

SAMOA

MARINE ECOSYSTEM SERVICE

VALUATION

Summary Report





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Introduction

This study, conducted in early 2020, aimed to **determine the economic value of seven marine and coastal ecosystem services in Samoa**. The assessment focuses on the value of ecosystem services in the year 2019 and provides information on trends over time where possible. The global Covid-19 pandemic that started in 2020 has had significant impact on the use and values of some marine ecosystem services in Samoa. In particular, the number of tourists, and consequently the value of coastal environment to tourism, has dropped dramatically in the past year. On the assumption that the use of marine ecosystem services is likely to rebound to pre-Covid levels when the pandemic is brought under control, this study considers 2019 values to be a better representation of ecosystem service values for the purpose of long-term decision making. This study forms part of the broader Marine Spatial Planning (MSP) project that aims to support countries moving to address environmental threats and to build sustainable marine resource management systems.

The role that natural ecosystems, especially marine and coastal ecosystems, play in human wellbeing is often overlooked or taken for granted. The benefits humans receive from ecosystems, called *ecosystem services*, are often hidden because markets do not directly reveal

their value - **nature provides these benefits for free**. These can be broadly categorised into provisioning, regulating and maintenance and cultural services. **Failure to recognize the role that marine ecosystems play in supporting livelihoods, economic activity, and human wellbeing has, in many instances, led to inequitable and unsustainable resource management decisions.**

Coastal and marine resources and biodiversity provide Samoa's businesses, households and government many real and measurable benefits. Samoa has sovereign rights over the resources within its exclusive economic zone, an area totalling about 120,000 km² (more than 40 times Samoa's land territory). This report describes, quantifies and, where sufficient data is available, estimates the economic value of Samoa's key marine and coastal ecosystem services, in an effort to inform sustainable and equitable management decisions and support national marine spatial **planning**.

Seven key marine ecosystem services were evaluated in detail: subsistence fishing; commercial fishing; sand and aggregate mining; tourism; coastal protection; carbon sequestration; and marine research, education and management. Other services are explored as well, including cultural and traditional values associated with the sea, potential future industries, and other human benefits that have not yet been developed or analysed. The scarcity of data about many of these ecosystem services prevents calculation of the total economic value, so the values below should be regarded as minimum estimates. Data gaps and estimation methods are described in detail in the full report.



Fisheries

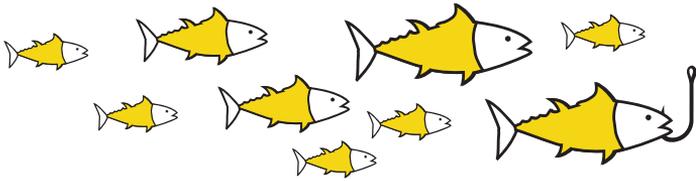
The fisheries sector in Samoa is divided into two categories: coastal and offshore. The coastal fisheries is further divided into coastal commercial and coastal subsistence, while the offshore or oceanic fishery targets mainly tuna and tuna-like species. Coastal fishing takes place in any reef, lagoon, mangrove, inter-tidal zones or other areas that have relatively shallow water and mostly have non-migratory fish and invertebrate species. A considerable amount of fishing takes place from the shore or in shallow waters, without the use of vessels. Where fishing vessels are used, they are generally small, either non-powered canoes, dinghies, or vessels with outboard motors. Offshore fisheries occur in deep water areas and open oceanic environments. Larger vessels of 8m to 20m in length powered by inboard engines are mostly used for commercial fishing for demersal species beyond the reef slopes and trolling for tuna in the open ocean areas.

Coastal subsistence fishing refers to harvesting of fish and other marine products for household consumption, given as gifts, or exchanged with other goods and services by fishers while the coastal commercial catch is mostly destined for sale at the local markets. This distinction is sometimes blurred, as anyone fishing trip may include commercial, subsistence and recreational activities. Tuna fisheries is largely exported.

Subsistence fisheries

The study uses data from 2018 Household Income and Expenditure Survey, socio-economic fisheries survey (2014), Gillett (2014, 2016, 2018), the Fisheries Division market database and Food and Agriculture Organisation (2017, 2019) reports to estimate subsistence catch. The catch was estimated to be between 5,000 mt to 5,438.5 mt, giving a net annual benefit from subsistence fishing of SAT\$48,125,000 and SAT\$52,345,562. A range is given for the subsistence production estimates to compensate for uncertainty about the quantity of production.

Despite the uncertainty in subsistence fishing data, the proximity of households to marine resources and the limited income available to many Samoan households to purchase imported and/or processed foods indicate that subsistence fishing is and will continue to be important for food security of Samoan families. This is particularly true for families close to nearshore lagoon, reef, and mangrove habitats that are accessible to fishing with minimal costs.



Commercial fisheries

The domestic commercial fisheries also include deep-water bottom fishing, trolling and small-scale tuna longlining, but these are categorised as offshore fisheries in the Fisheries Division reports because the fishing activities are carried out on the outer-reef slopes and the open oceanic environments. Given the diverse nature of the fishery and constraints in deriving reliable cost data, the value-added ratio of 0.8 for **coastal commercial fisheries** in Samoa noted in (Gillett, 2014) was used. The production was estimated to be between 5,000 mt and 5,439 mt with a net value or producer surplus of between **SAT\$ 50 million to SAT\$ 54.4 million**.

Sea cucumber is consumed and marketed locally as a mixture of intestine (viscera) and body wall, mixed with seawater and with other invertebrate products and seaweeds. Of the 5 species consumed in Samoa, 3 species comprise 90% of the catch. The local industry has been estimated to annually contribute a net benefit of SAT\$139,165.20. Only a small number of fishers do bottom fishing where they are more likely to target emperors present in shallow depths rather than deep-water fishes. Based on Fisheries Division data, the average annual catch of deep bottom fish is estimated as 13.8 mt; and with a value added cost ratio of 0.8 giving annual net value estimate of SAT\$192,034. Trolling for pelagic fish such as tuna was estimated as 249 mt with a net value of SAT\$1,039,324. Catch from troll fishery varies depending on fishers access to FADs, other environmental factors and climatic variables influencing tuna biology and ecology. The artisanal longline tuna fishery data from the Fisheries Division indicates that average annual catch is about 23.8 mt with an annual net value of SAT\$ 344,541.

Tuna fisheries in Samoa are relatively smaller than most other Pacific Island Countries because of the small size of Samoa's EEZ. Nevertheless, tuna generates an important source of income for the government and remains the dominant fish export. The average annual total catch of tuna and tuna like species from Samoan waters was estimated as 2,871 mt. The average annual longline albacore catches account for over 75% of this tuna catch which is largely exported frozen to cannery in American Samoa. Yellowfin represents about 12% of total tuna catch while bycatch is relatively low around 3%. Main bycatch species include dolphinfish, wahoo and barracuda, which are all sold in local markets or to restaurants. Using data from the Forum Fisheries Agency (FFA), the annual net benefits (gross revenue minus costs) from tuna fishing is estimated to be between SAT\$7.78 million to SAT\$10.23 million (US\$ 2.96 -3.89 million). In addition, annual employment earnings were estimated at SAT\$5.2 million (US\$1.98 million), local purchases at SAT\$3.3 million (US\$1.24 million) and government revenue from license and access fee at SAT\$3.1 million (US\$1.18 million). Albacore stocks remain in a biologically healthy state, but its future prospects depend on local abundance, catch rates and economics. Some sharks and marlin species as by-catch have been over-exploited. The locally based foreign vessels and local vessels land all their catch in port in Samoa before it is exported to various destinations, thus supporting generation of local benefits such as employment and local purchases.

Sand and aggregate

Sand is extracted for commercial and private or individual use in Samoa. Information on the extraction activities by the different groups, and information on the location of the sites is unavailable. Dredged sand, coral chips and crushed coral chips are commodities commonly sold by concrete manufacturing companies which indicates that marine extraction of dead coral and sand are ongoing activities in Samoa. The total gross revenue derived from sales of sand permits in 2018/19 period was SAT\$26,430. However, this amount is an under-estimation of the value of this ecosystem service as there is no information on the volume of coastal sand that was extracted to accurately estimate the true economic value which also should take the negative externalities from beach mining and dredging to be subtracted from net revenues.



Tourism

The participants or consumers of marine and coastal tourism and recreation are diverse and can be from nearby communities, other parts of Samoa, or other countries. Therefore, tourism and recreation are categorised into international tourism and domestic recreation and tourism. Opportunities for tourism are dependent on the natural and cultural amenities that people find attractive, and the human-made amenities that



support travel, accommodation, and recreation. The extent to which tourism and recreation are considered ecosystem services depends on the extent that these activities depend on the natural ecosystems.

Approximately 172,496 international tourists visited Samoa in 2018 (Bureau of Statistics, 2020). There has been a steady increase in holiday visitors, but the (visiting friends and relatives) VFR in 2018 became the top reason to visit Samoa. An international visitor survey conducted by Samoa Tourism Authority in 2018 estimated that the average expenditure per person per visit was about SAT\$2,649 with average length of stay around 8.2 nights. The total international visitor expenditure was SAT\$514.1. The value of domestic tourism was estimated to be about SAT\$29.7 million. This latter value is limited to travel between Upolu and Savaii and reflects only one aspect the domestic tourism in Samoa.

Using data from the international visitor survey reports, the gross expenditure attributed to marine and coastal ecosystems (SAT\$182.47 -SAT\$447.27), intermediate costs (55.5%) and ecosystem contribution factor (60%-78%); the net producer benefit from coastal and marine ecosystems services was estimated to annually generate between SAT\$ 48.72 – SAT\$155.25 million.

The government of Samoa also benefits from marine and coastal tourism through tax revenue. Tourists pay 15% on most purchases including hotels and restaurants. Based on the gross

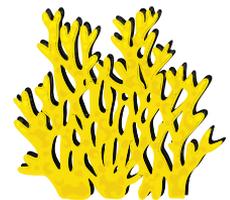
expenditure attributed to marine and coastal ecosystems, the government of Samoa could receive about (SAT\$27.37- SAT\$67.09 million) in tax revenue from this ecosystem service. **The total economic value of the ecosystem service is the sum of the producer and consumer benefits and government benefits. The producer benefit and government benefits are estimated at SAT\$ 76.09 – SAT\$222.34 million.** The benefits that tourists receive from marine and coastal ecosystems have not been quantified in this study. Estimating consumer benefits would require a detailed survey of tourists' behavior and preferences.

Although domestic recreational tourism related to marine and coastal ecosystems has a high value for Samoans, huge data gaps remain which prevent accurate estimation of its real economic value. This should be evaluated and included in marine and coastal resource management and planning.

If managed responsibly, tourism can be a lucrative and sustainable activity supported by coastal ecosystems. Tourists are often motivated by the desire to protect healthy ecosystems. This motivation can provide an incentive to support the protection and even rehabilitation of marine environments. However, tourism can also increase demand for water, energy, infrastructure, food and imported goods. It can generate harmful waste and pollution as well as exacerbate coastal urbanisation. If poorly managed, these impacts can lead to degradation of the ecosystems the tourists are originally attracted to. It is important to carefully evaluate the environmental pressures of tourism and focus on what can be achieved realistically and practically, and how the economic benefits can be sustained, given the critical role of tourism for Samoa's economy.

Coastal Protection

Reefs and mangroves protect Samoa's coasts from erosion and flooding. The avoided damage cost method was used to analyze the value. The annual value of coastal protection provided by coral reefs against damage from storm flooding in Samoa for residential and tourist accommodation along the coastal areas can be estimated as US\$7,535,962 or SAT\$19,766,828. These values do not include avoided damages to infrastructure and crops. The scope of this assessment is restricted to only one aspect of coastal protection (storm damage), and considers only damage to houses and hotels. The full value of this ecosystem service for Samoa is likely to be considerably higher.



Carbon Sequestration

The occurrence of mangroves in Samoa marks the eastern limit of their Indo-Pacific mangrove distribution. Samoa's mangroves provide carbon sequestration benefits to the world, worth about SAT\$ 384,201.97 (US\$146,084.4) each year. A mangrove audit report in 2010 noted that the total area of mangroves in Samoa was 752 hectares (Siamomua-Momoemausu, 2010; Saifaleupolu,



2015), while another study noted that the total area of mangroves in Samoa in 2018 as 374 hectares (Percival, 2018). This indicates that the rate of mangrove loss during this period has been high. If mangroves at risks are protected, they could be sold as carbon offsets, but the costs of verifying and managing the protected area would need to be assessed. Even small payments for this ecosystem service can act as an incentive and raise conservation interest as an approach compared to no payments. It is also possible that sustainability could be enhanced if the communities interested in conserving and sustainably managing their mangroves increases and communities are willing to invest in protection of their mangroves.

Research, Education and Management



Marine and coastal areas attract foreign aid for research, development and management work that benefits the Government and Samoan people. In 2019, 28.6% of total donor cash grants were allocated to coastal and marine, and climate change-related, projects worth about SAT\$ 65.8 million or US\$24.8 million, although administration costs should be subtracted to determine the true net social benefit. Investment in marine and coastal biodiversity also includes many projects coordinated through MNRE, Fisheries Division and NGOs, so total benefits will be much greater. Money spent by individuals and institutions which carry out research on marine and coastal ecosystems or advocate for their protection, also benefits government, while aid expenditure trickles through many sectors of the economy, much like tourism expenditure. Marine research and protection projects also bring technical assistance and capacity development, and potentially increase the value of ecosystem services through improved resource management and sustainability.

Other benefits

Other marine and coastal ecosystem services include mariculture, handicrafts, bioremediation, cultural identity, and aesthetic beauty. These services have not been quantified in this study because of a lack of data and resources, but they provide important passive benefits to Samoa and the rest of the world. Non-market values linked to tradition, culture and heritage are an important aspect of the Samoan way of life. Although these values were not quantified in this study, their qualitative characteristics indicate the critical role they can play in improving livelihoods of Samoans, as ways of encouraging resource stewardship. More in-depth research is needed to identify non-market cultural values such as the bequest value of traditional resource management practices, by identifying their opportunity costs and individuals' willingness to pay (WTP) for their continued existence. Capturing these values through a more detailed assessment would certainly help justify government expenditure on incentives to improve resource management and stewardship.

Conclusion

In preparing this report, accessing reliable data was difficult which was further exacerbated by restrictions placed during the pandemic. As such the figures contained represent both gross values and values net of costs (i.e., true economic value) that are estimated using available information.

Most of Samoa's marine ecosystem service benefits come from international tourism, subsistence and commercial fishing, protection from storm flooding (avoided costs) as well as foreign aid towards coastal and marine related projects. The value of coastal protection accrues to owners of coastal businesses; carbon sequestration provides global benefits, albeit with no related economic activity within Samoa. The tuna industry is the most valuable fish export commodity in Samoa. The locally based domestic and foreign tuna vessels provides employment, and their catch supports some local processing industry.

Discussions led and facilitated by the Ministry of Natural Resources and Environment (MNRE) has been fundamental for the development of this ecosystem service valuation. Throughout the development of this report, the authors made every effort to share information about the economic value of marine ecosystems with various government departments and stakeholders that have a role in marine resource use and management. These discussions indicated an awareness and understanding that economic valuation information can better inform development and implementation of marine resource management policies, and legislation and regulation of marine activities.

This study is a step towards a national process of recognizing the human benefits from natural ecosystem processes and functions, which will lead to more equitable and sustainable management of Samoa's marine natural assets. These results can serve as an inventory of current information about the economic value of Samoa's marine and coastal assets and as a starting point for more in-depth valuations of each of the ecosystem services discussed above. More generally, the government should continue to take steps towards accounting for natural capital to ensure the sustainable prosperity of the country. Several initiatives are already underway which require incorporating ecosystem service valuation into national accounts and reporting systems, such as work related to the Convention on Biological Diversity Aichi Target 2; the Wealth Accounting and Valuation of Ecosystem Services; the Ocean Health Index, and the UN System of Environmental Economic Accounting SEEA. In addition, research is needed to assess Samoa's coastal and marine ecosystems carrying capacity to continue to provide ecosystem services so that planners and policy makers can better control development and implement policies for sustainable resource use.

Annual economic value of marine and coastal ecosystem services in Samoa in 2019 prices

Sec- tor	Ecosystem service benefits	Beneficiaries	Net annual value 2019 adjusted (million)	Sustainability ¹
Fisheries	Subsistence fishing	Samoan households, particularly low income	SAT\$48.13 m – SAT\$52.35 m US\$18.30 m – US\$19.90 m	Inshore habitat can support sustainable subsistence harvest but areas of localised overfishing has reduced productivity, thus threatening sustainability
	Domestic coastal fishing	Samoan fishers and consumers, some restaurants and businesses (only value to fishers is estimated)	SAT\$50 m – SAT\$54.4 m US\$19.01 m – US\$20.68 m	Data trends indicate some overfishing
	Sea Cucumber	Some local fishers and consumers	SAT\$139,165 US\$52,914.45	Some recovery of stock because of moratorium; decline of targeted species; re-stocking trials could further enhance productivity
	Deepwater bottom fishing	Some local fishers, consumers, and some restaurants, some overseas relatives	SAT\$207,928 US\$79,060.08	Current stock is sustainable but will require management of catch and effort
	Offshore tuna	Local businesses, some fishers, foreign fishing fleets, government, some local processing and fishing jobs (value is government revenue and industry net economic benefit).	SAT\$7.78 m – SAT\$10.23 m US\$2.96 m -US\$3.89 m	Current albacore longline fishing and skipjack is sustainable but yellowfin and bigeye will require adopting regional management measures for catch and effort
	Nearshore pelagic troll fishing	Some local fishers, consumers, some restaurants	SAT\$1.53 m US\$581,749.04	Catch rates variable and dependent on access to FADs; skipjack stock is sustainable
	Marine Aquarium	Some tourists and local Samoans benefit since no commercial harvesting is undertaken	NA	Potential for mariculture could be explored; harvest from wild stock is unsustainable
	Mariculture	Fisheries Division through capacity building	NA	Still at an experimental level

Sector	Ecosystem service benefits	Beneficiaries	Net annual value 2019 adjusted (million)	Sustainability ¹
Mining	Sand & aggregate	Local business operations, individuals and communities who extract; government revenue through charges	SAT\$26,430 ² US\$10,049.43	Unsustainable local areas of extraction, causing erosion; can impact on tourism and fisheries; require effective management measures
	Deep-sea minerals	With no activity in the deep sea, the tourists and fishers are major beneficiaries	NA	Limited understanding of the ecosystem potential and threats; requires institutional arrangements to be established for further research and investigations
Tourism	International tourism	Local Samoan and foreign businesses, tourists, local communities as input suppliers, government through taxes and charges	SAT\$76.09 m – SAT\$222.34 m US\$28.93 m – US\$84.54 m	Tourism can be sustainable if managed under an integrated ecosystem-based approach
	Domestic tourism	Some Samoan businesses and individuals as consumers, government	SAT\$29.7 m US\$11.29 m	Can be sustainable with a management plan; requires more detailed study including its cultural value assessment
Regulating services	Coastal protection	Samoans and visitors, in particular owners of coastal properties (avoided repair costs)	SAT\$7.5 m - SAT\$19.8 m US\$2.85 m -US\$7.53 m	This could be either increased or decreased depending on efforts to restore degraded ecosystems and protecting reefs and beaches
	Carbon sequestration	Global benefit; potential benefit from carbon credits (not included in the value)	SAT\$146,084 ³ US\$55,545	Mangrove protection strategies will be needed
Foreign aid and investment	Research, education and management	Mostly government; aid money trickles through the economy to organisations, consultants, businesses, students and researchers. (values reflect cash grants to marine and coastal projects including those associated with climate change adaptation)	SAT\$65.76 m ⁴ US\$25 m	Depends on international relations and agreements related to nature conservation

