

STATUS OF THE CORAL REEFS IN AMERICAN SAMOA

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Introduction

The Territory of American Samoa is a group of five volcanic islands and two atolls in the central South Pacific Ocean. These islands are small, ranging in size from the populated high island of Tutuila (142 km²) to the uninhabited and remote Rose Atoll (4 km²). The total area of coral reefs (to 100 m) in the territory is 296 km² (Table 33).

Island/Bank	Island Type	Area Size (km ²)	Coral Reef Area (km ²)	Reef Type
Tutuila	Volcanic	142.3	243.0	Fringing, non-structural
Ofu	Volcanic	7.5	3.2	Fringing
Olosega	Volcanic	5.4	2.0	Fringing
Ta'u	Volcanic	45.7	1.7	Fringing, non-structural
Aunu'u	Volcanic	1.8	0.5	Fringing
Suvaivi	Atoll	0.1	3.3	Atoll
Rose	Atoll	0.1	7.0	Atoll
Nafanua Bank	-	N/A	6.0	Submerged bank/atoll
Taama Bank	-	N/A	4.0	Submerged bank/atoll
Outer banks	-	N/A	25.0	Submerged bank/atoll
Total		203	296	

Table 33. American Samoan island's and their coral reef area (Source: Hunter 1995).

The Samoan reefs support a diverse assemblage of 890 fishes, 200+ corals, and 80 algal species. These reefs provide an important source of food for villagers through daily subsistence use and sales at local stores. They also provide invaluable infrastructure and shoreline protection from storm wave action. Other potential uses of the reefs are low at present (e.g., tourism, or the extraction of reef products for aquariums).

Condition of Coral Reefs

Due to the steepness of the main islands, shallow water habitats around the islands are limited and consist primarily of fringing coral reefs (85%) with a few offshore banks (12%), and two atolls (3%). The fringing reefs

have narrow reef flats (50-500 m); depths of 1000 m are reached within 2-8 km from shore.

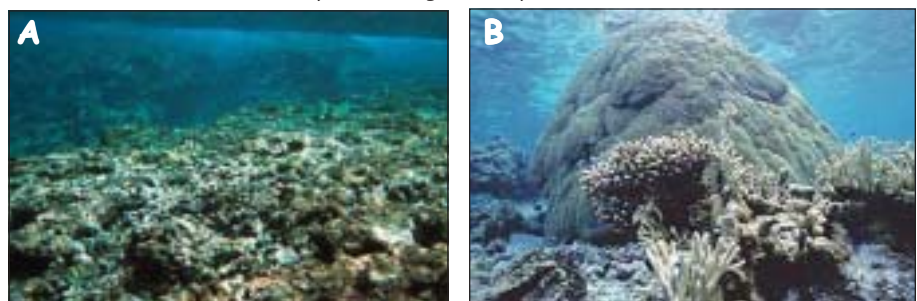
Coral – The coral reefs are currently recovering from a series of natural disturbances over the past two decades: a crown-of-thorns starfish invasion (1979), three hurricanes (1986, 1990, 1991), and a period of warm water temperatures that caused mass coral bleaching (1994) (Fig. 261). Additionally, there are chronic human-induced impacts in areas like Pago Pago Harbor (Craig *et al.* 2000a).

By 1995, the corals were beginning to recover, as evidenced by an abundance of coral recruits (Mundy 1996, Birkeland *et al.* 1997). Coral growth has continued through 2000, but a full recovery will take time. There have also been improvements to reefs in Pago Pago Harbor by the removal of 9 shipwrecks; and another shipwreck was removed at Rose Atoll (Green *et al.* 1998). Additionally, the export of 'live rock' from coral reefs was banned in June 2000.

Algae – Information is limited, but with a few exceptions, the algae found around the islands indicate a low-nutrient environment and/or heavy grazing by herbivores. Encrusting coralline algae cover (*Porolithon*) is high (40-50%). These algae help cement and stabilize the loose surface below (Birkeland *et al.* 1997).

Fish and Harvested Invertebrates – Despite the on-going recovery of corals on local reefs, many fish and invertebrates are not recovering as quickly. Harvested species such as giant clams and

Figure 261. After being impacted by hurricanes (A), a crown-of-thorns starfish outbreak, and coral bleaching, reefs in American Samoa are now recovering (B). (Photos: National Park of American Samoa and Kip Evans, Fagatele Bay NMS).



parrotfish are overfished (Fig. 262), and there is heavy fishing pressure on surgeonfish (Craig *et al.* 1997, Page 1998, Green and Craig 1999). Fewer and/or smaller groupers, snappers, and jacks are seen. Most village fishermen and elders believe that numbers of fish and shellfish have also declined (Tuilagi and Green 1995). Also, in some areas, fish are now toxic with heavy metals, particularly those from Pago Pago Harbor (AECOS 1991).

Since 1995, the nighttime artisanal spear fishermen began using SCUBA gear, greatly increasing their catches. This led to a territorial ban on SCUBA-assisted fishing in April 2001.

Sea Turtles – Often overlooked as a part of the coral reef ecosystem, Hawksbill sea turtles feed on reef sponges and other organisms. hawksbill populations are in serious decline for two major reasons: 1) illegal harvest and 2) loss of nesting habitat (Tuato'o *et al.* 1993). The hawksbill is listed as endangered and is rapidly approaching extinction in the Pacific (Eckert *et al.* 1995).

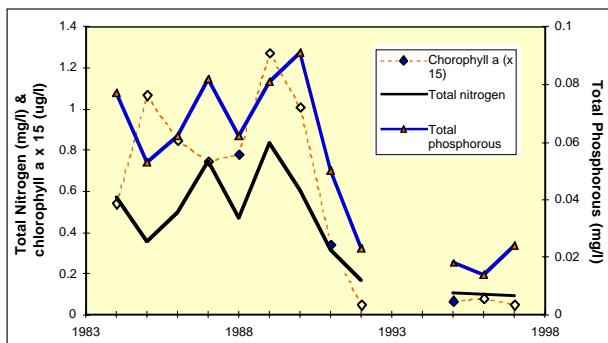


Figure 263. Improvements in water quality in inner Pago Pago Harbor after canneries were required to dispose of wastes beyond the inner harbor in 1991. Actual values of chlorophyll a are 15 times greater than values shown graphically. (Source: ASEPA 2000).

Green sea turtle populations in the South Pacific have declined as well and should probably be classified as endangered (Eckert *et al.* 1995). Conservation efforts are complicated by the turtles' complex migration patterns. Some migrate from American Samoa to both Fiji and French Polynesia. Conserving 'shared' turtle populations will require international cooperation.

Water Quality – Due to the steepness of the islands and their limited development of shallow water habitats, the continual flushing by ocean currents provide generally good water quality. There are three exceptions: 1) sedimentation from

improper land use practices that pours into coastal waters after heavy rains, 2) nutrient enrichment from human and animal wastes in populated areas, and 3) contamination in Pago Pago Harbor.

Pago Pago Harbor suffers from two kinds of pollution. First, fish and substrates in the harbor are contaminated with heavy metals and other pollutants (AECOS 1991). Second, nutrient loading from cannery wastes in the inner harbor formerly caused perpetual algal blooms and occasional fish kills due to oxygen depletion. In the early 1990s, the canneries were required to dispose of their wastes beyond the inner harbor (Fig. 262), greatly reducing nutrient levels.

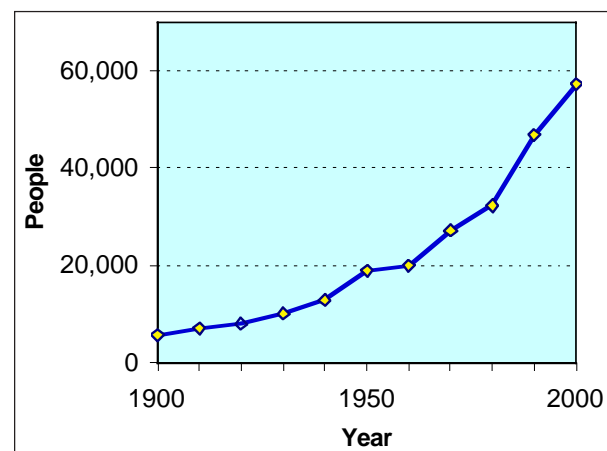


Figure 262. Today, giant clams are rare in populated areas of American Samoa (Photo: Nancy Daschbach).

Coastal Populations and Reef Economics

American Samoa's population was 57,300 in 2000. During the past 10 years, the population increased by 10,500 people, an increase of 22%. The population is increasing at a yearly rate of 2.1%, adding about 1,200 people each year (Fig. 264). It is expected to continue, given the high birth rate (4.0 children per female), the fact that 50% of the population is younger than age 20, and the high immigration rate. Adverse human-related impacts will likely increase with rapid population growth.

Figure 264. Population growth in American Samoa.



A recent Governor's Task Force on Population Growth report called for a population ceiling of 115,000. This ceiling is calculated on resources (particularly drinking water) and the diminishing quality of life. An action plan for the Territory identifies specific steps to reduce birth and immigration rates (Craig *et al.* 2000b).

More than 18,000 tourists (calculated in 1995) visit the islands annually and expend over \$10 million (calculated on tourist receipts from 1990, United Nations Economic and Social Commission for Asia and the Pacific 2002).

In 2001, ex-vessel landings from small boats in the domestic commercial fisheries generated \$2 million (NMFS 2001). However, the actual economic impact of commercial fisheries in American Samoa is far greater when distant-water tuna harvests are included. These fish are processed in two local canneries in Pago Pago Harbor. Their ex-vessel value from both foreign and domestic vessels was approximately \$232 million (Western Pacific Fishery Management Council 1999). American Samoans still rely on local coral reefs for food, and it is estimated that the reefs provide an economic base of \$1 million per year (Fig. 265).

Environmental Pressures on Coral Reefs

Human Stresses – At a recent workshop on coral reefs in American Samoa (Craig *et al.* 1999), the following list of human-related threats was identified and ranked.

High

- Overfishing of reef resources
- Coastal development and habitat destruction
- Oil and hazardous waste spills in Pago Pago Harbor

Medium

- Sedimentation
- Dumping/improper waste disposal
- Nutrient loading/eutrophication in Pago Pago Harbor

Low

- Nutrient loading/eutrophication elsewhere
- Oil and hazardous waste spills elsewhere
- Ship groundings
- Anchor damage
- Destructive fishing habits
- Marine debris from marine sources
- Alien species (e.g., from ballast water)
- Crown-of-thorns starfish predation
- Coral diseases
- Collections for the aquarium market
- Bio-prospecting/natural products

Natural Stresses – American Samoa lies close to a warmer than usual mass of seawater that tends to form south of the territory during La Niña years. Nearby Fiji and Western Samoa have been hit hard by mass coral bleaching in recent years, so it would seem probable the reefs of American Samoa may be similarly impacted.

Current Conservation Management

Mapping – American Samoa needs coral reef habitat mapping. NOAA habitat mapping activities are planned to begin in 2002. Fagatele Bay National Marine Sanctuary supported a multibeam mapping effort in 2001 that resulted in maps for the sanctuary and Pago Pago Harbor, with partial coverage elsewhere (D. Wright pers. comm.). This information is available on their web site (Oregon State University 2002).

Monitoring and assessment of coral reefs has been conducted in one of three ways to date: one-time surveys, long-term monitoring, and fisheries monitoring. One-time surveys of corals and fishes have been conducted over the years using various methods/sites/depths on all seven islands in the territory (e.g., Hunter *et al.* 1993, Green 1996, Mundy 1996, Green and Hunter 1998). Some of the data from these may be incorporated into future monitoring programs.

Water quality in Pago Pago Harbor has been monitored since 1984 (ASEPA 1998). Corals, other invertebrates, fish, and algae have been monitored by Birkeland *et al.* (1997) for nearly 20 years in Fagatele Bay National Marine Sanctuary and in

Figure 265. Both commercial and subsistence fisheries play an important role in American Samoa (Photo: National Park of American Samoa).





Figure 266. Coral reef monitoring in Fagatele Bay National Marine Sanctuary (Photo: Kip Evans).

lesser detail at other Tutuila locations (Fig. 266). Corals along an historical transect on a Pago Pago Harbor reef flat have been monitored on several occasions since 1917 (Green *et al.* 1997).

Limited harvest information is available for fish and invertebrates caught on the surrounding coral reefs. Declining subsistence catches were monitored in 1979 and 1991-1995 (Wass 1980, Saucerman 1996), but the surveys were discontinued. The artisanal (small-scale commercial) catch was monitored in 1994 – it is currently assessed via market invoices, but compliance by vendors is incomplete, so the harvest levels are not well known. Three studies have examined fishing pressure on harvested surgeonfish (Craig *et al.* 1997), parrotfish (Page 1998) and giant clams (Green and Craig 1999).

In 2002, a workshop was held to develop a territorial monitoring plan for coral reefs in the territory. Also, NOAA's *Townsend Cromwell* conducted a survey in 2002 of all the islands including manta tows, fish and coral surveys, and mapping.

MPAs – There are four Marine Protected Areas (MPAs) in American Samoa, one of which is a no-take area (Rose Atoll, Table 24). Together, these MPAs account for about 6% of the territory's coral reefs. But protection in

these areas through regular surveillance and enforcement is generally lacking. In the main islands where overfishing occurs, there are no no-take MPAs.

Poaching in all MPAs is an problem. Page (1998) determined that 9% of the

local artisanal fishery occurs illegally within the National Park of American Samoa on Tutuila Island.

Government Policies, Laws, and Legislation

Legislation is in place for water quality standards, land use regulations, waste disposal, fishery management, habitat protection, endangered species, protected areas, ship pollution, and other environmental issues. Environmental violations are more frequently detected and prosecuted, but enforcement of these regulations is not widespread and many problems persist.

Local environmental agencies have also undertaken aggressive education programs to increase community awareness and understanding of environmental issues. This effort is commendable, but it is difficult to keep pace with the territory's rapidly growing population and development pressures.

Gaps in Current Monitoring and Conservation Capacity

On-island expertise in environmental protection has increased in recent years. Various research, monitoring, and environmental compliance efforts are conducted by several groups within the Department of Marine and Wildlife Resources, the American Samoa Environmental Protection Agency, the Department of Commerce and Fagatele Bay National Marine Sanctuary, American Samoa Community College, and the National Park of American Samoa (Craig and Basch 2001).

Nonetheless, these programs are generally small and would benefit from increased on-island capacity. Also, there is little on-island expertise to accurately identify the Indo-Pacific corals and fishes found on local reefs (200+ and 890 species, respectively). Consequently, it is necessary to

Table 24. Existing MPAs in American Samoa.

MPA	Island	Area Size (km ²)	Coral Reef Area (km ²)	Percent of Territorial Coral Reefs	No-take Status	Adequate Enforcement
Rose Atoll National Wildlife Sanctuary	Rose Atoll	158.8	7.0	2.4%	Yes	No
National Park of American Samoa	Tutuila, Ofu, Ta'u	9.1*	9.1	3.1%	No	No
Fagatele Bay National Marine Sanctuary	Tutuila	0.7	0.7	0.2%	No	No
Vaoto Territorial Park	Ofu	0.2	0.2	0.1%	No	No
Total		168.8	17.0	5.8%		

focus on indicator species so the local staff can monitor key reef resources at appropriate intervals.

Conclusions and Recommendations

To date, coral reefs in American Samoa have been resilient to a series of natural perturbations, although full recovery may take another decade. The message for managers is that the reefs will recover no additional human pressure, but there are several examples where serious harm has already been done, particularly overfishing of reef resources, reduced water quality in populated areas, and loss of turtle nesting beaches to coastal construction. Climatic change has uncertain consequences for local reefs. Several areas needing additional work for coral reef conservation in the Territory.

Expand coral reef monitoring efforts, but focus the objectives. Most quantitative monitoring efforts in American Samoa might be characterized as ecological monitoring that tracks changes in the ecosystem over time. These studies have provided valuable insight, highlighting that coral reefs are very dynamic systems.

From another perspective, however, these studies do not address questions commonly faced by coral reef managers. Such things as “Is overfishing occurring?” “Is sediment from poor land-use practices harming the reef?” Consequently, any monitoring program must clearly identify 1) who is the intended user of the data, and 2) what parameters should be measured to provide that information. In addition to this management-driven approach, a monitoring program in American Samoa should be 1) achievable with local staff, although off-island scientific expertise may be needed to address some issues, 2) stable to rotations of technical staff who are typically hired on 2-year contracts, 3) comparable to other programs as much as possible, and 4) open to community input and management.

Restart monitoring of coral reef fisheries. A workshop in American Samoa identified overfishing as the major problem hindering recovery of local reefs (Craig *et al.* 1999). It is essential to collect basic harvest data to monitor trends in total catch, catch-per-unit-effort, etc.

Improve land-use practices that impact water quality. Despite welcome improvements in water quality in Pago Pago Harbor, coral reefs there have not fully recovered nor is there safe swimming or

uncontaminated fish in the harbor. A phased recovery plan is needed to build on the progress already made. Harbor fish and sediments also need to be re-tested for toxicity at regular intervals. Additionally, improvements in land-use and waste disposal practices are needed to reduce sedimentation and pollutants (Fig. 267).

Create a territorial network of no-take marine protected areas. There are two issues here. First, existing MPAs in the territory are not adequately enforced. Second, no-take MPAs are needed in the main islands where there is overfishing.

Create a regional network of MPAs. A meaningful effort to protect coral reef resources requires a regional approach. In addition to the issue of larval transport of reef fishes and invertebrates, sea turtles provide an excellent example of a shared resource that binds the islands in the region together. Tagging data show green sea turtles nest in American Samoa and migrate to both Fiji and Tahiti to feed, so conservation efforts are needed at both ends of their migration routes. The South Pacific biogeographic region needs a network of MPAs to address these issues.

Figure 267. Land-use practices within nearby watersheds affect coral reef health through their influence on sedimentation and nutrient levels (Photo: Kip Evans).



