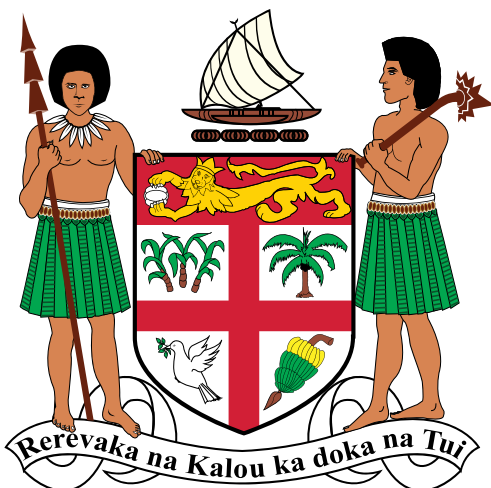
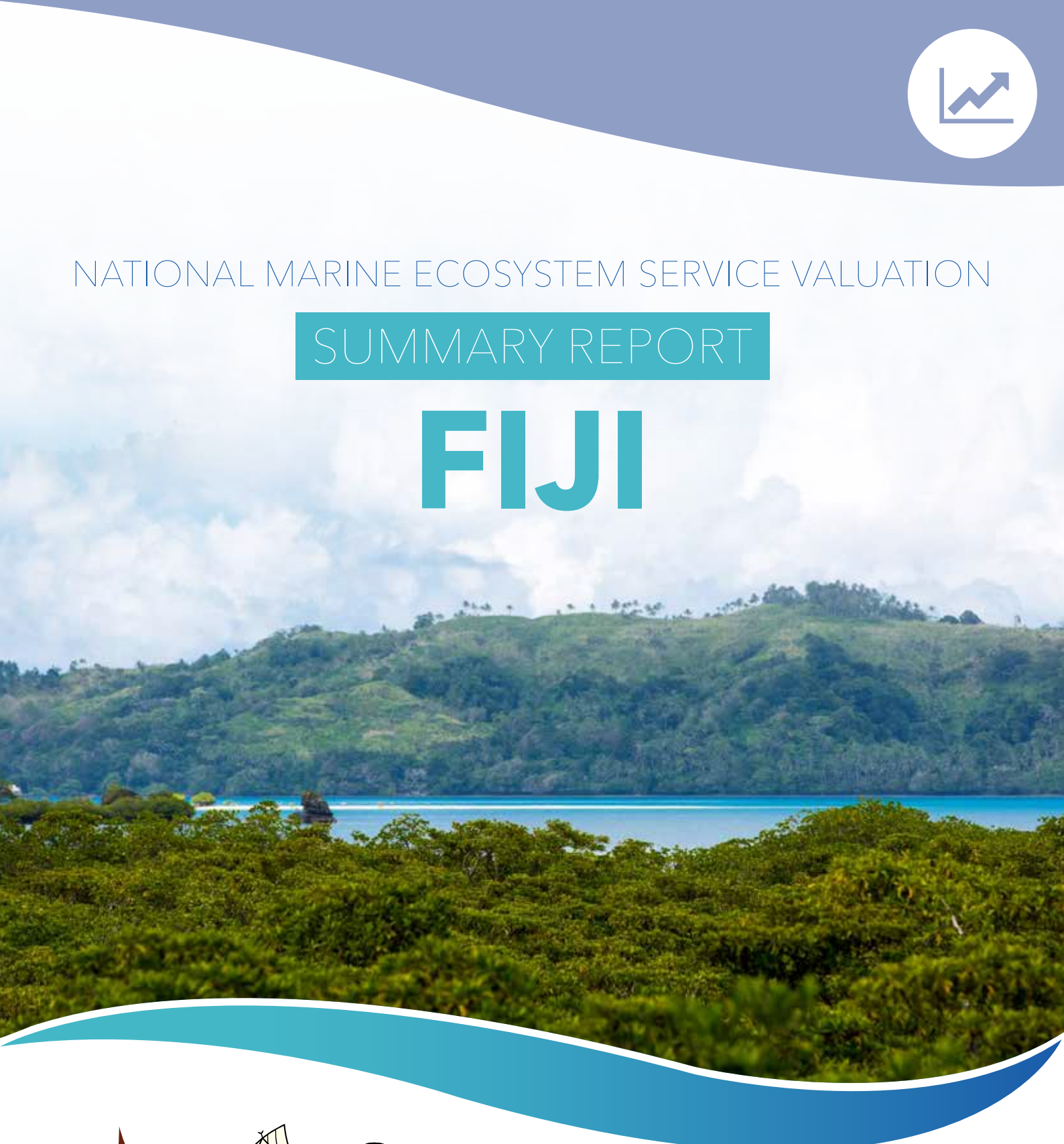




NATIONAL MARINE ECOSYSTEM SERVICE VALUATION

SUMMARY REPORT

# FIJI





## MARINE ECOSYSTEM SERVICE VALUATION



The living resources of the Pacific Ocean are part of the region's rich natural capital. Marine and coastal ecosystems provide benefits for all people in and beyond the region. These benefits are called ecosystem services and include a broad range of values linking the environment with development and human well-being.

Yet, the natural capital of the ocean often remains invisible. Truly recognizing the value of such resources can help to highlight their importance and prevent their unnecessary loss. The MACBIO project provides technical support to the governments of Fiji, Kiribati, Solomon Islands, Tonga and Vanuatu in identifying and highlighting the values of marine and coastal resources and their ecosystem services. Once values are more visible, governments and stakeholders can plan and manage resources more sustainably, and maintain economic and social benefits of marine and coastal biodiversity in the medium and long term.

The MACBIO Project has undertaken economic assessments of Fiji's marine and coastal ecosystem services, and supports the integration of results into national policies and development planning. For a copy of all report and communication material please visit [www.macbio.pacific.info](http://www.macbio.pacific.info).

MARINE ECOSYSTEM  
SERVICE VALUATION

MARINE SPATIAL PLANNING

EFFECTIVE MANAGEMENT





# NATIONAL MARINE ECOSYSTEM SERVICE VALUATION

## SUMMARY REPORT

# FIJI

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Marine and Coastal Biodiversity Management  
in Pacific Island Countries



On behalf of:



Federal Ministry  
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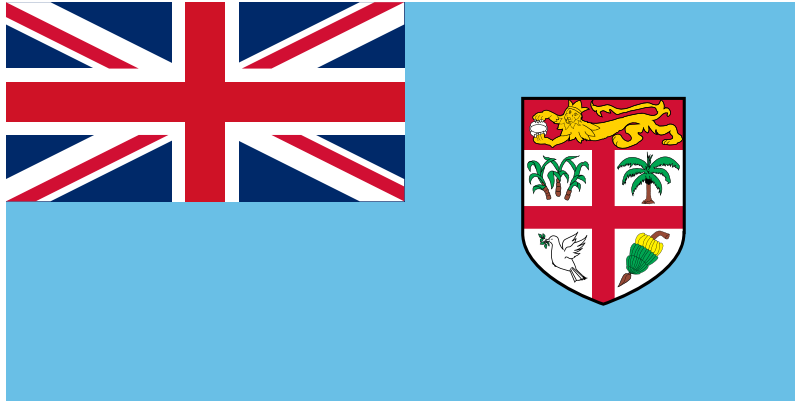
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This study, conducted in 2015, aimed to determine the economic value of seven marine and coastal ecosystem services in Fiji. The study forms part of the broader MACBIO project (Marine and Coastal Biodiversity Management in Pacific Island Countries) that aims to strengthen the management of marine and coastal biodiversity in Pacific island countries.

The role that natural ecosystems, especially marine 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. 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 Fiji's businesses, households and government many real and measurable benefits. Fiji has sovereign rights over the resources within its exclusive economic zone, an area totaling about 1.29 million km<sup>2</sup> (more than 60 times Fiji's land territory). This report describes, quantifies and, where sufficient data is available, estimates the economic value of many of Fiji's 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; minerals and mining; tourism; coastal protection; carbon sequestration; and marine research 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 analyzed. 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 are described in detail in the full report.

## INSHORE FISHERIES

Small-scale inshore fishing and gleaning for home consumption and sale at local markets provides food security and incomes for many Fiji households. The subsistence and inshore commercial fisheries depend on the health and productivity of reef, lagoon, and mangrove areas.

## SUBSISTENCE FISHING

The Fiji Fisheries Division last conducted a thorough national investigation of subsistence fishing in 1979. The most recent national-scale estimates, based on primary data, were made by an academic researcher (Starkhouse 2009), who extrapolated data from 12 villages to estimate the total annual subsistence harvest for Fiji as 15,186 tonnes (68% finfish and 32% invertebrates). Based on seafood consumption estimates from household income and expenditure surveys and the cost of equivalent replacement protein (tinned fish), the net value of subsistence seafood to Fiji households is estimated to be about FJ\$ 59 million (US\$ 29.5 million) per year.

Subsistence fishing benefits Fijian households directly. Modernization and the demand for cash are putting increasing pressure on coastal communities to sell part of their subsistence catch. Limited available information indicates that the inshore and nearshore finfish and invertebrates in many areas of Fiji are overexploited. Such a threat to the subsistence fishery is a major concern in terms of the ability of the fishery to meet the nutritional and food security needs of the country.



at urban markets and roadside stalls, and the *bêche-de-mer* fishery, which is almost entirely for export. Although the artisanal inshore commercial fishery provides food to most Fiji households, restaurants, and resorts, data about harvests and sales are very limited. Given the limitations of the data, the economic value of the artisanal fishery (in 2014) is estimated to lie between FJ\$ 14.6 and FJ \$53.7 million per year (US\$ 7.3–26.9 million). These estimates do not include some important inshore seafoods, such as mud crab and mackerel, so the total economic value of the ecosystem service benefits of inshore commercial fisheries likely lies at the higher end of that range.

Although some sea cucumbers are sold locally, *bêche-de-mer* is mostly an export product highly valued in international markets. From 2003 to 2012, the annual volume and value of the *bêche-de-mer* production varied significantly from a low of 130 tonnes in 2009 to peak of 340 tonnes in 2005, and was worth a gross value of FJ\$ 5.5 million to FJ\$ 16.5 million, respectively. The wide variance from year to year demonstrates the boom-and-bust cycle of the *bêche-de-mer* fishery, even within a short period of time.

Both of these sectors provide important income to coastal communities in Fiji, although most of the value of *bêche-de-mer* accrues to foreign exporters. A number of artisanal fishers are also semi-subsistence operators who keep part of the catch for home consumption. The artisanal commercial inshore fishery is essentially production from rural areas that supplies domestic urban markets. The sector clearly demonstrates a strong rural–urban link in Fiji. The net economic value of these fisheries is much less than the subsistence fishery because of the costs of bringing products to market. Limited available information indicates that inshore and nearshore finfish and invertebrates in many areas of Fiji are overexploited. The sustainability of subsistence and small-scale commercial fishing are interrelated.

## OFFSHORE COMMERCIAL TUNA FISHERY

It is estimated that about 42% of the total catch of tuna in Fiji is sold to canneries, 37% as fresh fish exports, and 21% as domestic sales. The catch composition recorded in 2010 was 70–80% albacore, 15–25% yellowfin and 8% bycatch. The tuna industry in Fiji has been faced with a number of problems relating to fluctuations in supply and competition from foreign fleets (some subsidized), as well as a general decline in stocks of bigeye and yellowfin, the higher-value species. There has been a sharp increase in fuel prices in recent years, which has caused a number of vessels to remain in port for extended periods during the fishing season. Scientists report that yellowfin stocks show signs of overfishing and bigeye stocks are becoming dangerously small, but that albacore stocks remain healthy.

The net economic value of tuna harvests in Fiji is estimated to be about 50% of the gross value; net value is FJ\$ 20.1 million (US\$ 10.1 million) for 2013 harvests (in 2014 prices). Most tuna fishing in Fiji is done by the locally based fishing fleets, although most of the harvest is exported. Fiji Government earns significant revenue from licensing of fishing vessels; exact figures are difficult to determine because licenses are negotiated confidentially with government. The tuna industry provides employment opportunities within harvesting, processing and marketing sectors.

## SAND AND AGGREGATE MINING

Dredging of sand and aggregate from beaches and lagoons provides benefits to the construction industry and consumers who benefit from concrete roads and buildings, but the negative impacts of dredging could not be assessed by this research. Possible impacts include destruction and siltation of reef and lagoon habitat, which may harm inshore fisheries, and increased erosion and flooding. One study estimated that ten harvesters in one community (Lami) could sell coral products for an estimated annual value of FJ\$ 5,214. The study looked at least-cost options for adaptation to climate change, including reduction of coral extraction. The cost of replanting mangroves was estimated at FJ\$ 1,781,000; building a sea wall was FJ\$ 12,377,000; and the cost of reducing coral extraction was FJ\$ 44,000. Localised mining of sand and coral directly benefits those involved in such activities, but information on the national magnitude of small-scale coastal mining activities is scant. Resource custodians may benefit from royalties or resource rent if a consent agreement is reached. There is no set standard, thus arrangements are often done by mutual agreement at the local level with little government intervention.

We assume the price for aggregates is FJ\$ 5 per cubic meter and consider the reported 300,000 m<sup>3</sup> to calculate the total value for aggregates in Fiji as FJ\$ 1.5 million per year.

## DEEP-SEA MINERALS

Although only one deep-sea mining operation is currently active in the Pacific (in Papua New Guinea), all Pacific island countries are interested in the potential costs and benefits of this ecosystem service. No seabed mining is currently undertaken in Fiji, although there are frequently requests for exploratory work by private foreign investors. In 2011, there were 17 deep-sea mineral exploration licences issued (compared to 50 for exploration on land). Exploration for deep-sea mining opportunities is already providing benefits to Fiji Government from various fees, about FJ\$1,550,000 (US\$776,480) per year. While this is an important benefit for Fiji Government, it is likely to represent only a fraction of the value of the resource. The majority of the benefits are likely to accrue to the foreign mining companies and the industries that use the minerals. The net benefit of deep-sea mining depends upon the market prices of minerals extracted, the extraction costs, and the costs of environmental damages or *externalities*. Since the extraction costs and externalities are largely unknown, a true valuation of deep-sea mineral mining is not yet possible. The magnitude of threats to offshore fishing and recreational diving and fishing cannot yet be quantified, but must be considered. Tourism and tuna industries provide substantial sustainable benefits to Fiji and may be impacted by deep-sea mining.

## TOURISM

Fiji receives more than 500,000 international visitors by air and cruise ship each year. Tourism is a major contributor to the economy and presents an opportunity for poverty alleviation and income redistribution. Domestic tourism, including beach walking, swimming, and recreational fishing is small-scale but widespread.

Tourism and recreation revenue from foreign visitors amounted to about FJ\$ 1.145 billion (US\$ 574 million) in 2013. A large proportion of this revenue is related to healthy marine and coastal ecosystems; the exact amount could not be estimated without a detailed survey. The total contribution to the Fiji economy from shark-diving alone was estimated to be US\$ 42.2 million in 2010. An important share of revenues from tourism leaks out of the country, due to revenue expatriation by foreign-owned hotels and tourism operators. The high level of imported goods (like food, drinks, and other inputs) that resorts and hotels provide to tourists results in a further share of those tourism revenues leaving the country. However, tourism benefits a variety of businesses, provides government tax revenue and provides local employment, supporting an estimated 43,000 direct jobs in 2013 (12.4% of total employment). Domestic tourism is harder to quantify, but also has economic value to Fijian families. Fijians enjoy rights of entry to beach areas and very few beaches have entry fees.

If managed responsibly, tourism can be a lucrative and sustainable ecosystem service. Because tourists generally seek out healthy ecosystems, tourism can create an incentive to protect and even rehabilitate marine ecosystems. However, serious environmental degradation on coral reefs and other coastal ecosystems has occurred where tourism is most intense, such as along the Coral Coast. Mining and fishing, particularly destructive types of inshore fishing, could also negatively impact tourism benefits.

## COASTAL PROTECTION

Fringing reefs, mangroves and seagrasses protect Fiji's coasts from erosion and flooding. The *avoided costs* method was used to analyze their value. The value of coastal protection provided by coral reefs against damage from storm surges in Viti Levu and Vanua Levu is estimated to be in the range of FJ\$ 12.7–21.2 million annually (US\$ 6.6–11 million) in avoided damages to homes and resorts. The scope of this assessment is restricted to only one aspect of coastal protection (cyclone damage), considers only damage to houses and hotels, and is limited in geographic extent (main islands). The full value of this ecosystem service for Fiji is likely to be considerably higher.



## CARBON SEQUESTRATION

Fiji's mangroves also provide carbon sequestration benefits to the world, worth about FJ\$ 29.7 million each year (US\$ 14.8 million). Annually, the social benefit of carbon sequestration plus avoided emissions by mangroves is estimated as FJ\$ 3,835.58 (US\$ 1,920.19) per hectare per year totaling FJ\$ 147.67 (US\$ 73.93) million a year in global social benefits by the Fijian mangroves.

Mangroves are being destroyed globally at an alarming rate (1.7%/year). If protected, areas of mangroves and seagrass at risk of destruction could be marketed and sold as carbon offsets, but the costs of verifying and managing the protected areas would need to be assessed on a case-by-case basis.

## RESEARCH, MANAGEMENT, AND EDUCATION

Marine and coastal areas attract foreign aid and research funding that benefits Fiji. Donor and development agencies give high priority to the advancement of the marine sector because of the potential it holds and because it is vulnerable to mismanagement. International agencies such as the World Bank, the Asian Development Bank, the European Development Fund, United Nations Development Programme, as well as developed countries such as Australia, New Zealand, Germany and the United States, all place a high priority on research and education in the marine sector. Tertiary institutions in Fiji such as the USP and the Fiji National University also have dedicated study programmes and identified research priorities focused on the marine sector. These investments support scientific studies of fish stocks, aquaculture experimentation, seabed exploration and training and capacity-building in marine and coastal development. Information on the value of research projects and educational activities specifically associated with coastal and marine ecosystems is disaggregated and time consuming to obtain, so a total value could not be estimated. These funds benefit government mostly, although aid expenditures indirectly benefit local institutions, local communities and the private sector (experts and implementing agencies). 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 marine and coastal ecosystem services** include cultural identity, handicrafts, bioremediation and aesthetic beauty. These services have not been quantified by this study because of a lack of data and human and financial resources, but they indeed provide benefits to Fiji citizens and the rest of the world. Recently, the Fiji Government has shown an interest in mariculture because of its potential to provide income via exports; however, the broader ecosystem impacts of mariculture would also need to be considered. A number of commodities are at various stages of experimental trials such as mangrove crabs. Maintaining a healthy coastal environment is critical for the realisation of this potential.





## CONCLUSIONS

In preparing this report, accessing reliable data was difficult. As such the figures contained represent both gross values and values net of costs (i.e. the latter being true economic value).

The majority of Fiji's marine ecosystem service benefits come from subsistence and small-scale fishing for local sale, tourism, and protection from erosion and flooding (avoided costs). The value of coastal protection accrues to owners of coastal businesses; carbon sequestration provides global benefits, albeit with no related economic activity within Fiji. The tuna industry provides jobs and government revenue, but much of the economic value accrues to foreign countries.

Discussions led and facilitated by the Ministry of Environment and the Ministry of Fisheries have been fundamental for the development of this ecosystem service valuation. Throughout the development of this report, the authors endeavored to share information about the economic value of marine ecosystems with a wide range of 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 inform development and implementation of marine resource management policies, and legislation and regulation of marine activities and, in fact, identified several specific uses for these results and areas for improving data collection, which are outlined in the report.

This study is a step towards a national process of recognizing the human benefits of natural ecosystems, which will lead to more equitable and sustainable management of Fiji's marine assets. These results can serve as an inventory of current information about the economic value of Fiji's marine and coastal assets and as a starting point for more in-depth valuations of each of the ecosystem services discussed above.



TABLE 1 • Annual economic value of marine and coastal ecosystem services in Fiji (2014)

Sector	Ecosystem service	Beneficiaries	Net annual value <sup>1,2</sup> (2014 adjusted) m = million	Sustainability <sup>3</sup>
Fisheries	Subsistence fishing	Fiji households, particularly rural and low-income	FJ\$ 59.04m (US\$ 29.56m)	No data on stock trends. Growing population and increased commercialization of inshore fishery may be depleting stocks to unsustainable levels
	Small-scale commercial (artisanal) inshore fishing	Mostly Fijian fishers and consumers, some restaurants and businesses (only value to fishers is estimated)	FJ\$ 14.57–53.69m (US\$ 7.30–26.88m)	No data on stock trends. Increased population and tourism have increased prices and demand for inshore products, but capacity for inshore management by locally managed marine areas (LMMAs) has been increasing
	Bêche-de-mer	Most value goes to export companies and foreign consumers. Cash income for local fishers, some government revenue	FJ\$ 5.5–16.5m <sup>1</sup> (US\$ 2.9–8.7m) Gross value	Over-harvesting has led to periodic closures, but inconsistent and difficult to enforce. Not sustainably managed
	Offshore tuna	Fishing fleets, government, some local processing and fishing jobs (value is net economic value of catch to local and foreign fishing fleets)	FJ\$ 20.11m (US\$ 10.07m)	Albacore stocks appear sustainable, but yellowfin threatened and bigeye overfished. Subsidized foreign fleets threaten sustainability of fishery
Mining	Sand and aggregate	Insufficient data to estimate benefits to households, construction companies, and everyone who uses concrete structures and roads	FJ\$ 1.5m (US\$ 0.76m)	Coral harvesting for construction is unsustainable; lagoon dredging and beach mining needs monitored to prevent diminishing fishing and tourism ecosystem services
	Deep-sea minerals	International mining companies; government and local economic benefits depends on taxes, royalties, and business operations	FJ\$ 1.55m (US\$ 0.78m)	Sustainability unknown; potential risks to tuna fishery, recreational fishing, and dive tourism
Tourism	Tourism and recreation	Fijian businesses (local and foreign-owned), employees, and government	FJ\$ 1,146m (US\$ 574m) Gross value	Sustainable, if human pollution and damage is prevented
Regulating services	Coastal protection	Citizens and visitors, in particular owners of coastal properties (measures avoided repair costs)	FJ\$ 12.72–21.20m (US\$ 6.36–10.61m)	Sustainable if reef is living
	Carbon sequestration	Global benefit; potential benefit to communities from carbon credits (not included in value). Value is for social value of sequestration plus the cost of avoided emissions from mangroves	FJ\$ 147.67m (US\$ 73.93m)	Sustainable, if mangroves and seagrasses are protected. value includes carbon sequestration by mangroves and the broader oceanic waters of Fiji
Foreign investment	Research, education, management	Mostly government and universities; aid money trickles through economy to organizations, consultants, businesses (Insufficient data for value)	Insufficient data	Depends on international relations, university initiatives, and agreements related to nature conservation

1 Different beneficiaries (local, foreign, producer, consumer, government) are included in the value estimates; read beneficiaries column for explanation and exceptions. Gross values do not reflect costs.

2 Unless otherwise indicated.

3 Sustainability refers to whether the values presented can be expected to decrease (unsustainable), increase, or stay the same (sustainable) with current human behaviours.