-related functions and sanctuary-related budget expenditures, estimated at over $1.5 million per year (see Table 4-1). Proposed staff positions for managing the sanctuary, coordinating research efforts, promoting ocean literacy, and providing resource protection would increase employment and income and would have a long-term beneficial economic impact. The sanctuary has estimated as many as 10 new positions would be created to conduct the activities described in this management plan, with salary ranges estimated from $20,000 to $60,000 per year (K. Grant 2011).

Increased protection of marine resources within the boundary of the sanctuary would likely improve the quality and diversity of coral reef ecosystems. With higher quality coral reefs, the potential for increases in non-consumptive uses such as research, diving, snorkeling, and

photography may increase. While some of the areas proposed to be included as part of the sanctuary are not easily accessible, increased resource management and sanctuary designation would contribute to the overall growth of the tourism and recreation industry making it possible to provide access to the coral reef. Employment opportunities from increased tourism and recreation related activities include jobs related to the need for lodging, boating, and transportation to accommodate travelers interested in activities to enjoy the coral reef ecosystems.

While the socioeconomic impacts in the six units would be both beneficial and adverse, the overall impact to the region would be beneficial. Alternative 3 would not result in any disproportionate impacts on environmental justice populations or children.

5.5.2 Action: Discharge Prohibition

5.5.2.1 Physical and Biological Environment

Water Quality and Habitat

Non-point source pollution is a primary source of water quality concern throughout American Samoa (AS-EPA 2010). While the nearshore waters of the proposed units are not considered impaired water bodies, there is the threat of runoff from coastal development, agricultural actives, and land clearing, just to name a few sources of non-point pollution. In general, the discharge prohibition would have a beneficial impact on water quality, providing additional protection for sanctuary waters. Through the Resource Protection & Enforcement, and Partnerships & Interagency Cooperation Action Plans, ONMS will work with relevant agencies to control non-point source pollution and educate landowners on the use of best practices to reduce and eliminate runoff into streams and near-shore waters that empty into sanctuary waters as described in *Strategy RP&E-5: Facilitate research and monitoring regarding the effect of land-based sources of pollution on sanctuary resources and develop outreach materials to share the results*.

While there are only minor benefits to water quality under Alternative 2, this action provides a much greater benefit under Alternative 3, due to the potential of land-based pollution entering sanctuary waters. Land-based pollution, specifically from piggeries, is contributing to degraded water quality in many areas of American Samoa. Under Alternative 3, there would be beneficial impacts to water quality if piggeries were no longer discharging waste into streams that feed into the near-shore waters and embayments. This is most relevant for the Larsen Bay and Aunu'u Island units, as piggeries occur within their watersheds, although a direct link to degraded water quality has not been established (AS-EPA 2006). The AS-EPA has been working with piggeries in recent years to bring them into compliance with existing laws (and has reduced the number of non-compliant piggeries by 20 percent), but by adding these units to the sanctuary system, the discharge prohibition regulation will also apply, strengthening the legal action that can be employed for noncompliance. ONMS will work cooperatively with AS-EPA, landowners, and other agencies involved helping bring piggery operations and other land-use activities into compliance with sanctuary regulations. Ta'u Island and Swains Island have little to no farming

activity within their watersheds (USDA 2005), greatly reducing the threat from land-based pollution and limiting the beneficial impact of this action. Water quality is excellent at these units and threats to water quality are largely absent. In addition, the coral reef ecosystem's proximity to deep water (Brainard *et al.* 2008) provides continuous flushing and dilution for any land- or vessel-based pollution.

The impact from the vessel discharge prohibition would be similar to that described under Alternative 2, minimizing the release of pathogens and excess nutrients. The total number of vessels operating in the nearshore waters is poorly known, but is expected to be fewer than 30 for the entire territory (NMSP 2007). While the alia fleet has 9 vessels berthed on Tutuila and 7 vessels on Aunu'u (PIFSC 2011), most of these are for private recreational use and are generally used on the weekends (Wearing 2011). Freighters, tankers, and commercial fishing vessels likely only pass through nearshore waters in designated shipping lanes to and from Pago Pago Harbor and would not likely traverse through any of the proposed sanctuary units. The pelagic waters of the Ta'u and Swains Island units provide a large buffer zone to protect the unique corals and other resources in the shallow water habitat.

The prevalence of coralline algae disease down current from Pago Pago Harbor (Brainard *et al.* 2008) is a concern for Larsen Bay, and should be monitored to determine if further action is warranted. The untreated sewage currently being discharged onto the shallow water fringing reef located on the southwestern part of Aunu'u Island is polluting the water with bacteria (AS-EPA 2007). While a small community wastewater facilities plan was prepared in 2007, it is not yet constructed (Tuitele 2010). Recent surveys indicate that the bacterial counts for the waters in the area around the sewage outfall meet American Samoa water quality standards for recreational beaches, although the location and depth of the outfall indicate a potential for unacceptable bacterial levels along these beaches (AS-EPA 2007). Including the waters where the outfall is located as part of the sanctuary network could cause the existing wastewater facility to be in violation of the sanctuary discharge regulation, potentially requiring the operation to cease or be fined for non-compliance. Under Alternative 3, various legal remedies would be available under the NMSA, including civil penalties for violations and assessment of response costs and monetary damages for injuries to sanctuary resources. This would provide a beneficial impact to near-shore water quality, but the funding for the construction and the sewage treatment facilities (estimated at $7 million in 2009) would still need to be resolved, and could cause a significant economic impact (discussed in section 5.5.2.3 below). Through the Resource Protection and Enforcement, and the Partnerships & Interagency Cooperation Action Plans, ONMS could work with cooperatively with the agencies involved to help bring the wastewater operations into compliance so that they are not discharging into sanctuary waters.

Overall, there would be beneficial impacts on water quality under Alternative 3 as water quality would have enhanced protection and additional technical, financial resources dedicated to it. This benefit would be most prevalent for the Aunu'u Island unit, with minor benefits to the Larsen Bay unit. As part of the National Marine Sanctuary System, there would be greater enforcement capabilities and resources to protect and enhance water quality. A cooperative approach, working with all stakeholders, would be pursued to protect water quality and resolve stressors and threats to it.

Target and Non-Target Fish and Invertebrate Resources and Special Status Species

As described in Alternative 2, any improvement to water quality will have a complementary benefit to the coral reef habitat and the biological resources occurring in the ecosystem. In particular, excess nutrients in the coral reef habitat can cause algal blooms, which can smother the reef, damaging and possibly killing coral. Pathogens released into the water can spread disease to coral and coralline algae (Aeby 2005; 2006), and possibly fish, invertebrates, turtles and marine mammals. Limiting the level of pollution entering sanctuary waters through the strength of the NMSA will have a beneficial impact on fish, invertebrates and special status species.

5.5.2.2 Human Environment

Because all of the proposed sanctuary units except Muliāva are adjacent to inhabited land, the discharge prohibition impacts both vessel operations and land-based activities. In general, vessels operations will only be slightly impacted. Many of the vessels operating in the nearshore environment are small and their only discharge is engine exhaust, which is exempt from the regulation. Because of the small size of the individual sanctuary units, other vessel discharge, including graywater (*e.g.*, vessel washdown, sink water), could easily be postponed until the vessel is well away from sanctuary waters.

Protecting water quality and nearshore habitats from poor land-use practices, illegal sand and rubble mining, and non-compliant waste water treatment facilities violating the discharge prohibition is a priority for the sanctuary. Managers understand the need to work cooperatively with the public and other resource agencies to effectively address these potentially costly issues. Regulations without adequate enforcement or public buy-in do little to curtail harmful activities (*e.g.*, sand mining is prohibited within the park system boundaries to 10 fathoms, but is known to occur throughout the territory). The issue of pathogen- and/or toxin-laden waters from Pago Pago harbor potentially entering and damaging resources of the Aunu'u, Larsen or Fagatele units also has the potential to create significant impacts in the human environment. Inasmuch as these regulations limit the level of pollutants entering nearshore waters, this action will have a beneficial impact preventing exposure to hazardous materials and improving human health and safety.

While the sanctuary will have the authority to cite violators and impose substantial fines, education and outreach efforts to improve voluntary compliance, in addition to direct agency and public support to resolve poor practices and infrastructure inadequacies will be more effective while limiting impacts in the human environment. This action has the potential to have significant impacts to village land-use activities (farming), as well as businesses (Pago Pago Harbor) and utilities (Aunu'u wastewater treatment plant), but can be mitigated through a focus on non-regulatory strategies.

5.5.2.3 Socioeconomic Environment

Economic impacts from this regulation are not expected for any type of vessel operating in American Samoa. Economic impacts to land-based activities are possible, particularly for the Aunu'u wastewater treatment facility as described above. While the sanctuary has the ability to impose fines, providing solutions for persistent or recurrent land-based pollution discharge could provide additional employment in the territory, although appropriate funding sources would need to be resolved. Conversely, sources of land-based pollution entering sanctuary waters for which solutions could not be found (or funding not obtained) could be required to cease operations. The estimated $7 million cost to build the wastewater treatment plant for the 476 Aunu'u residents could impose a significant economic burden on the American Samoa government, particularly since the outfall appears to cause minimal impacts to the reef and human uses. An alternative solution could be to exclude the waters in the vicinity of the outfall from sanctuary designation while the wastewater facility obtains a NPDES permit, providing the sanctuary and ASG time to determine whether the Aunu'u unit, as proposed in this alternative, can be included without creating substantial adverse economic impacts. While these potential impacts can be identified, determining the actual economic impact is not possible due to a variety of unknown factors, beginning with how the sanctuary intends to enforce this particular regulation. The economic impact from this action cannot be determined.

5.5.3 Actions: Anchoring Prohibition and Other Benthic Habitat Protection

The seven benthic habitat protections described in Alternative 2 would be in effect for all six units under Alternative 3. Impacts will be similar under this alternative, although some location-specific impacts are described below.

Benthic Habitat Protection Regulations for Alternative 3

- No anchoring, and use a mooring buoy where available
- No disturbing the benthic community by dredging, filling, dynamiting, or otherwise altering the seabed
- Prohibition on the release of introduced species from within or into sanctuary waters
- Prohibition on abandoning any structure, material, or other matter on or in the submerged lands of the sanctuary
- Prohibition on deserting a vessel aground, at anchor, or adrift in the sanctuary.
- Prohibition on leaving harmful matter aboard a grounded or deserted vessel in the sanctuary
- Prohibition on removing, damaging, or tampering with any historical or cultural resource

5.5.3.1 Physical and Biological Environment

Water Quality and Habitat

Of the seven regulations, prohibition on abandoning structures, deserting vessels, and leaving harmful matter aboard deserted or grounded vessels provide some protection for water quality within the sanctuary units. In addition to the damage caused by the wreck at Rose Atoll discussed in Alternative 2, several abandoned vessels are currently rusting along the south shore of Tutuila (Van Tilburg 2007). As discussed in Alternative 2, leaking oil, leaching

iron, equipment, cargo and the vessel itself remain a threat, either abandoned on land or on the reef, until it is removed.

The prohibition on habitat disturbing activities has an obvious benefit to the coral reef ecosystem. Sand and rubble mining in the foreshore environment has been extensive over the past few decades, even though territorial regulations prohibit the activity (Spurgeon *et al.* 2004). This has led to a loss of beach and reef flat substrate, both critical to the maintenance of healthy coastal ecosystems. Location-specific data for this illegal activity is unavailable. Nevertheless, promulgating this habitat protection regulation through the NMSA for the six specific units of this alternative provides a strong enforcement component as well as allowing for education and outreach efforts (*e.g., Strategy RP&E-1: Develop and disseminate education and outreach materials regarding all new regulations [including boundaries] within 1 year*) that will benefit the sanctuary habitat and associated resources.

The beneficial impacts from the anchoring prohibition are the same as described under Alternative 2, in that they will be location-specific and the benefit is directly proportional to the level of vessel activity in each sanctuary unit. The highest potential benefit will likely be for the Aunu'u Island unit as it has the greatest amount of shallow reef habitat (Kendall and Poti in prep.), is close to the largest population center (US DOC 2000), and is adjacent to popular recreational fishing grounds (Wearing 2011). In addition, seven fishing vessels are currently home ported on Aunu'u Island (PIFSC 2011). Nevertheless, there are no reports of habitat damage from anchoring within the proposed boundaries of the Aunu'u Island unit.

Incorporating these regulations across all sanctuary units makes available various legal remedies under NMSA, including civil penalties for violations and assessment of response costs and monetary damages for injuries to sanctuary resources. Section 312 of the NMSA provides for the protection of sanctuary resources by making any person who destroys, causes the loss of, or injures any sanctuary resource liable for the amount equal to the amount of response costs and damages resulting from the destruction, loss, or injury. The recovered amounts would then be used to reimburse any agency that conducted a response action, with remaining monies used to restore, replace, or acquire the equivalent of any sanctuary resource. For these reasons, the implementation of habitat protection regulations across all sanctuary units will have a beneficial impact on habitat.

Target and Non-Target Fish and Invertebrate Resources

Benefits of the regulation prohibiting the release of introduced species into sanctuary waters are similar as those described under Alternative 2. In addition, the proximity to Pago Pago Harbor may make the Aunu'u and Larsen Bay units more susceptible to introduced species. Any increase in traffic from vessels not permanently stationed in American Samoa (*e.g.*, research vessels) increases the risk to individual sanctuary units, as ballast water and hull fouling are known vectors for marine introduced species. This regulation may be even more critical for the Swains Island and Muliāva units, as species within isolated ecosystems may be less likely to have developed defenses against introduced species (Blackburn *et al.* 2004). *Strategy RP&E-2: Conduct and facilitate research and monitoring regarding detection, prevention, ecosystem*

effects of, control and where feasible eradication of alien/invasive species will provide a means for vessels and other potential vectors of introduced species to be informed of the regulation and improve efforts to minimize accidental introduction. Incorporating this regulation and related protection strategies will have a beneficial impact on the biological resources of the sanctuary.

Special Status Species

In addition to benefits described for Alternative 2, entanglement hazards from abandoned vessels, particularly those abandoned fishing vessels on Tutuila's south shore, which may still have ropes, nets or other entangling material on board, should be minimized by these regulations. Also, hawksbill turtles occasionally nest on American Samoa beaches. Successful nesting requires a stable beach environment. The ability this action has to curtail illegal sand mining will have a beneficial impact on this endangered species. For these reasons, the habitat protection regulations described above are expected to have a minor beneficial impact on special status species.

5.5.3.2 Human Environment

Fisheries

Anchoring is not part of normal operations for boat-based fishing in American Samoa (Wearing 2011). Commercial, recreational and charter fishing are dominated by pelagic trolling and bottomfishing on offshore banks, while most artisanal, nearshore fishing is not conducted from boats (Craig *et al.* 2008). Handlining and free diving, which constitute 25% and 14% of the subsistence and artisanal fishing effort, respectively (Craig *et al.* 1993), are occasionally conducted using boats. These vessels may anchor during operations, and fishers from Aunu'u, Futiga and Vaitogi (Larsen Bay), and Si'ufaga, Ta'u, Faleasao, Fitiuta and Leusoali'i (Ta'u) would occasionally be restricted by this anchoring prohibition. Due to the low level of reef-associated fishing across the archipelago, the small percentage of that which is boat-based, and collaboration between ONMS and the associated communities prior to proposing these units for inclusion (and associated regulations), impacts on the anchoring restriction on fishers from these villages are expected to be less than significant.

Tourism and Recreation, Research and Other Vessels

While dive charters and research vessels could be more likely to anchor, these operations always have at least one person who remains on the boat at all times. They often occur in very close proximity to the shallow reef, where changing currents could cause anchored vessels to strike the reef. As such, there is not a critical need to anchor for these activities. Research studies that require anchored vessels may qualify for a research permit allowing the prohibited activity of anchoring. Cruise ships, tankers and freighters generally traverse deep waters and ship channels en route to Pago Pago Harbor, and should not be anchoring in the nearshore habitat. Military vessels rarely operate in the vicinity of the proposed units, but are nevertheless exempted from these regulations while conducting their activities. For these reasons, the anchoring prohibition is

expected to have a less than significant impact on dive charter, research, and other vessels operating within the boundaries of the sanctuary units.

Maritime Heritage and Cultural Resources

The whaling vessel lost at sea in the vicinity of Aunu'u Island (Van Tilburg 2007) is the only identified maritime heritage resource that could be damaged due to anchoring or other action prohibited under Alternative 3. Because a proper survey has yet to be completed to determine the location of the wreck and its current condition, it is unknown whether it lies within sanctuary boundaries. Nevertheless, these prohibitions will provide the appropriate protection of this and all other unidentified maritime heritage resources until proper assessments can be conducted and appropriate safeguards are created. For these reasons, Alternative 3 will have a beneficial impact on maritime heritage and cultural resources.

5.5.3.3 Socioeconomic Environment

The impacts realized from the anchoring prohibition and other benthic regulations are primarily the same as described under Alternative 2, although because more vessel activity can be expected in the units close to harbors and population centers, additional benefits may be realized for the non-use values of the corals due to the improved habitat protection. There is expected to be no impact on the socioeconomics from human uses from this set of actions. There will be no adverse impact on low-income populations or children.

5.5.4 Actions: Fishing Restrictions

Alternative 3 incorporates a number of restrictions on the harvest of fishery resources. None of these proposed regulations are in effect for the federal waters of the Muliāva unit at this time. These restrictions can be categorized into three groups; 1) prohibited gear, 2) prohibited species, and 3) access notification and no-take zones. Some of these restrictions support existing federal and territorial regulations, including a ban on coral harvest shallower than 60 feet deep, prohibited gear including poisons, explosives and drift nets, and the protection of sea turtles and marine mammals. While fishing restrictions for Alternative 3 have been crafted to accommodate the socioeconomic concerns of the associated villages, their impacts on the physical and biological resources are similar. For this reason, they are discussed collectively in this section. Because of the number and variety of sanctuary-wide and sanctuary unit-specific fishing regulations within this action, as well as the economic and cultural importance of artisanal, commercial and recreational fishing in American Samoa, the analysis for this section is more extensive than analyses of other actions.

Fishery Regulations for Alternative 3

Prohibited Gear

- Poisons, electrical charges, and explosives
- Scuba-assisted spearfishing
- Drift gill nets
- Bottom trawling that disturbs the benthic community
- Seine, trammel or any type of fixed net
- All fishing gear except hook-and-line at Larsen Bay

Prohibited Species

- Live coral and wild live rock
- Other bottom formations
- Giant clams
- All species of live shells except the goldmouth turban snail
- Crown-of-thorns starfish
- Any marine mammal or sea turtle

Other Prohibitions

- Sustenance harvesting only at Swains
- No-take zones at Aunu'u Island and Fagatele Bay
- Notification requirement at Aunu'u Island

5.5.4.1 Physical and Biological Environment

Water Quality and Habitat

Most destructive gear, including explosives, poisons, electrical devices, and drift nets, is already prohibited under territorial law (ASCA 24.0902-24.0945 as summarized in Kilarski *et al.* 2006). Bottom trawls are prohibited under federal fishery regulations in American Samoa (50 CFR 665.104(a), 127, and 164), as they were determined to be destructive to coral reefs and essential fish habitat (WPFMC 2009). Fixed nets, including beach seines, are considered among the most destructive gears within the coral reef habitat (Mangi and Roberts 2006; McClanahan and Mangi 2001). The weighted line damages seagrass beds and coral reefs as it drags along the reef flat. Fishing grounds where beach seines are used have significantly lower coral density than where beach seining is not used (Mangi and Roberts 2006). Fixed nets, particularly inexpensive polypropylene nets, are difficult to remove when attached to branching coral, and are often removed by breaking the coral apart with a hammer or left on the reef to cause continuous

damage to habitat and marine life. Because of the relative ease of enforcement[3], the restriction of gears known to cause damage to the coral reef environment is an effective means to provide protection to the sanctuary resources.

Under territorial regulations, coral harvest must occur deeper than 60 feet. This alternative further prohibits the harvest of coral and other live bottom formations within sanctuary units regardless of depth, thus protecting deeper, mesophotic reefs, where complex habitat is more limited than that in shallow waters. This regulation also improves protection for corals in the shallow habitat by eliminating confusion of legal and illegal take, allowing for easier enforcement of the regulation. In addition, as with all proposed regulations that reinforce existing regulations, protection under the NMSA provides additional compliance mechanisms and supplemental enforcement and outreach resources, improving overall protection of sanctuary resources.

The prohibition on the harvest of giant clams will also protect benthic habitat, as harvest requires damage to the surrounding substrate within which the giant clams are embedded. Prohibitions on the harvest of crown-of-thorns starfish and live shells maintain natural populations of these benthic species and reduce to a small extent the damage that can occur from their harvest. Based on this analysis, there will be a beneficial impact to habitats from the proposed action.

Target Fish and Invertebrate Resources

These regulations primarily protect fish and invertebrate resources occurring in the reef environment, which has a much higher diversity (890 species) compared to the deep reef (56 species), or the pelagic environment (45 species). Deep reef habitats do occur at all of the units, with the most extensive occurring in the no-take research zone within the Aunu'u unit. The primary pelagic habitat protection is the prohibition of commercial fishing within the Muliāva unit, which exists under No Action due to the 2009 monument designation.

While the large vessel American Samoa longline fishing fleet lands between 8 and 15 million pounds of pelagic species, primarily albacore tuna (WPFMC 2010), by regulation this fishery is closed in waters within 3-50 nm around American Samoa to vessels greater than 50 feet in length (67 FR 4369). Proclamation 8337 also prohibits commercial fishing within the boundaries of the Rose Atoll MNM. Participation in the small vessel longline fleet, which could operate in close proximity to the proposed units, has dropped to near zero as of 2008 (WPFMC 2010), although as many as 10 alias occasionally troll and bottomfish within five miles of Tutuila (PIFSC 2011; Wearing 2011). At Swains, where only sustenance harvesting[4] is allowed under this alternative, commercial longline vessels greater than 50 feet long are already prohibited from fishing. As such, offshore pelagic species resources that occur within proximity of the proposed sanctuary units are neither protected by these actions or are currently under substantial fishing pressure.

[3]Sanctuary regulation 922.102(A)(1)(ii) states "There shall be a rebuttable presumption that any items listed in this paragraph (a)(1) found in the possession of a person within the Sanctuary have been used, collected, or removed within or from the Sanctuary."

[4] Sustenance harvesting is defined as fishing where the catch must be consumed within the sanctuary or on the island itself.

The fishing restrictions proposed here relate to nearshore fisheries, which are primarily small-scale subsistence and artisanal fishing (Sabater 2010), as well as some recreational bottomfishing and pelagic trolling (Wearing 2011). While numerous papers described the steady decline in nearshore fishing activity in American Samoa over the past 50 years (Craig *et al.* 1993; Spurgeon *et al.* 2004; Brookins 2007; Fenner *et al.* 2008; WPFMC 2009; Sabater 2010), location-specific catch and effort data are lacking. Highly prized resources, including giant clams, shallow-water bottomfish, and the giant trevally are considered overharvested, even though proper stock assessments have not been done (Ochavillo 2011; Sabater 2010; NMSP 2007; Zeller *et al.* 2006). Some of the perceived decline has been attributed to scuba-assisted spearfishing prevalent in the 1990s. The method is currently banned by territorial regulation and reinforced under this action. In addition, while biomass per area of reef was estimated to be higher around Rose and Swains compared to Tutuila and the Manu'a Islands (Brainard *et al.* 2008), the total standing biomass for the archipelagic stock appears to be related to the amount of coral reef associated habitat for each of the islands (NOAA-NCCOS 2004). This indirectly shows the effect habitat availability has on biomass, with almost equal proportions of fish biomass to total habitat for the heavily populated Tutuila (0.58) as for the rest of the archipelago (Ofu-Olosega, Ta'u, Rose and Swains, 0.55). This fact does not demonstrate that fishing pressure (assumed higher in populated areas) has no impact on stock structure, as anecdotal evidence from fishermen and resource managers indicates that average fish size, particularly for targeted bottomfish, is much smaller in the waters around Tutuila than in more remote locations (Wearing 2011; Craig *et al.* 1993).

The prohibition on the harvest of giant clams at all units except Muliāva would have a beneficial impact on both the overall giant clam population, which is considered overharvested, even though a proper stock assessment has not been done (Sabater 2010). Their cultural importance makes them a highly valued delicacy, and their slow growth makes them vulnerable to overfishing. In one review of artisanal fisheries, 35 percent of giant clams harvested were below the legal size limit (Craig *et al.* 2008), indicating that many clams do not reach reproductive age due to heavy fishing pressure. Because giant clams are broadcast spawners, releasing their gametes into the waters, successful fertilization is directly related to density of adult clams (Murray *et al.* 1999). Providing a number of refuges across the archipelago increases the potential for successful fertilization, providing opportunities for their larvae to colonize unprotected and possibly overfished reefs. Under Alternative 3B, protection of giant clams would include the shallow waters along the southwestern coast of Ta'u, where the second most important population of giant clams (after Rose Atoll) occurs (Fenner *et al.* 2008b). Extending this prohibition to include all of Fagatele Bay, Larsen Bay, Aunu'u Island, Ta'u Island and Swains Island will have a beneficial impact on the population of giant clams. The impact of the prohibition on harvesting other invertebrate species, including coral, is more difficult to determine, as existing federal and territorial regulations provide some protection for corals, and there is no information on the level of harvest or resource status for other shellfish.

Alternative 3 also designates two no-take zones – Fagatele Bay and the research zone of the Aunu'u Island unit. No-take zones, in conjunction with other actions, can allow ecosystems to achieve a natural balance. Ecosystems in balance may be more resilient to disease, climate change, and other threats beyond the control of resource managers (Palumbi *et al.* 2009). While

Fagatele Bay has healthy fish populations, some species of grouper and snapper appear to be in decline (NMSP 2007). This is possibly due to illegal fishing activity, which is difficult to monitor and enforce given the remote location. In addition, local villagers have expressed confusion over where fishing is allowed within the bay (NMSP 2009), possibly leading to inadvertent illegal fishing. Making the entire bay a no-take zone would eliminate confusion in the regulations as well as provide clear evidence for illegal fishing activity. Providing a no-take zone will likely improve these local stocks. Information on the status of specific fish stocks is unavailable at Aunu'u, although similar protection for a much larger area, in conjunction with village cooperation, should have a similar beneficial impact.

The notification requirement for the Aunu'u Island unit will also provide protection of resources within the reef flat. American Samoa is in a unique position with regard to control of ocean resources. Customary marine tenure of nearshore resources traditionally belonged to the adjacent villages, and culturally this is still practices today (Cinner 2005; Levine and Allen 2009). However, from a legal standpoint, American Samoa shares the common U.S. practice of open-access to all ocean resources. In fact, there are indications that some reefs are being fished by people travelling by boat from outside villages, possibly using destructive practices (NMSP 2007). Even so, it is common practice to gain permission of the village before use of the ocean. Because of the strong focus on village cooperation in sanctuary management outlined in the Cultural Heritage & Community Engagement Action Plan, it is expected that the people from Aunu'u will have a strong understanding of sanctuary regulations and resource status. By requiring all boat-based fishing in the Aunu'u Multiple Use Zone to first notify a sanctuary representative on Aunu'u, outside villagers will both be able to honor the tradition of customary marine tenure, while providing them an opportunity to become acquainted with sanctuary regulations and best fishing practices. Through this notification requirement, the sanctuary will have a better understanding of current use levels for the area, as the Aunu'u community has expressed a desire to monitor the level of fishing effort in this area (Grant 2011). It will also provide an informal opportunity for the village representative to observe the gear on the vessel. It is likely that this requirement, coupled with the cultural tradition of customary marine tenure, will result in less regulatory violations and more conservation-focused fishing practices. The sanctuary's intent to monitor fishing effort and improve compliance with regulations through outreach at this and other sanctuary units will be developed through *Activity CH&CE-2.4: Develop and implement a program to formalize community involvement in sanctuary stewardship within 3 years*.

As these regulations in various ways limit fisheries, improve compliance, strengthen enforcement, and include harvest bans on specific vulnerable species, this action will have a beneficial impact to fish and invertebrate species.

Special Status Species

The nearshore commercial fisheries in American Samoa, trolling and bottomfishing, are listed Category III for a "remote likelihood of/no known incidental mortality or serious injury of marine mammals" (NOAA Fisheries 2010a). These regulations provide minimal additional protection for marine mammals. While the American Samoa longline fishery is designated

Category II (occasional mortality or injury), the regulations of this action do not affect this fishery. As the green sea turtle diet is predominantly limu, the prohibition on harvesting vegetation in the sanctuary would provide protection for its food source. As hook and line fishing is only prohibited in the two no-take zones, Aunu'u Research and Fagatele Bay, there would only be a minor benefit from the reduction of inadvertent hooking of these species. Overall, this action will have a minor beneficial impact on special status species.

5.5.4.2 Human Environment

Fisheries

Because customary marine tenure remains an integral part of Samoan culture along with the legal status of open-access, the village maintains stewardship over the fishery resources from the shoreline to the reef flat, and customarily only members of the village may fish for these resources (Levine and Allen 2009). As such, fishing restrictions for the proposed sanctuary units predominantly, if not entirely, impact people of the adjacent villages. Analysis of the impact to fisheries on a unit-specific level is complicated because the available fishery data are aggregate for the entire archipelago.

Cultural Harvest and Subsistence Fisheries

While modern fishing methods and gears have replaced traditional fishing practices in American Samoa, a handful remain, often conducted as important cultural village activities. These include the annual palolo harvest, *i'asina* (juvenile goatfish) harvest, atule fishing, and gleaning (hand-picking the reefs at low tide). Each of these traditional fishing practices remains permissible under Alternative 3, except in the no-take zones at the Fagatele Bay unit and within the Aunu'u Research Zone. Additionally, because of its cultural importance and the unpredictable nature of the palolo spawning event, the annual palolo harvest will be permitted at these no-take areas, with sanctuary staff conducting education and outreach to minimize the potential for negative impact to sanctuary resources. *I'asina* harvest and atule fishing would not be limited by gear restrictions, including the restriction of all but hook-and-line gear in Larsen Bay, but would be prohibited at these no-take areas. *I'asina* and atule runs likely do not occur within the Fagatele Bay or Larsen Bay units, due to the physical shape of these bays and that these species are not known to be fished here. Impacts within the Research Zone of the Aunu'u Island unit is expected to be significant but have been mitigated to less than significant due to collaboration with the community leading to agreements of cooperative management and restrictions. The Multi-Use Zone remains open to these harvests. Gleaning, which targets octopus, snails, edible seaweed, and other species, is generally permitted at all of the sanctuary units, although the harvest of giant clams and all species of live shells except the goldmouth turban snail (*Alili* in Samoan) will be prohibited. The prohibition on the harvest of giant clams will limit the availability of this delicacy, which may be featured in special events and ceremonies. Impacts are expected to be significant with regards to culture but have been mitigated to less than significant due to collaboration with associated villages leading to agreements of cooperative management and restrictions. Under Alternative 3A, there would be no restriction on the harvest of giant clams at Ta'u. The populations of giant clams along the north and west coasts of Ta'u are considered the second most important populations in the archipelago, after Rose Atoll (Fenner *et al.* 2008b).

Although fishing effort has been estimated at zero in the areas proposed under Alternative 3B (Spurgeon *et al.* 2004), sanctuary designation at Ta'u may impart a small impact to cultural harvest. Given the availability of giant clams along the northwest and north coasts of Ta'u, areas much closer to population centers and with calmer waters, this impact is expected to be less than significant. The collection of shells has not been identified as a regular practice, either through literature or public comments, and this prohibition is expected to have a less than significant impact on local fisheries.

The nearshore subsistence bottomfish fishery, that uses alias and wooden hand reels to target high value species in 40-300 meter deep waters (Spurgeon *et al.* 2004), has been in decline for decades (Zeller *et al.* 2006). In 2003, six alia operated out of Tutuila, four from Aunu'u and four from the Manu'a Islands (Spurgeon *et al.* 2004). In spite of the relatively large number of alia on Aunu'u, the coral reef habitat surrounding the island was designated only as medium use for artisanal fishing (Spurgeon *et al.* 2004). Taema Bank, a 0.75 square miles (2 square km) bank directly offshore of the Pago Pago Harbor entrance, and Nafanua Bank, a 1.25 square miles (3.3 square km) bank which lies to the east and stretches about 6 miles (10 kilometers) toward Aunu'u Island, are two of the major nearshore banks for bottomfishing and trolling. They are occasionally fished by small vessel alia fishermen (Wearing 2011). Approximately 0.8 square miles (2.1 square km) of Nafanua Bank occurs within the Multiple Use Zone of the Aunu'u Island unit, requiring all fishers to notify a sanctuary representative prior to fishing within this zone. Because bottomfish habitat in sheltered waters close to Pago harbor is limited, the seaward boundary of the Aunu'u Island unit approximates the 30 meter depth curve, maintaining the most productive bottomfish waters outside of the sanctuary boundary under this alternative. Nevertheless, this alternative restricts access to approximately 40 percent of these nearshore bottomfish and trolling grounds. Because 1) the total effort of this type of fishing is relatively low, 2) fishing remains open with a minor inconvenience of a notification requirement, 3) 60 percent of these nearshore bank grounds remain open access with no regulatory requirements, and 4) the Aunu'u Island unit boundaries were designed to minimize the impact on fishing, the overall impact is considered less than significant.

The prohibition on scuba-assisted spearfishing at all locations except Muliāva follows the territorial ban on this practice implemented in 2001, providing additional enforcement mechanisms to curtail this practice. In addition, this maintains consistency with territorial regulation, minimizing public confusion over fishing regulations across the territory. Free diving with spear remains legal throughout the territory. The prohibition on fixed nets, including seine, gill, and trammel nets may negatively impact fishers, although their use relatively low (Craig *et al.* 1993), and it is unknown whether nets are used much at all within any of the proposed units. Specifically, community members requested that nets be banned from sanctuary waters, and at Larsen Bay, spearguns as well (K. Grant 2010). The level of fixed net use at Swains Island is unknown, but overall fishing is minimal at this unit, and would likely only affect one or two individuals. Nevertheless, this may be a preferred method of fishing, and may cause significant impacts to the few people living on the island.

While nearshore fisheries are diverse, they are not extensively conducted throughout American Samoa (Sabater 2010). In addition, the regulations included in Alternative 3 were structured to

maintain culturally important fishing practices, as well as bottomfishing and trolling. The collaboration between ONMS and the villages associated with proposed units has aided in minimizing the impacts to fishing activity. For these reasons, fishery regulations proposed under Alternative 3 are expected to have a significant, but mitigable to less than significant impact or a less than significant impact on subsistence and artisanal fisheries, depending on the location and type of fishery.

Commercial Fisheries

Commercial fisheries, specifically the federally-permitted longline and purse seine fisheries, will not be impacted under Alternative 3. No fishery regulations are proposed in federal waters, and existing regulations prohibit these vessels from operating within 50 miles of any of the islands. Currently, there are no active federally-permitted commercial fishers operating in American Samoa (WPFMC 2009). There are 18 territorially-permitted jig and trolling/bottomfish vessels in the territory, with seven home ported on Aunu'u (PIFSC 2011), although these vessels appear to be used for recreation or subsistence fishing (Wearing 2011). Information on how much or where these vessels fish is not available. For commercial fishermen on Tutuila who may become active in the future, much larger bottomfish of the same species occur on some of the more distant banks, in 800 to 1200 feet of water (Wearing 2011). Because the total size of the no-take areas within the Aunu'u Island and Fagatele Bay units are such a small portion of the total available habitat along the south shore of Tutuila, the no-take areas will have a less than significant impact on commercial fisheries. The lost opportunity to the fishery from this small closed area is discussed under socioeconomic impacts.

Recreational and Charter Fisheries

The primary recreation fishing that occurs in American Samoa is boat-based trolling and bottomfishing, primarily on offshore banks, conducted by 8 or 9 vessels berthed on Tutuila's south shore (Wearing 2011). While recreational fishers commonly travel 20-30 miles offshore to preferred fishing grounds (Wearing 2011), the Swains Island and Muliāva units are much more distant from Pago Harbor, and are not expected to limit recreational fishing opportunities. While Fagatele Bay would become a complete no-take unit, and Larsen Bay would only allow hook-and-line fishing, these two locations are not ideal for either the type of bottomfishing or trolling that currently occurs. While the amount of recreational and charter fishing is unknown in the Manu'a group, these activities are not restricted at the Ta'u unit. Due to its proximity to the Nafanua Bank, which is popular for trolling prior to returning to Pago Harbor, the potential impact occurs at the Aunu'u Island unit. While the 10 square km of the proposed Research Zone would become no-take, this zone does not overlap with Nafanua Bank. Those wishing to troll or bottomfish within the Aunu'u Multiple Use Zone would be required to notify a sanctuary representative on Aunu'u prior to fishing. This may restrict 0.85 square mile (2.1 square km) of the 1.25 square mile (3.3 square km) Nafanua Bank to the recreational fishermen who are returning from offshore banks. These waters are popular for dogtooth tuna, as well as small (6-7 inches) snappers. The Aunu'u Island unit was designed to minimize the overall impact to recreational fishers, retaining the majority of these banks outside of proposed sanctuary waters. While there is no available data on the level of sport and recreational fishing near Aunu'u Island, the no-take zone and notification requirement would limit access to a portion of the nearshore

fishing grounds. Because the level of activity within the proposed sanctuary unit is unknown but likely low, and as alternative fishing grounds exist adjacent the closed grounds, this action will have a less than significant impact on recreational and charter fishing.

Tourism and Recreation

The fishing restrictions described above could provide a small beneficial impact for tourism and recreational opportunities. While coral reef fishing effort is generally low across the archipelago (Sabater 2010), additional protections that further limit effort can improve the overall status of stocks, minimize habitat damage and debris on the reef, as well as limit user conflict. Fagatele Bay, Larsen Bay, and Aunu'u Island are logistically convenient for tourists and residents on Tutuila and snorkeling, SCUBA, scenic boat tours, dinner cruises and whale watching could be viable recreational activities drawing tourists to these sanctuary units. Promoting multiple locations that limit extractive activities could increase the desirability for eco-tourism opportunities. A larger protected area is easier to promote and highlight in advertising efforts and can provide more areas for tour operators. While charter fishing occurs infrequently in American Samoa, there are two vessel owners with six-pack licenses (*i.e.*, license to carry up to six people for charter fishing trips). Because there are few quality trolling grounds around the islands, the no-take zone and notification requirement at the Aunu'u Island unit will have a less than significant impact on charter vessels and the tourists wishing to partake in charter fishing opportunities while visiting American Samoa. As described in Chapter 3, multiple external barriers exist to promoting tourism activities within the sanctuary (Resort Consulting Associates 2010). Based on this analysis, fishery restrictions will have an overall minor beneficial impact to tourism and recreational activities under Alternative 3.

Research and Monitoring

The designation of no-take zones at the Fagatele Bay and Aunu'u Island units will provide the ability to better define resource baselines for comparisons in protection and management efforts a beneficial impact for research in the sanctuary. Developing baseline conditions is critical in understanding human impacts to marine ecosystems, and is a specific activity of the Marine Conservation Science Action Plan. Alternative 3 provides two ideal sites to compare anthropogenic impacts against natural conditions. The physical and biological similarities between Fagatele and Larsen Bays allow Fagatele to act as a control when assessing human use impacts on coral reef ecosystems. The extensive no-take zone at the Aunu'u Island unit encompasses multiple habitat types, from reef flat to deep water reef, providing scientists the ability to compare natural changes in the environment (*e.g.*, climate) across multiple contiguous habitats with limited human-induced stressors. Alternative 3 will have a beneficial impact on research and monitoring.

5.5.4.3 Socioeconomic Environment

While maintaining resource protection as the primary goal of this action, ONMS worked with each village adjacent to the specific sanctuary units to craft fishing restrictions for Alternative 3 that accommodate socioeconomic concerns. For example, during meetings between sanctuary staff and the villages associated with Fagatele Bay and Larsen Bay, Futiga and Vaitogi, community members were concerned with enforcement and effectiveness of the partial no-take zone at Fagatele, as well as the use of potentially destructive fishing gears at Larsen Bay. The use of hook-and-line gear was determined to be important for the community, and a compromise was reached to fully protect Fagatele Bay from resource extraction, while low impact hook-and-line gear would remain allowable at Larsen Bay (Grant 2010). Similar compromises were established for fishing regulations at each of the proposed sanctuary units.

In spite of this technique, the expanded sanctuary regulations proposed under Alternative 3 would implement various restrictions that would impart negative economic impacts to the fisheries within the six units in the form of revenue (for commercial fisheries) or revenue-equivalent (for subsistence fisheries). As described above, because of customary marine tenure, these impacts would predominantly affect the villages adjacent to each sanctuary unit.

Because location-specific catch and effort data are unavailable for these fisheries, an estimate of the portion of the entire fishery impacted by these proposed regulations is determined by the percentage of reef area within these units. The estimated direct economic value for subsistence and artisanal fisheries for the entire territory is $250,000 (PIFSC 2010). The value for the entire American Samoa economy, using a multiplier of 1.25 (Spurgeon 2004), is $312,000.

As shown in Table 5-3, the reef habitat area in the proposed no-take zones include 0.51 square km at Fagatele Bay and 1.21 square km within the Aunu'u Research Zone. Fisheries operating within these two locations will experience a complete loss of revenue, estimated at $7,445.

The Aunu'u Multiple Use Zone includes 0.71 square km of reef habitat, in which boat-based fishermen must notify a sanctuary representative prior to fishing within this zone. Because of the traditional practice of customary marine tenure, little, if any, of the estimated $3,067 of revenue generated from this area will be lost based on this action. Because the boundary of the Aunu'u unit was established to minimize the impact on the recreational and artisanal bottomfishing and trolling grounds, with an estimated 12 part-time vessels fishing along the entire Nafanua and Taema banks of Tutuila's south shore (Wearing 2011), the economic impact to bottomfishing and trolling is estimated at $0.

Larsen Bay, with 0.96 square km of reef habitat, will allow only hook-and-line gear to harvest sanctuary resources. While the community suggested this regulation, the amount of revenue loss due to the prohibition of other gear types cannot be calculated. To be conservative, the entire estimated revenue of $4,127 is considered as lost.

Table 5-3: Reef Habitat and Associated Near Shore Commercial Fishery Economic Value.

Site	Reef Habitat Area (km^2)	Reef Habitat Area (%)	Economic Value of Area (2009 $)
Fagatele Bay	0.51	0.7	2,219
Larsen Bay	0.96	1.3	4,127
Aunu'u Multiple Use Zone	0.71	1.0	3,067
Aunu'u Research Zone	1.21	1.6	5,226
Ta'u Island	0.83	1.1	3,593
Swains Island	0.97	1.3	4,189
Rose Atoll	0.40	0.5	0
American Samoa	74.13	100	312,000

While the best available information indicates that no fishing occurs along the south and west coasts of Ta'u (Pederson 2000; Spurgeon *et al.* 2004), this analysis estimates the economic value of fisheries within the Ta'u unit at $3,593, based on the area of coral reef habitat. Nevertheless, there are no unit-specific fishery regulations, and no revenue from nearshore fisheries is expected to be lost.

The value for subsistence fishery on Swains Island is estimated at $7,435 (Spurgeon *et al.* 2004) or $4,189 (based on this analysis). This value is expected to be for the harvest of fish consumed on the island by residents, which would continue to be allowed under Alternative 3. Although commercial fishing would be prohibited, large vessels are prohibited from fishing within 50 miles of the island, and no commercial fishing is known to occur within the boundaries of the proposed unit. Therefore, there will be no economic loss from fishing regulations at Swains Island.

The value of the near shore fisheries at Rose Atoll is $0. Because commercial fishing is currently prohibited by Proclamation 8337, and no known artisanal, subsistence or recreational fishing occurs within these waters, there will be no economic loss from fishing regulations at Muliāva.

Based on this analysis, a loss of $11,572 in income can be expected from fishery regulations across all of the sanctuary units, or 3.7 percent of the economic value of the fishery. This analysis did not include impacts from the prohibition of take of specific species, including the giant clam. Because an economic value of the giant clam harvest cannot be determined, and it is considered more of a cultural resource than an economic one, the impact from this restriction is addressed from its cultural perspective above.

5.5.5 Action: Other Regulations

The remaining sanctuary-wide regulatory actions under Alternative 3 are existing regulations for Fagatele Bay National Marine Sanctuary, and have been analyzed as part of Alternative 2 for Muliāva. Three relate to safety measures, one relates to vandalism and theft of sanctuary property, and the last provides additional protection for sea turtles and marine mammals. In general these regulations do not have any impacts on physical or biological resources, and are intended only to make the human activity within the sanctuary safer. Socioeconomic impacts are also not expected.

Other Regulations for Alternative 3

- Divers must display dive flag when diving from a vessel
- Vessels must not exceed 3 knots within 200 feet of a dive flag
- Vessels must operate in a safe manner so not to strike or damage sanctuary resources
- No damaging or removing sanctuary signs or markers
- No ensnaring, entrapping or fishing for sea turtles or marine mammals

5.5.5.1 Physical and Biological Environment

Because Alternative 3 includes much more shallow reef habitat than Alternative 2, particularly at the Aunu'u Island and Larsen Bay units, and the new units are located near harbors, personal vessels are much more likely to occur within sanctuary waters. As such, the regulation requiring all vessels to operate in a safe manner will provide some protection against habitat damage by reducing the potential for running aground a reef flat or reef crest. As described for Alternative 2, the additional legal mechanism to protect sea turtles and marine mammals may provide some protection for these species in addition to that provided through the education and outreach efforts proposed in the sanctuary management plan. In general, promulgating these regulations at all proposed units will likely impart a minor beneficial impact to the physical and biological resources of the sanctuary.

5.5.5.2 Human Environment

As described above for the physical and biological environment, the boating and diving regulations are more applicable for sanctuary units in closer proximity to population areas, where vessels are more likely to operate in sanctuary waters. While scuba diving and snorkeling are not common activities in American Samoa, the designation of these areas as part of the sanctuary network could create an increase in these activities. As such, the regulations provide a safe environment for divers and snorkelers.

By providing a consistent message, through both regulation and education, for appropriate public behavior while boating, conducting research or enjoying recreational activities in the sanctuary, ONMS fosters awareness among users, and emphasizing human health and safety. The regulations emphasize proper and safe conduct, and do not prohibit any appropriate human uses. As such, these regulations are expected to provide a beneficial impact to human health and safety, and have no impact on any human uses.

The regulation related to sanctuary property makes these actions a federal crime, punishable by a substantial fine. While enforcement could be difficult, it provides a strong discouragement against theft or damage of sanctuary property. Sanctuary signs are used to warn the public of unsafe conditions, inform users of the rules of conduct for the specific sanctuary unit, and provide interesting facts of the natural, cultural and historical significance of the sanctuary. Signs increase user enjoyment, protect resources and improve safety. Inasmuch as the regulation limits this theft and damage to sanctuary property, it is expected to provide a beneficial impact to natural resources, tourism and recreation, and human health and safety.

5.5.5.3 Socioeconomic Environment

Because these regulations primarily complement safe and legal behavior, no socioeconomic impacts are expected from the creation of these regulations.

5.6 ALTERNATIVE 4: MULTI-VILLAGE SANCTUARY UNIT EXPANSION WITH BUFFER ZONES AND ADDITIONAL REGULATIONS

Alternative 4 includes all of the actions described in Alternative 3, in addition to a number of actions that provide increased protection across all units. This includes expanding the boundaries of the Aunu'u Island Research Zone, and the Ta'u Island and Swains Island units, as well as prohibiting the take of additional fish and shark species. With regards to the Muliāva unit, Alternative 4 is divided into 4A and 4B. Alternative 4A designates waters within a 12 nm radius around Rose Atoll as a no-take zone for all types of fishing. Alternative 4B extends this no take zone to include the entire Muliāva unit including the proposed sanctuary waters that surround the Vailulu'u seamount. Alternative 4B also proposes an overlay of the marine areas of the Rose Atoll NWR, as directed by Proclamation 8337.

5.6.1 Action: Extended Boundaries for the Aunu'u Island, Swains Island, Ta'u Island, and Muliāva Units, Including Overlays of Other Federal MPAs

This action extends the boundaries of four units, increasing the total size of the sanctuary by approximately 794.4 square miles (2,057.5 square km). At three of the units, the expansion consists entirely of federal waters. As such, under Alternative 4 sanctuary-wide fishing regulations would be extended to these federal waters. Boundary expansion qualities of this action are summarized in Table 5-4. These impacts will be discussed in section 5.6.2, in addition to the other fishing regulations described above. Impacts from all other actions described in Alternative 3 (*i.e.*, discharge prohibition, benthic habitat protection, and other regulations) on these additional waters will be discussed here. In addition, the administrative impact of the overlay of the NPAS and Rose Atoll NWR will be discussed here under human environment.

Alternative 4 extends the eastern boundary of the Aunu'u Island unit into federal waters so that the unit encompasses mesophotic reefs to a depth of 984 feet (300 meters). This mesophotic reef habitat is important both for its rarity within the archipelago and for its ecological connection to

the shallow reef habitats of the Aunu'u unit. The Swains Island expansion is entirely oceanic pelagic waters, and acts primarily as a buffer zone for the isolated ecosystem. The Ta'u Island unit overlays the marine portions of the NPAS, encompassing coastal waters that includes the culturally significant *Taisamasama*, the Yellow Waters of Tui Manu'a. The Muliāva unit expansion overlays the shallow reef and lagoon of the Rose Atoll NWR, managed by the USFWS. The two small islands, Rose and Sand, would not be included in the sanctuary.

Table 5-4: Alternative 4 Boundary Expansion Qualities.

Sanctuary Unit	Size Increase	Federal Waters	Other Management
Aunu'u Island	0.33 mi^2	Yes	None
Swains Island	790 mi^2	Yes	None
Ta'u Island	1.4 mi^2	No	NPAS overlay
Muliāva	2.6 mi^2	Yes	NWR overlay

5.6.1.1 Physical and Biological Environment

Water Quality, Habitat, and Biological Resources

Beneficial impacts to water quality, habitat and biological resources would be similar to those described for the three sets of actions (*i.e.*, discharge prohibition, benthic habitat protection, and other regulations) in Alternative 3. Incorporating the mesophotic reefs within the Aunu'u Island unit expands the overall diversity of habitats protected within American Samoa, while providing an opportunity to study the deep reef-shallow reef connectivity in a relatively undisturbed ecosystem. Benthic habitat regulations provide relatively less protection for the additional deep waters at Swains and Aunu'u Islands, as many of the prohibitions are unlikely to occur (*e.g.*, anchoring, abandoning a vessel), although anchoring could occur at Aunu'u. The anchoring prohibition would provide protection for the rare mesophotic reefs east of Aunu'u Island. These three sets of prohibitions provide relatively more benthic habitat protection for the shallow waters of Ta'u Island, although the absence of land-based pollution and minimal boat traffic makes these regulations of a more precautionary nature. At Rose Atoll, access to the lagoon and reefs is closed to the public through USFWS regulation. The remote location, in addition to monument designation and management by USFWS, minimizes existing and potential future anthropogenic threats to the shallow water resources of Rose Atoll. Therefore, inclusion of these marine waters and corresponding regulations would likely result in little additional protection to the natural resources of the Rose Atoll NWR. The buffer zone at Swains Island would limit the potential of harmful discharge affecting the shallow water coral reef habitat by increasing the distance from land vessels would be permitted to discharge, as well as imparting increased public awareness through education and outreach.

As part of the sanctuary system, ONMS could bring additional enforcement capabilities and resources to protect and enhance water quality, habitat and biological resources for the NPAS. The overlay would create a consistent regulatory regime across the shallow and deep waters of Ta'u, minimizing confusion and providing a clear directive for enforcement personnel (*i.e.*, USCG, NMFS OLE). At Rose Atoll, USFWS currently provides protection in the lagoon area of the monument, as their regulations include complete no-take and access restrictions. Sanctuary regulations for this lagoon area would be redundant. Sanctuary overlays at these two units would provide some value added beneficial impact to natural resources through additional enforcement mechanisms, including a civil penalty schedule and additional resources where ONMS and the other federal partners could collaborate on appropriate management action to maintain the health of these reef ecosystems. Collaboration with USFWS and NPAS has already occurred with a number of activities, including research at Fagatele Bay. The buffer zones would reduce doubt of enforcement personnel as to whether an activity occurred within or outside these expanded sanctuary boundaries.

As such, at Aunu'u, Ta'u and Swains, the expanded sanctuary units will provide a beneficial impact for water quality, habitats and the biological resources of the sanctuary. The exception is the inclusion of the FWS Refuge where the additional regulations are unlikely to add much additional protection.

5.6.1.2 Human Environment

Fisheries

The expansion of these four units and the associated regulations described above will have the same impact on fisheries as that for described for Alternative 3. These are primarily indirect benefits from the general improvement of ecosystem health, as none of these actions limit fishing activity. As with the sanctuary-wide prohibition on the use of destructive gear, general Park Service regulations prohibit "fishing by the use of drugs, poisons, explosives, or electricity (36 CFR 2.3-5)." Furthermore, the enabling legislation for the NPAS allows only subsistence fishing in the marine areas of the park, effectively prohibiting commercial fishing. To ensure consistency between federal agencies, the more stringent regulations (*i.e.*, subsistence use only) would be upheld. Expansion of the unit at Muliāva would provide no additional benefit as the waters of the refuge are currently completely no-take under USFWS regulation.

Marine Heritage and Cultural Resources

The culturally important Yellow Waters of Tui Manu'a at *Taisamasama* were initially included as part of the proposed sanctuary unit at Ta'u because the Secretary of Samoan Affairs desired additional protection. It was confirmed to have the qualities of national significance worthy of sanctuary designation and scored the highest possible rating regarding historical and cultural resource values by the advisory council's Site Selection Working Group. While no existing threats to *Taisamasama* have been identified, this action provides appropriate safeguards for future threats, including discharge and anchoring prohibition from potential increases in fishing activity near the site. The protection of cultural resources and the prohibition on abandoning

vessels extended to the overlay waters provide a management structure that will ensure the long-term protection of *Taisamasama*. A precautionary approach is warranted for this highly important cultural site. These regulations are strengthened through the civil penalty schedule and additional enforcement capabilities by ONMS. This protection reinforces that of the Park System Resource Protection Act, which states "*any person who destroys, causes the loss of, or injures any park system resource is liable to the United States for response costs and damages resulting from such destruction, loss, or injury*." Collaboration between ONMS and NPS on management issues could benefit the entire ecosystem through the sharing of resources and focusing on a holistic approach that includes the nearshore and offshore waters. In addition to those benefits described under Alternative 3, the sanctuary overlay at the Ta'u Island unit is action would provide a beneficial impact to these cultural resources. There is no change in impact from Alternative 3 for the expanded areas of Swains, Aunu'u and Muliāva due to the absence of marine heritage and cultural resources in these locations.

Tourism and Recreation

The expansion of these four units would have little effect on tourism and recreation. As entry to Rose Atoll NWR is already prohibited to the public, no change in human use would be expected compared to No Action. Inaccessibility to the southern shore of Ta'u limits tourism and recreation, while the expansion of the sanctuary into pelagic waters at Swains Island will likely provide no additional tourism or recreational incentives. As such, this action would similar beneficial impact for tourism and recreation described under Alternative 3.

Research

The single purpose for the expansion of the Research Zone into federal waters off of Aunu'u is to provide protection for the mesophotic reefs, a continuous extension of the shallow, patch reef habitat already included under Alternative 3. Extending the highly protective management regime of the research zone into these waters provides opportunities to research a complete, relatively undisturbed reef habitat. This action would provide a beneficial impact to research.

5.6.1.3 Socioeconomic Environment

While Alternative 4 increases the overall size of the sanctuary network by 794 square miles, an increase in available funding or personnel is not expected over that described in Alternative 3. The inclusion of additional waters in the Aunu'u Research Zone could increase interest in research of the area, but will likely not increase ONMS funding for research, and outside funding cannot be predicted. The expansion of the sanctuary units under Alternative 4 will have the same socioeconomic benefit as that described for Alternative 3.

5.6.2 Action: Additional Fishing Regulations

This section analyzes the sanctuary-wide fishing regulations first discussed in Alternative 3 as they relate to the expanded waters of this alternative, including those gear and species-specific regulations that were not applicable for the Muliāva unit in previous alternatives. This section also analyzes the impact of two additional regulations; the sanctuary-wide prohibition on the harvest of certain large fish species, and two options for a no-take zone at the Muliāva unit, a 190 square mile zone (12 by 12 nm square) around Rose Atoll (Alternative 4A), and 2) making the entire unit no-take for all fishing (Alternative 4B). Because the proposed no-take zone supersedes the gear and species prohibitions, these individual restrictions will not be analyzed for the Muliāva unit.

Fishery Regulations for Alternative 4

Prohibited Gear

- Poisons, electrical charges, and explosives
- Scuba-assisted spearfishing
- Drift gill nets
- Seine, trammel or any type of fixed net
- Only hook-and-line gear at Larsen Bay

Prohibited Species

- Live coral and wild live rock
- Other bottom formations
- Giant clams
- All species of live shells except the goldmouth turban snail
- Crown-of-thorns starfish
- Any marine mammal or sea turtle
- Certain large fish species (new to Alternative 4)

Other Prohibitions

- Sustenance harvesting only at Swains
- No-take zones at Aunu'u Island and Fagatele Bay
- Notification requirement at Aunu'u Island
- No-take zone to 12 nm at Muliāva (Alternative 4A)
- No-take zone for all of Muliāva (Alternative 4B)

5.6.2.1 Physical and Biological Environment

Water Quality and Habitats

Impacts to water quality and habitat created by fishing regulations are the same as those discussed in Alternative 3. As Rose Atoll NWR and the waters to 50 fathoms surrounding the refuge are already designated no-take, there are no additional habitat benefits from gear or species take prohibitions for this unit, although these benefits are realized for the additional benthic habitat at the Ta'u and Aunu'u units. The 12 or 50 nm no-take zone in the Muliāva unit would limit fishing vessel traffic in the area, providing protection against other ship groundings like the Taiwanese longliner *Jin Shiang Fa*. These regulations will provide beneficial impact to habitat but have no impact on water quality.

Target and Non-Target Fish and Invertebrate Resources

The sanctuary-wide fishery regulations are largely not relevant for pelagic waters, and would likely impart no additional impact to fishery resources over those described under Alternative 3. The increase in size of the Aunu'u Island unit's research zone, the prohibition on the take of large coral reef associated species, and the creation of a no-take zone at Muliāva will provide protection for biological resources of the sanctuary and are discussed below.

Increase Size of Aunu'u Research Zone

The expansion of the no-take research zone closes off an additional 0.33 square miles (0.85 square km) of reef area, primarily waters between 100 and 200 meters deep. Most of this additional area is within federal waters, which has not been identified through interviews and community meetings as high valued bottomfishing grounds. Nevertheless, providing full protection for these deeper waters with their unique mesophotic reefs will benefit their associated biological resources from potential future fishing pressure.

Prohibition on Take of Large Coral Reef Associated Species

The proposed prohibition on the take of the Maori wrasse (*Chelinus undulatus*), bumphead parrotfish (*Bolbometopon muricatum*), giant grouper (*Epinephelus lanceolatus*), giant trevally (*Caranx ignoblis*), and six shark species was first considered by the DMWR in 2007 based on apparent low numbers and small sizes of these species compared to numbers observed in uninhabited and remote islands and atolls in the western Pacific. The presumption was that these large fish are in such low number simply because of fishing pressure applied on them (Sabater 2011). Because there has been no stock assessment or thorough analyses of fishery data on these species, these conclusions were controversial, and the DMWR has put this regulation on hold until there is evidence that fishing is the root cause of the decline in numbers (Ochavillo 2011). Additionally, based on existing fishery data, these groups of fishes have not been targeted in the local fishery and fishing effort has been declining over the years (Sabater 2011).

It should be noted that these species naturally exists in low population densities on the reef. Densities of adult Maori wrasse rarely exceed 20 fish per 10,000 square meters of reef, while heavily fished areas will display only a few adults (Sadovy *et al.* 2003). Densities appear to be much lower in American Samoa, possibly because of limited juvenile habitat. For example, a sand bottom substrate bordered with branching corals is the preferred habitat for juvenile Maori wrasse which comprises only one percent of the total reef flat of Tutuila (Sabater 2011).

As these species are generally late-maturing top predators and are highly prized by many fishermen, even low levels of fishing pressure may cause a dramatic drop in stock size (Friedlander and DeMartini 2002; DeMartini *et al.* 2008). Predicable spawning aggregation sites and naturally low abundance make these fish especially vulnerable to overfishing (Sadovy 2003). Additionally, consumer preference for small (e.g., plate-size) fish may result in the extraction of pre-reproductive individuals from the population, which could result in localized extinction (Sadovy 2003). A precautionary approach against overfishing within the waters of the sanctuary is warranted based on these factors.

While these species may occur at low densities across the archipelago, they provide an important function in maintaining healthy reef ecosystems. Depletion of apex predators can cause cascading effects across trophic levels of the marine community (Stevenson *et al.* 2006). As noted in studies in Hawaii (Friedlander and DeMartini 2002), Fiji (Jennings and Polunin 1997) and the Line Islands (Stevenson *et al.* 2006), total fish biomass and the amount of biomass in the top trophic levels decrease with fishing pressure. The Fiji and Hawaii studies show that coral reef

ecosystems with high numbers of top predator can also support high densities of herbivores. The prohibition on the take of large species could benefit apex predator populations. Their influence in maintaining a healthy ecosystem balance will provide a beneficial impact to all of the biological resources within sanctuary waters.

No-take Zone at Muliāva

In addition to the no-take zones at Fagatele Bay and Aunu'u Island discussed in Alternative 3, Alternative 4A would incorporate a no-take zone from the extreme low waterline outside the perimeter reef of Rose Atoll out to 12 nm. Commercial fishing is currently prohibited by Proclamation 8337 within 50 nm of Rose Atoll, and all fishing is prohibited within the 50 fathom (300 foot, 91.5 meters) contour line around Rose Atoll (50CFR665.99). This action would thus prohibit noncommercial, sustenance, traditional indigenous, and recreational harvesting in the pelagic waters surrounding the atoll out to 12 nm. This additional protection may be important due to Rose Atoll's relative isolation. The atoll lies upstream in South Equatorial current relative to the rest of the archipelago and analysis of larval connectivity in the region suggests Rose Atoll "may be isolated from larval sources & less resilient to disturbance" (NCCOS 2011). This proposed no-take zone surrounding Rose Atoll would be the only pelagic no-take zone across the archipelago. While highly migratory species including bigeye and yellowfin tuna traverse across the entire south Pacific basin, they are known to be attracted to geological features such as seamounts and islands. Because bigeye tuna are currently undergoing overfishing, while yellowfin tuna are being fished close to the sustainable limit (SPC 2010), this no-take zone may provide some refuge for these species. Nevertheless, it may be important to provide protection of the pelagic waters surrounding the isolated and unique habitat of Rose Atoll to manage the area on an ecosystem level.

Alternative 4B would incorporate a no-take zone throughout the entire Muliāva unit, including the Vailulu'u Seamount. As seamounts enhance ocean mixing, they can increase available food and concentrate fish and invertebrate species in an otherwise impoverished pelagic environment (Wessel *et al.* 2010). While fishing is not known to occur in the area, Vailulu'u is relatively close to Ta'u Island and could be targeted for future fishing ventures. Due to the unique hydrothermal benthic fauna of Vailulu'u, additional protection may be warranted, particularly for any gear that may come in contact with the seafloor. With regards to pelagic species, protection would be similar as that for Alternative 4A, although the importance of the entire 13,508 square miles (34,985 square km) of the Muliāva unit to the biology and ecology of marine resources in the area has not been assessed.

This suite of actions provides protection for unique mesophotic reef habitat, vulnerable large coral reef fish species, and holistic protection of the isolated and fragile habitat of Rose Atoll and its surrounding pelagic waters. For these reasons, the impact on biological resources from this action would be beneficial to the biological resources of the sanctuary.

Special Status Species

While special status species can and do occur in waters throughout the archipelago, perhaps the most important known specific location is Rose Atoll, the primary nesting site for green turtles in the archipelago. In spite of its remote location, major declines in nesting have been reported over the past 50 years, with several dozen nests laid between October and March each year (Maison *et al.* 2010). Because the atoll is closed to the public, the nesting areas are generally protected from disturbance, although an event such as the grounding of the Taiwanese longliner in 1993 could seriously impact this endangered species. The creation of the 12 nm no-take zone will protect pre- and post-nesting females from accidental hooking or other fishery interactions. While there are possibly more hawksbill turtles throughout the year in the territory, with an estimated 50 females nesting annually on Tutuila and 30 on the Manu'a Group (WPFMC 2009), specific nesting beaches and foraging grounds have not been identified. As such, net prohibitions, beach protection, and no-take zones likely benefit turtles, but cannot be stated definitively. Protection imparted to marine mammals and turtles are similar to that described in Alternative 3. The 12 nm (4A) or 50 nm (4B) no fishing zone around Rose Atoll, in addition to the other protections described previously will impart a beneficial impact on special status species.

5.6.2.2 Human Environment

Fisheries

Alternative 4 imparts the most restrictions related to fishing activity, including all of the restrictions previously described under Alternative 3, in addition to the expansion of the units at the Aunu'u and Ta'u Island units, the prohibition on the harvest of the Maori wrasse and other large reef species, and the Muliāva no-take zone. Alternative 4 also extends sanctuary boundaries into federal waters at the Aunu'u and Swains Island units.

The expansion of the Ta'u boundary to overlap with the NPAS will likely impart no additional impact to fisheries as no fishing has been reported along the south and south west coasts (Spurgeon *et al.* 2004; Pederson 2000). The expansion of the Swains Island unit into federal waters will also likely impart no additional impact to fisheries as large commercial vessels are prohibited from fishing within 50 nm of the island, and subsistence fishing, which accounts for all known effort both nearshore and offshore (Brainard *et al.* 2008), is still allowed under this alternative. As Swains is over 200 miles from Pago Pago Harbor, small commercial vessels are likely not equipped to travel this distance. The expansion of the no-take Research Zone by 0.33 square miles (0.85 square km) closes off a relatively small area available for small vessel commercial, recreational and artisanal fishermen. This additional area of deepwater, in which the habitat is primarily mesophotic reefs, has not been identified through interviews as high valued fishing grounds and the area beyond the reef flat has been categorized as zero effort (Spurgeon *et al.* 2004). The more productive and popular grounds, including Nafanua Bank, remain open within the Multi-Use Zone, although access is controlled through a notification requirement described in Alternative 3.

The prohibition on harvesting certain large species will affect recreational fishers targeting the giant trevally. The giant trevally is a favorite of the Pago Pago Gamefishing Club, a group of recreational fishers with 8 or 9 boats who partake in trolling for large pelagic species, primarily marlin, yellowfin, tilefish, and giant trevally. While concerns were raised about closed areas, club members did not indicate that any of the proposed sanctuary units overlapped with their preferred fishing grounds (Wearing 2011). Spearfishers targeting the Maori wrasse and other species may also be affected, as well as users of other subsistence gear types, although data is not available to indicate the level of impact. While rare on most reefs around the territory, schools of Maori wrasse are frequently seen in the nearshore waters of Swains Island (Fenner *et al.* 2008). Prohibiting the harvest of this species will likely affect subsistence fishers living on the island, who catch an estimated 1.2 tons of fish and invertebrates per year (Spurgeon *et al.* 2004) and would likely consider the wrasse a delicacy. Education and outreach about the vulnerability of these species and the isolation of the island would be critical for compliance as enforcement of subsistence use in such a remote location is obviously problematic. As these species rarely appear in commercial catch records (Sabater 2011), this action is expected to have no impact on either the small or large vessel commercial fisheries.

Due to its large size, and occurring completely within federal waters, the no-take zone at Muliāva (either the 12 nm or the entire unit) would appear to present the largest impact on fisheries. This impact is tempered due to a number of factors; 1) commercial fishing is already prohibited in the monument-designated waters 50 nm around Rose Atoll, 2) the closest port to the western boundary of the Muliāva unit is Faleasao Harbor on Ta'u, at more than 30 miles away, and 3) only six vessels are home ported in the Manu'a Islands, all of them 28 to 32 foot long, outboard engine powered *alias* that conduct single day fisheries (DMWR and WPFIN 2010). Spurgeon *et al.* 2004 assigned a value of zero to fishing in the vicinity of Rose Atoll. These small one-day vessels would need to travel at least 60 miles round trip in a day (Alternative 4B), or more than 100 miles (Alternative 4A) for this no-take zone to limit the fishery. The Paramount Chief of Manu'a indicated that the Ta'u people cannot go fishing beyond 20 miles (Interagency Meeting 2 September 2009). There is no indication that the value of the pelagic waters of the Muliāva unit are more productive fishing grounds that the thousands of square miles of open access pelagic waters that surround the Manu'a Islands. It is therefore not surprising that there have been no documented records of artisanal, recreational, or subsistence fishing occurring within the proposed Muliāva unit (Interagency Meeting 2 September 2009). However, fisherman from the Manu'a Island group raised concerns about limiting fishing during scoping meetings held for the Rose Atoll MNM (Wearing 2011). This may be related to future opportunities, as people await the WPFMC recommendations on proposed regulations for the monument.

Based on this analysis, expansion of sanctuary units will have no impact on commercial, subsistence, or recreational fisheries. The prohibition on harvest of the large reef fish would have a less than significant impact on recreational fishers, as it would limit their fishing for giant trevally within sanctuary units, although most of the waters around the islands would remain open. This prohibition would have a less than significant impact on subsistence fishers, particularly at the Swains Island unit, as rare species like the Maori wrasse and bumphead parrotfish are prized catches across the South Pacific. The proposed 12 nm no-take zone would

have no impact on fisheries due to the current state of the local fleet and the distance required to travel for non-commercial fishing. The proposed 50 nm no-take zone would have a less than significant impact as the distance to travel remains great while large areas open to fishing are closer. Overall, this set of actions would have a less than significant impact on fisheries in American Samoa.

Marine Heritage and Cultural Resources

Impacts from the prohibition on the harvest of certain large reef species are expected to have a less than significant impact to American Samoan culture due to the general rarity of these species in the catch records and collaboration with associated villages leading to agreements of cooperative management and restrictions.

Tourism and Recreation

The fishery actions of Alternative 4 would have a minor beneficial impact for tourism and recreation as it could improve the enjoyment of snorkelers and scuba divers enjoying the healthy reef ecosystems within the sanctuary units if the effect allows for an increase in the numbers of large fish within the sanctuary.

5.6.2.3 Socioeconomic Environment

The socioeconomic impact of this set of fishery actions would be similar to that described under Alternative 3. Based on the methodology, there would be slightly more lost revenue as the overall size of the sanctuary increased. The economic impact from the prohibition on harvesting large reef fish would cause some additional lost revenue, but as stated previously, these species are rarely listed in the commercial catch. The impact from the no-take zone within the Muliāva unit would be a lost opportunity and not lost revenue, as commercial fishing is already prohibited by proclamation and there is no documentation of any artisanal, recreational, and subsistence fishing occurring within the proposed boundaries of the Muliāva unit. Spurgeon *et al.* (2004) has also assigned a value of zero to fishing in the vicinity of Rose Atoll. The existing fleet within the Manu'a Islands is not equipped to travel such great distances, and the expense and safety concerns for small vessels operating in these waters are high barriers to fishing within Muliāva. Nevertheless, the no-take zone does eliminate the possibility of future fishery development opportunities.

In addition to the losses calculated for Alternative 3, the expansion of the sanctuary units at Aunu'u, Ta'u and Swains Islands would not likely further limit fisheries. Additional loss is not expected as the Aunu'u Research Zone is expanded only into deep waters and would not impact coral reef fisheries, bottomfishing or trolling. The lack of known activity along the south and west shores of Ta'u indicates that the Alternative 3 revenue loss estimate may already be overstated, and no additional revenue loss is expected. As large vessel commercial fishing is prohibited within 50 nm around Swains, the expansion of the sanctuary to 12 nm would not impact commercial fisheries and the ongoing subsistence fishing would remain allowed. For the same reason that estimates of the impact on giant clams cannot be determined, impacts from the

prohibition on harvesting large reef species is confined to impacts on cultural resources and recreational activities. As such, a loss of $11,572 in income can be expected from fishery regulations across all of the sanctuary units.

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6.0 CUMULATIVE PROJECTS AND IMPACTS

A cumulative impact is an "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions" (40 CFR 1508.7; NOAA 1999). Cumulative impacts can result from individually minor but collectively significant actions taking place over time (40 CFR 1508.7).

The Council on Environmental Quality (CEQ) guidance for considering cumulative effects states that NEPA documents "should compare the cumulative effects of multiple actions with appropriate national, regional, state, or community goals to determine whether the total effect is significant" (CEQ 1997). Cumulative projects considered below are similar to the proposed action, large enough to have far-reaching effects, or are in proximity to the proposed action with similar types of impacts.

As this is primarily a regulatory and management action which would create over 13,500 square miles of new MPAs within the American Samoa EEZ, assessing existing and potential MPAs along with this proposed action is critical to understanding the overall impact on American Samoa's marine environment. This will provide an important understanding of the variety of marine area management occurring under various agencies, including the diverse range of goals of these management regimes, and the overall level of protection within the territory, as well as the total impact these regulations have on marine users. In addition to this primary assessment, the effects of relevant infrastructure projects occurring in proximity to the proposed sanctuary units will be discussed.

The overall effect of all existing and proposed MPAs supports the regional, national and global concern for coral reef ecosystems. While American Samoa has a variety of mechanisms to protect these natural resources, the common characteristic is the development of community support and involvement. While MPAs do restrict some uses, particularly the harvest of marine resources, these designations are made to limit the cumulative socio-economic impact. As such, the cumulative effects on human uses are negligible, while the cumulative effects on marine resources in the territory are beneficial.

6.1 CUMULATIVE METHODOLOGY

For this section, past, present, and future foreseeable projects are assessed throughout American Samoa. Cumulative effects may arise from single or multiple actions and may result in additive or interactive effects (CEQ 1997).

The projects listed in Section 6.2 are either existing or are anticipated to occur in the reasonably foreseeable future within American Samoa. The potential effects of these actions have been considered in combination with the impacts of the proposed action to determine the overall cumulative impact on the resources.

6.2 PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE PROJECTS

Marine Protected Areas

This section identifies numerous projects that could potentially contribute to cumulative impacts in the vicinity of the proposed sanctuary under the various alternatives (Table 6-1). The project information provided in Table 6-1 was compiled from a number of sources, including NOAA, the American Samoan government, and the AS-EPA.

Governor Tauese Sunia's mandate to protect 20 percent of American Samoa's coral reefs as no-take MPAs will require careful and extensive marine resource management planning (Oram 2008). This proposed sanctuary expansion and associated resource protection measures would contribute to this goal of marine resource protection in American Samoa. In addition to the management described in this document, other marine management activities across the Samoan archipelago must be considered for the total cumulative effect on the marine environment. Since the proposed sanctuary expansion directly impacts the marine environment of American Samoa, MPAs and similarly designated sites throughout American Samoa are the focus of this cumulative impact section.

MPAs and marine managed areas in American Samoa are key tools for maintaining sustainable reef ecosystems by limiting or promoting particular resource uses and activities and raising awareness on issues of reef sustainability (Kendall and Poti in prep.). Numerous local and federal agencies are involved and a "diversity of MPAs [are] now in place across the archipelago from the village and local community level to national protected areas and those with international significance. Many of the different MPAs in the network were created through independent processes with different objectives and management authorities. Each contributes to the mosaic of marine resource management in the region" (Kendall and Poti in prep.).

There are 23 existing MPAs in American Samoa (Kendall and Poti in prep.), with an additional 7 at various stages in the proposal process. Of these 7 proposed MPAs, 5 are those considered in this document and 2 are Congressionally-approved (16 U.S.C. 410qq-1) proposed expansions/ additions to the NPS in the Manu'a Islands. All 23 existing MPAs and the 7 proposed MPAs are listed in Table 6-1.

Photo 1: Damaged coral in Alofau CFMP Reserve, a hotspot for fish biomass and one of 22 existing MPAs in American Samoa. Photo: Doug Fenner.

Table 6-1: Cumulative Projects – Marine Protected Areas.

MPA and Location	Implementation Date	Project Sponsor	Description	Approximate Size
Alofau CFMP Reserve Located in SE Tutuila	2001	DMWR	• In a biogeographic region that is a hotspot for fish biomass • Prohibitions: fishing and destructive fishing methods* with the exception of occasional Saturday openings, fishing by outsiders	~0.3 km^2
Amanave CFMP Reserve Located on the western tip of Tutuila	2009	DMWR	• In a biogeographic region that is a hotspot for coral cover and fish biomass and richness	~0.3 km^2
Amaua and Auto CFMP Reserve Located in SE Tutuila	2003	DMWR	• In a biogeographic region that is a regional hotspot for coral cover and fish biomass • Established to "manage, protect, and preserve the fish, shellfish, and the coastal area of the village of Amaua and Auto"	~0.4 km^2
Aoa CFMP Reserve Located in NE Tutuila	2005	DMWR	• In a biogeographic region that is a hotspot for coral richness	~0.3 km^2
Aua CFMP Reserve Located on the eastern side of Pago Pago Harbor	2002	DMWR	• In a biogeographic region that is a hotspot for fish biomass and has a unique coral community • Established to "manage, protect, and preserve the fish, shellfish, and the coastal area of the village of Aua." • Prohibitions: fishing and destructive fishing methods*, use of scuba gear and nets for fishing, the breaking up of corals for fishing, fishing by outsiders	~0.2 km^2

MPA and Location	Implementation Date	Project Sponsor	Description	Approximate Size
Fagamalo CFMP Reserve Located in NW Tutuila	2003	DMWR	• In a biogeographic region that is a hotspot for coral cover and fish biomass and richness • Established to "preserve the coral reef area of the village of Fagamalo" • Abuts the Fagamalo No-Take MPA and fronts a ~2.1 km2 watershed in pristine condition • Prohibitions: fishing and destructive fishing methods*, fishing within Fagamalo streams.	~0.4 km^2
Fagamalo No-Take MPA Located in NW Tutuila	2010	DMWR	• In a biogeographic region that is a hotspot for coral cover and fish biomass and richness • Prohibitions: fishing	~2.9 km^2
Leone Pala Special Management Area Located in SW Tutuila	1994	ASCMP	• Designated to protect wetland habitats from development pressures and on-shore activities • Marine component is the Leone lagoon, which has a benthic environment comprised mainly of mud with a mangrove shoreline	~0.09 km^2 marine component, along with the adjacent wetland areas
Masausi CFMP Reserve Located in NE Tutuila	2002	DMWR	• In a biogeographic region that is a hotspot for coral richness • Established to "conserve the marine resources in the ocean or in the village reef" • Prohibitions: fishing and destructive fishing methods*, the use of scuba gear for fishing, flashlights for night fishing, and breaking up of corals for fishing, and fishing by outsiders	~0.2 km^2
Matu'u and Faganeanea CFMP Reserve Located along the south central coast of Tutuila	2005	DMWR	• In a biogeographic region that is a hotspot for fish richness • Established with the primary goal of "protecting the coral reefs of Matu'u and Faganeanea to provide more fish for the future generation". • Prohibitions: fishing, loitering in the reserve and in village streams	~0.3 km^2

MPA and Location	Implementation Date	Project Sponsor	Description	Approximate Size
Nu'uuli Pala Special Management Area Located in south-central Tutuila	1995	ASCMP	• Regulates on-shore activities in the wetland areas that could be harmful to unique marine ecosystems • No specific fishing regulations nor a written management plan.	Includes a ~2.0 km^2 marine component and adjacent wetlands
Ofu Vaoto Territorial Marine Park (also known as Ofu Vaoto Marine Reserve) Located on the southwest tip of Ofu Island	1994	DPR & DMWR (see box to right)	• In a biogeographic region that is a hotspot for fish biomass and coral and fish richness • Established "to protect its unique coral reef wildlife habitat while enabling the public to enjoy the natural beauty of the site". • Department of Parks and Recreation (DPR) has management authority, the DMWR exercises primary authority over fishing regulation • Prohibitions: fishing and shellfish harvesting (except subsistence fishing and harvesting by Ofu Island residents)	~0.5 km^2
Pago Pago Harbor Special Management Area Located in central Tutuila	1997	ASCMP	• Designated to regulate on-shore activities that could be harmful to wetland areas and nearshore marine ecosystems • No fishing regulations exist beyond territorial regulations. There is no written management plan. Sale of fish or shellfish from inner Pago Pago Harbor is prohibited by public health directive due to contamination by heavy metals and other pollutants	~1.2 km^2 of marine habitat
Poloa CFMP Reserve Located on the NW tip of Tutuila	2001	DMWR	• Established to "conserve, protect, and manage the resources in the village reef". • Prohibitions: fishing and destructive fishing methods*, the use of scuba gear for fishing, flashlights or lanterns for night fishing, the breaking up of corals for fishing, and is fishing by outsiders	~0.4 km^2

MPA and Location	Implementation Date	Project Sponsor	Description	Approximate Size
Sailele CFMP Reserve Located in NE Tutuila	2005	DMWR	• In a biogeographic region that is a hotspot for coral richness	~0.1 km^2
Tisa's (Alega) Private Marine Reserve Located in the southeast of Tutuila in Alega Bay	1985	Private	• Is a small part of a biogeographic region that is a hotspot for fish richness • Prohibitions: fishing by outsiders	~0.1 km^2
Vatia CFMP Reserve Located on the north central coast of Tutuila	2001	DMWR	• In a biogeographic region that is a hotspot for coral cover • Prohibitions: fishing and destructive fishing methods*, the use of scuba gear for fishing, flashlights for night fishing, the breaking up of corals for fishing, and fishing by outsiders.	~0.6 km^2
Fagatele Bay National Marine Sanctuary Located on the SW side of Tutuila	1986	ONMS	• In a biogeographic region that includes Larsen Bay and is a hotspot for coral cover as well as coral and fish richness • Designated to "protect and preserve an example of a pristine tropical marine habitat and coral reef terrace ecosystem" • Fishing within the inner bay restricted to traditional methods with line, fishing is permitted in the outer bay	~0.7 km^2
National Park of American Samoa – Ofu Unit Located along the southeast shoreline road of Ofu Island from Fatauana Point to Asega Strait and extends 0.25 miles offshore.	1988 and formally established in 1993	NPS	• In a biogeographic region that is a hotspot for fish biomass and coral and fish richness • Fishing or gathering is prohibited in the park, except subsistence fishing by native American Samoans using traditional tools and methods in accordance with rules established by the National Park Service and village leaders	~1.5 km^2 marine portion

MPA and Location	Implementation Date	Project Sponsor	Description	Approximate Size
National Park of American Samoa – Ta'u Unit Located in south and southeast of Ta'u Island	1988 and formally established in 1993	NPS	• Overlaps two biogeographic regions that are hotspots for coral cover, coral and fish richness, and that share a unique coral community representative of Ta'u island • Fishing or gathering is prohibited in the park, except subsistence fishing by native American Samoans using traditional tools and methods in accordance with rules established by the National Park Service and village leaders	~ 4.7 km^2 of marine habitats
National Park of American Samoa – Tutuila unit Located between the villages of Fagasa and Afono on the north-central part of Tutuila	1988 and formally established in 1993	NPS	• In a biogeographic region that is a hotspot for coral cover • Fishing or gathering is prohibited in the park, except subsistence fishing by native American Samoans using traditional tools and methods in accordance with rules established by the National Park Service and village leaders	~6.5 km^2 of marine habitats
Rose Atoll Marine National Monument (encompassing Rose Atoll National Wildlife Refuge) Located at the eastern end of the Samoan archipelago	2009 (monument) 1974 (refuge)	USFWS	• Comprises a distinct biogeographic region that is a hotspot for fish biomass and has a unique coral community • Established to protect the "lands, submerged lands, waters, and marine environment around Rose Atoll" and its "dynamic reef ecosystem that is home to a very diverse assemblage of terrestrial and marine species, many of which are threatened or endangered". • Refuge is closed to the public and fishing is prohibited. • Commercial fishing is prohibited, within the monument; Secretary of Commerce (through NOAA) has primary management authority over fishery-related activities in the marine areas seaward of the mean low water line	~35000 km2 with ~9.1 km2 of potential reef habitat shallower than 150 m

MPA and Location	Implementation Date	Project Sponsor	Description	Approximate Size
Proposed MPA - Two expansions/additions to the NPS in the Manu'a Islands	NA	NPS	This is an ongoing effort of the NPS. Details of the action are unknown at this time.	Unknown
Proposed MPA - adjustment to the boundary of an existing CFMP reserve on Tutuila	NA	DMWR	This is an ongoing effort of the NPS. Details of the action are unknown at this time.	Unknown

Source: Information in Table 6-1 is derived from Kendall and Poti in prep.
* includes the use of bleach, poisons and/or electrical shocking devices, and explosives

ASCMP	American Samoa Coastal Management Program, Department of Commerce
CFMP	Community-Based Fisheries Management Program
DMWR	Department of Marine and Wildlife Resources
DPR	Department of Parks and Recreation
km	kilometer
MNM	Marine National Monument
MPAs	Marine Protected Areas
NA	Not Applicable
NPS	National Park Service
ONMS	Office of National Marine Sanctuaries
SMA	Special Management Area
USFWS	U.S. Fish and Wildlife Service

As shown in Table 6-1 above, the extensive network of MPAs in American Samoa has been developed and managed by both territorial and federal agencies. The different designations of MPAs discussed above include:

- Eleven community-based fisheries reserves;
- Three special management areas;
- One no-take MPA;
- One territorial marine park;
- One marine national monument;
- One national wildlife refuge;
- One national marine sanctuary;
- Three national park units; and
- One private marine reserve.

The community-based fisheries reserves are territorial MPAs managed cooperatively between the DMWR Community-Based Fisheries Management Program (CFMP) and the local villages surrounding the reserves. The CFMP is intended to promote sustainable management of marine resources to protect and enhance fisheries stocks for future generations. This will be accomplished through mechanisms such as seasonal closures and fishing restrictions within

designated reserves, as agreed upon by village leaders and the DMWR (ASCA 24.1002 from Kendall and Poti in prep.). The reserves typically do not extend into the open ocean waters and generally encompass about ~0.1 to ~0.6 square km of marine environment.

The Special Management Areas (SMAs) are also territorial MPAs managed by the AS DOC. Designated by the American Samoa Coastal Management Act of 1990, SMAs were designed to protect areas that "possess unique and irreplaceable habitat, products or materials, offer beneficial functions or affect the cultural values or quality of life significant to the general population of the Territory and fa'a Samoa" (ASCA 26.0221). Their primary purpose is to regulate on-shore activities that could be harmful to unique marine ecosystems. Therefore the SMAs incorporate both marine waters and adjacent lands. Two of the three SMAs have MPAs greater than 1.2 square km, while the third has a much smaller area of marine protected waters.

The one no-take MPA is a territorial MPA designation managed by DMWR. The No-Take MPA Program, created by the American Samoa Government to "ensure protection of unique, various, and diverse coral reef habitat and spawning stocks" through permanent no-take areas" (Sunia 2000, Oram 2008) is a direct response from Governor Tauese Sunia's mandate to protect 20 percent of American Samoa's coral reefs as no-take MPAs. As indicted in the name, fishing is prohibited within the no-take MPA.

The territorial marine park in American Samoa was established "to protect its unique coral reef wildlife habitat while enabling the public to enjoy the natural beauty of the site" (PL 23-13, ASCA 18.0214). While management authority for the park lies with the Department of Parks and Recreation (DPR), the DMWR exercises primary authority over fishing regulations prohibiting fishing except for subsistence fishing and harvesting by local Ofu Island residents (Kendall and Poti in prep.). At the present time this park has no enforcement, monitoring, or management plan.

The marine national monument, national wildlife refuge, and national marine sanctuary are all federally-designated MPAs. As noted in Chapter 1, ONMS was created to designate and protect areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or esthetic qualities (16 U.S.C. Sec. 1431). The Rose Atoll Marine National Monument overlays the Rose Atoll National Wildlife Refuge.

The National Park of American Samoa was designated in 1988 to preserve and protect both terrestrial and aquatic resources of American Samoa as well "to provide for the enjoyment of the unique resources of the Samoan tropical forest by visitors from around the world" (Public Law 100-571). The National Park consists of 3 separate units on the islands of Tutuila, Ta'u, and Ofu. Management of the National Park maintains traditional Samoan customs and allows subsistence fishing by local American Samoans using traditional tools and methods in accordance with rules established by the National Park Service and village leaders (Kendall and Poti in prep.).

Tisa's private marine reserve at Alega Bay is privately held and managed. No information on the management, goals and restrictions of this reserve is available.

Figure 6-1 shows the location of all existing MPAs throughout American Samoa. The collective suite of existing MPAs protects approximately 32 square km of potential reef ecosystem (areas shallower than 150 m) and ~7 square km of coral reef habitats (Kendall and Poti in prep.). Rose Atoll adds an additional 35,000 square km of marine habitat. Despite the variety of agency involvement, size and location, the MPAs collectively are designed to protect biological resources and improve water quality.

MPAs with boundaries that are closer to the shoreline, such as the community-based fisheries reserves, likely have more impact on the local village and their customary marine tenure practices than on outsiders. MPAs, such as the SMAs, which are designed to regulate on-shore activities that might negatively impact marine resources, also have a greater impact on the local community for the same reason.

However, assuming that the existing and proposed MPAs are designed and managed in cooperation with the local villages they impact, the cumulative projects would have a beneficial impact on cultural and historic resources by providing a higher level of protection for these resources through the establishment of the MPAs. Marine resources near local villages are already subject to customary marine tenure practices throughout American Samoa. Local villagers use the waters near their village and a cultural system of limited or no use by outsiders is well established. Therefore, the MPAs likely have little impact on human uses and activities in near-shore waters. Typical tourist activities such as SCUBA diving, snorkeling, bird watching, ecotours, cruise ship visits, and more recreational boaters could be under taken by a local village but would not be determined by the MPA designation alone.

Typically, the further the MPA boundary extends into the ocean, the more likely it will have an impact on the American Samoa population as a whole since the marine resources beyond the reef flat (primarily offshore banks) are not associated with customary marine tenure. For example, the few small vessel commercial fisherman typically fish the offshore banks 20 to 30 miles from the shallow waters surrounding the islands (Wearing 2011), while recreational and sustenance boat-based fishers likely fish waters closer to shore, although data on effort and location are not available (Sabater 2010). MPAs that extend into deeper waters will more likely affect this type of fishing, as well as general vessel traffic, and potentially tourist and recreational activities.

The economic situation for commercial fishing in American Samoa is complex and is described in more detail in Chapters 3 and 5. The overall impact from the existing and proposed MPAs on fishing is significant if future MPAs include deeper waters offshore where commercial fishing operations are located. None of the MPAs listed in this section extend into these deeper waters.

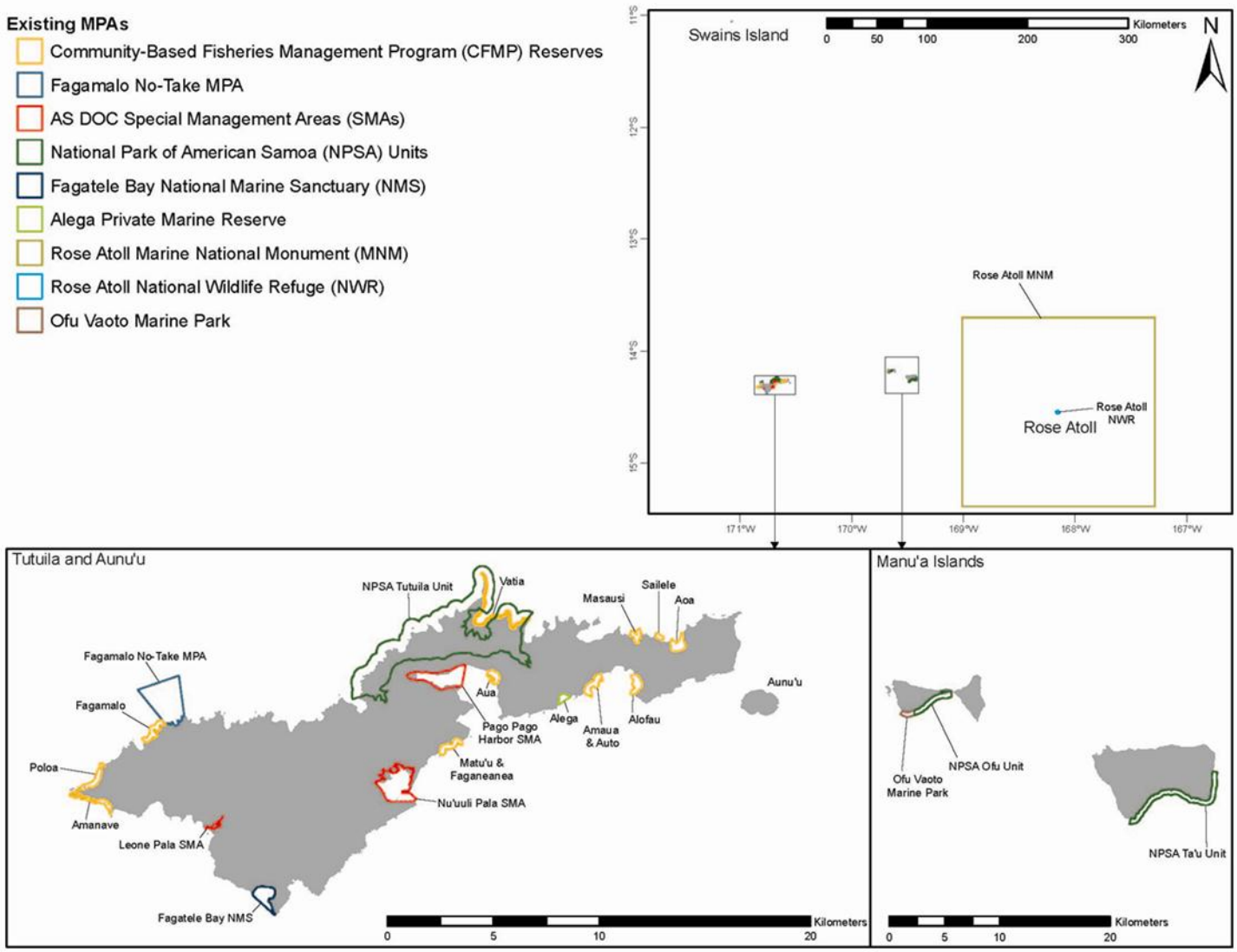

Figure 6-1: American Samoa Marine Protected Network.

Numerous MPAs listed in Table 6-1 have fishing restrictions, such as gear restrictions, no-take zones, anchoring restrictions, or no fishing for people outside of the local community. These restrictions may reduce fishing opportunities across the archipelago, while providing an overall beneficial effect on water quality and biological resources.

MPAs affecting vessel traffic, docking, and controlling access would reduce the likelihood of water quality degradation from spills or vessel discharges contributing to a beneficial cumulative impact. Overall, the existing and proposed MPAs could have a beneficial impact on the marine resources of American Samoa. The alternatives considered for Fagatele Bay National Marine Sanctuary are generally aligned with the growing trend of MPAs and with Governor Tauese Sunia's mandate to protect 20 percent of American Samoa's coral reefs as no-take MPAs.

Infrastructure Projects

There are a number of construction activities/actions considered under this cumulative impacts chapter that could directly or indirectly impact the marine resources of American Samoa, although most will likely have no direct impact on the marine resources of the proposed sanctuary units. A number of these projects relate to America Recovery and Reinvestment Act funding, set to expire in April 2012, and are described in more detail on the American Samoa Economic and Stimulus Recovery Office website (http://www.asesro.com/). These include more than $38 million in infrastructure projects to build new roads, community health centers, waste water systems, clean water projects, energy efficiency and other projects. More than $5 million has been allocated to install photovoltaic panels on government buildings, which will generate 5 percent of American Samoa's energy production capacity. More than $8 million has been allocated to improve highways, roads, and public transportation projects.

The American Samoan government recently awarded McConnell Dowell a shoreline protection contract to construct a 450 foot long rock seawall plus drainage at the Faga'itua Village on the main island of Tutuila. Details of the project are unavailable. The Samoa Port Master Plan (Lyon Associates 1999) is designed to address "the Port Facility's future development and infrastructure needs, which includes the Pago Pago Harbor commerce area and expansion of Fuel Dock and Main Dock" (Lyon Associates 1999). It describes a series of projects which would improve and possibly expand harbor facilities. These projects include:

- Extension of container dock out 40 feet into the Harbor;
- Extension of main dock 400-500 feet towards the market place;
- Connect fuel dock with container dock;
- Align the water front docks/wharves from fuel dock to the main dock, including the new extension;
- Extend the port area to the point of inland boundary;
- Identify potential sources of financing to accomplish the determined future development and infrastructure needs; and
- Develop an operation and maintenance plan for the port facilities.

The recommendations within the Port Master Plan center on the improvement of port facilities and operations to enhance the experience of cruise ship passengers as well as increasing the capacity of the harbor to accommodate more freight. All freight services have to be suspended in order to facilitate the docking of a cruise ship in the harbor. This mode of operation creates inefficiencies with the import and export of containers and lowers the turnover rate of goods transiting through the harbor. By increasing dock space within the harbor and allowing for concurrent cruise ship docking and freight transfer, the economic loss will be minimized. An expansion of tourist services includes installing utilities within the harbor (i.e. restrooms and potable water) as well renovating historic buildings in the harbor to serve as a tourist attraction. These efforts, if completed, could increase the quality of visitor experiences, ultimately bringing more people to American Samoa which may in turn increase use of the sanctuary. The increased capacity for freight services will bring additional revenue into the territory.

Increased capacity of the small boat facilities is also discussed within the Samoa Port Master Plan. This action can be expected to have a positive effect on the number of tourists visiting American Samoa and the sanctuary unit, thus increasing the opportunity to foster an understanding of and a sense of stewardship for the sanctuary. In May of 2011, $18 million in funding was requested to the U.S. House Committee on Transportation and Infrastructure for design and construction of harbor facilities at Leone Village, Aunu'u and Auasi, as well as improvements to the harbors at Ta'u, Faleasao and Ofu (www.SamoaNewsOnline.com).

Other recommendations within the plan relate to improvements of the port to accommodate more fishing vessels and the needs of the tuna cannery. Given the closure of one of the tuna processing facilities since the development of this plan, these recommendations may be less relevant at this time.

While the Port Master Plan could increase overall vessel traffic within the territory, the modernization of facilities could provide beneficial impacts to water quality, human health and safety, as well as a variety of human uses. Both projects could be expected to improve the socioeconomic environment of the territory.

Table 6-2 summarizes the two infrastructure projects described above.

Table 6-2: Cumulative Projects – Infrastructure.

Project & Location	Implementation Date	Project Sponsor	Project Description
ARRA Infrastructure Projects	Ongoing	U.S. Government	Road improvements, shoreline protection, waste water systems, clean water, and energy efficiency projects
Samoa Port Master Plan Located in Samoa Port, Tutuila	Unknown	American Samoan Government	Project designed to address the Port Facility's future development and infrastructure needs

Sources:
1. http://www.asesro.com
2. Samoa Port Master Plan, Lyon Associates, 1999

Overall, the cumulative impacts of these two known infrastructure projects will improve nearshore water quality, which will benefit all coral reef ecosystems within the territory. They also have the capacity to improve American Samoa as a tourist destination, which would likely increase overall sanctuary use, which currently is very low. This would likely improve cumulative human uses in the territory.

6.3 SUMMARY OF CUMULATIVE EFFECTS

The above described projects and activities are separated into two types; resource protection through management and infrastructure projects. Determining the cumulative impacts from these two categories of projects is highly speculative, as the management actions are designed to control human uses, primarily fishing, in order to protect specific marine resources, while infrastructure projects generally improve socioeconomic conditions to the entire population, although at times at the expense of natural resources. Coastal construction, including road development and harbor improvements, can have short- and mid-term adverse impacts to water quality and nearshore habitats, and the creatures that rely on these waters. Because the ongoing and proposed infrastructure activities will not be occurring adjacent to proposed sanctuary units, the cumulative impacts are negligible when compared to the impacts of this action. A single exception may be the impact to the tourism industry, where infrastructure improvements and MPA designation (including this action) may provide a cumulative beneficial impact. With regards to ongoing and future MPA designation, developing a scientifically-based and public-supported network of protected sites across the archipelago is expected to have a cumulative benefit on marine resources, including safeguarding ecological hotspots in the event that human uses, including the implementation of coastal infrastructure projects, cause long-term adverse impacts to habitats outside of the MPAs. Overall, the cumulative impacts of the above described projects will have a negligible impact on the natural resources within the proposed sanctuary boundaries and the human resources across American Samoa.

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INDEX

bumphead parrotfish, 66, 96, 100, 350, 353

climate change, 17, 27, 29, 81-82, 89, 120-123, 171, 183, 187, 203, 205, 209, 213, 216-225, 234, 243, 247, 249, 251, 264, 266, 269, 274-275, 277, 282-283, 310, 336

community engagement, 27, 183, 187, 189, 194, 202-203, 205, 209, 216, 225, 234, 237, 249, 266, 274, 277, 281, 303, 308, 309, 324-325, 337

condition report, 7, 11, 18, 25, 120, 205-206, 220, 249, 306

coral bleaching, 22, 84, 122, 151, 171, 216, 219, 221, 253, 261, 306

coral disease, 15, 131, 134-135, 157, 171, 179, 181, 209, 221, 317, 319

crown-of-thorns starfish, 10, 27, 29, 34, 48, 52, 60, 71, 73, 92, 132, 179, 306, 335

Ecosystem Based Management, 3

fa'a-Samoa, 4, 8, 23, 46, 101, 103, 109, 189, 190, 194, 195, 196, 202

giant clam, 34, 60, 71, 73, 92-93, 95, 109, 110, 115, 125-126, 131, 169, 174, 179, 303, 306, 308, 324, 335-336, 338, 343, 354

giant trevally, 66, 96, 303, 336, 350, 353

grouper, 66, 86, 95-96, 111, 154, 306, 307, 337, 350

jack, 85, 94-96, 110, 179

Le Tausagi, 10, 12, 144, 222, 223, 235, 238, 244, 245, 267, 269

Leone Bay, 38, 39, 106, 144

Nafanua Bank, 86, 144, 162, 164, 339, 340, 352

Pala Lagoon, 38-39

Preserve America, 14, 196, 202, 269, 292

public scoping, 6-9, 20, 22, 25, 37-39, 41, 43, 45, 119, 183-184, 237, 255, 279

R/V Manumā, 17, 47, 151, 226, 270

sea turtle, 6, 34, 48, 52, 60-61, 71, 73, 85, 88, 97, 99, 127, 130, 147, 154, 252, 265, 291, 306, 320, 322, 334, 344

Taema Bank, 86, 132, 144, 339, 342

Two Samoas Initiative, 30, 41

Vailulu'u Seamount, 32, 55, 68, 71, 76, 86, 172, 174, 323, 345, 351

water quality, 4, 11, 13-15, 18, 38, 75, 77, 79-81, 123-125, 127-129, 151-152, 157, 161, 165-166, 169, 172, 178, 208, 245, 253, 260, 263, 271, 290, 294, 303, 305, 316, 318, 327, 330, 334, 346, 349, 366, 368-370

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APPENDIX A: GLOSSARY

This glossary presents the pronunciation and definition(s) of Samoan terms that appear in the main text of the document. Place names and proper nouns are excluded from this glossary.

aiga \ī-**ng**-ə\ \eye-ING-ah\ : family

aiga potopoto \ ī-**ng**-ə pō-tō-pō-tō \ \eye-ING-ah poh-toh-poh-toh\ : group of extended family members who acknowledge a common allegiance to a particular matai

alamea \äl-ä-mā-ä\ \ah-lah-may-ah\ : crown-of-thorns starfish

ali'i \ä-lē-ē\ \ah-lee-ee\ : high chiefs

alia \ä-lē-ä\ \ah-lee-ah\ : traditional, double-hulled, wooden canoe ; **also** : modern, double hull, aluminum boat

alili \ä-lē-lē\ \ah-lee-lee\ : turbo snail

atule \ä-tü-lā\ \ah-too-lay\ : bigeye scad or horse mackerel (a type of marine fish) harvested traditionally in Samoa

aumaga \aů-mäng-ä\ \ow-mong-ah\ : the group of untitled and young men in a village, who often provide community service

fa'amatai \fä-ä-mä-tī\ \fah-ah-mah-tie\ : the traditional chiefly system

fa'a-Samoa \fä-ä-sä-mō-ä\ \fah-ah-SAH-mo-ah\ : the traditional Samoan lifestyle, or way of life

fa'alavelave \fä-ä-lävā-lävā\ \fah-ah-lahvay- lahvay\ : gatherings among communities and extended families for events such as weddings, funerals, and other important events where traditions are observed and ritual exchanging of gifts takes place

fale \fä-lā\ \fah-lay\ : traditional Samoan house

fautasi \fä-ü-tä-sē\ \fah-oo-tah-see\ : traditional long boat typically rowed by 50 people

fe'e \fā-ā\ \fay-ay\ : octopus

fono \fō-nō\ \foe-no\ : meeting

Fono, the \fō-nō\ \foe-no\ : territorial Legislature of American Samoa

i'a sa \ē-ä-sä\ \ee-ah-sah\ : sea turtle (general term, literally "sacred fish")

i'asina \ē-ä-sē-nä\ \ee-ah-see-nah\ : juvenile goatfish

laumei fai uga \laů-mā-ē fäē-ün-gä\ \low(as in cow)-may-ee fah-ee oon-gah\ : hawksbill sea turtle

laumei meamata \laů-mā-ē mëä-mä-tä\ \low(as in cow)-may-ee mee-ah-mah-tah\ : green sea turtle (see also *tuālimu*)

limu \lē-mü\ \lee-moo\ : seaweed, seagrass, moss and freshwater weed

lupotā \lü-pō-**tä**\ \loo-poh-TAH\ : the term used for jacks (general term for the Carangidae family of marine fish) once they have reached about six inches in length

malau \mä-laů \ \mah-low (as in cow)\ : red squirrelfish (general term for this type of marine fish)

manumā \mä-nü-**mä**\ \mah-new-MAH\ : rainbow or many-colored fruit dove (also the name of the sanctuary's research vessel)

matai \mä-tī\ \mah-tie\ : chief

muliāva \mü-lē-**ä**-vä\ \moo-lee-AH-vah\ : end of the current (also the name for the sanctuary unit proposed at Rose Atoll)

'*oso* \ō-sō\ \oh-so\ : stick used in traditional agricultural planting or digging

palolo \pä-lō-lō\ \pah-low-low\ : sea worms traditionally harvested during their mating season in October or November

Sa'o \sä-ō\ \sah-oh\ : leading matai or chief

saofa'iga ale nuu \sä-ō-fä-ēng-ä ä-lā nü-ü \ \sah-oh-fah-ing-ah ah-lay new-oo\ : village council meeting

tapu \tä-pü\ \tah-poo\ : restrictions or things forbidden (similar to taboo)

tausagi \taů-säng-ē\ \tow(as in cow)-song-ee\ : bird song or dawn chorus of birds (*Le Tausagi* is a consortium of environmental education staff from various territorial and federal agencies that provides environmental education and outreach programs throughout American Samoa)

tautai \taů-tä-ē\ \tow(as in cow)-tah-ee\ : the master fisherman of a village

tautua \taů-tü-ä\ \tow(as in cow)-too-ah\ : the practice of serving one's family and community

tia seu lupe \tē-ä sā-ü lü-pā\ \tee-ah say-oo loo-pay\ : large, often star-shaped, raised platforms typically 2-15 feet (0.6 to 4.5 m) high, also known as "star mounds", built primarily in the last 500 years, and associated with the activities of higher ranking individuals to snare and catch pigeons

Tui Manu'a \tü-ē mä-nü-ä\ \too-ee mah-new-ah\ : the oldest and most sacred paramount chief title of the Manu'a Islands

tuitui \tü-ē-tü-ē\ \too-ee-too-ee\ : the type of sea urchin most commonly harvested by Samoans

tulafale \tü-lä fä-lā\ \too-lah fah-lay\ : talking chiefs or orators

tupua \tü-pü-ä\ \too-poo-ah\ : legendary, sacred stones, rocks or formations that represent ancient humans

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APPENDIX B: LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS RECEIVING COPIES OF THE DEIS

The Honorable Togiola T.A. Tulafono
Governor, American Samoa Government
Pago Pago, American Samoa

The Honorable Alexander Jennings
Swains Island Representative, Fono

Mr. Faleseu Paopao
Director, American Samoa Department of Commerce
Pago Pago, American Samoa

Mr .Nate Ilaoa
Manager, American Samoa Coastal Zone Management Program
Pago Pago, American Samoa

Mr. Hideyo Hattori
Coral Reef Initiative Coordinator, American Samoa Coral Reef Advisory Group
Pago Pago, American Samoa

Ms. Carolyn Doherty
NOAA Coral Reef Management Fellow, American Samoa Coral Reef Advisory Group
Pago Pago, American Samoa

Mr. Lelei Peau
Chair, American Samoa Coral Reef Advisory Group
Pago Pago, American Samoa

Ms. Alice Lawrence
MPA Coordinator, American Samoa Department of Marine and Wildlife Resources
Pago Pago, American Samoa

Ufagafaga Ray Tulafono
Director, American Samoa Department of Marine and Wildlife Resources
Pago Pago, American Samoa

Fanuatele, Dr. Toa'fa Vaiaga'e
Director, American Samoa Environmental Protection Agency
Pago Pago, American Samoa

Dr.ClaireTuia-Poumele
Director, American Samoa Department of Education
Pago Pago, American Samoa

Dr. Seth Galeai
President, American Samoa Community College
Pago Pago, American Samoa

Mr.DavidHerdrich
Director, American Samoa Historic Preservation Office
Pago Pago, American Samoa

Tufele F. Liamatua
Director, Office of Samoan Affairs
Pago Pago, American Samoa

Tapatonu Gaoteote
Eastern District Governor, Office of Samoan Affairs

Galu T. Satele
Western District Governor, Office of Samoan Affairs

J.Hudson Misaalefua
Manu'a District Governor, Office of Samoan Affairs

Matagi Ray McMoore
Director, American Samoa Department of Port Administration
Pago Pago, American Samoa

Mr. David Vaeafe
Executive Director, American Samoa Visitors Bureau
Pago Pago, American Samoa

Gaoteote Palaie Tofau
Senate President, ASG-Legislative Branch
Fagatogo, American Samoa

Savali Talavou Ale
House Speaker, ASG-Legislative Branch
Fagatogo, American Samoa

Senator Amituanai Eteuati
Chair, Fono Communications and Fisheries Committee
Fagatogo, American Samoa

Senator Malepeai Setu
Vice Chair, Fono Communications and Fisheries Committee
Fagatogo, American Samoa

Senator Fuata T. I'atala
Chair, Fono Economic Development Committee
Fagatogo, American Samoa

Senator Mauga T. Asuega
Vice Chair, Fono Economic Development Committee
Fagatogo, American Samoa

Senator Fuamatu J.V. Fuamatu
Chair, Fono Marine and Wildlife Committee, and Parks and Recreation Committee
Fagatogo, American Samoa

Senator Asuega F. Lauvai
Fono Parks and Recreation Committee
Fagatogo, American Samoa

Senator Letalu Maui
Vice Chair, Fono Marine and Wildlife Committee
Fagatogo, American Samoa

Representative Simei Pulu
Chair, Fono Department of Public Works/Parks and Recreation
Fagatogo, American Samoa

Representative Puletu D. Koko
Fono Department of Public Works/Parks and Recreation
Fagatogo, American Samoa

The Honorable Doc Hastings
Chairman, House Natural Resources Committee
Washington, D.C.

The Honorable Edward Markey
Ranking Member, House Natural Resources Committee
Washington, D.C.

The Honorable Colleen Hanabusa
House Natural Resources Committee & Subcommittee on Fisheries, Wildlife, Oceans and Insular Affairs, Washington, D.C.

The Honorable John D. Rockefeller IV
Chairman, U.S. Senate Committee on Commerce, Science, and Transportation
Washington, D.C.

The Honorable Kay Bailey Hutchison
Ranking Member, U.S. Senate Committee on Commerce, Science, and Transportation
Washington, D.C.

The Honorable Daniel Inouye
U.S. Senate Committee on Commerce, Science, and Transportation
Washington, D.C.

The Honorable Eni F.H. Faleomavaega
House Natural Resources Committee
Washington, D.C.

Rear Admiral Charles W. Ray
Commander, 14th Coast Guard District, U.S. Coast Guard, 14th District
Honolulu, Hawaii

Lieutenant Trevor Parra
U.S. Coast Guard, American Samoa
Pago Pago, American Samoa

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