Economic value of the Pacific Ocean to the Pacific Island Countries and Territories

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Acronyms

ADB	Asian Development Bank
AOSIS	Alliance of Small Island States
CBD	Convention on International Trade in Endangered Species
CITES	Convention on Migratory Species
CMS	Convention on Biological Diversity
CNMI	Commonwealth of Northern Mariana Islands
CPI	Consumer Price Index
DWFV	Distant Water Fishing Vessel
EEZ	Exclusive Economic Zone
EIS	Entry Insurance System
FSM	Federal States of Micronesia
FFA	Forum Fisheries Agency
ft	Foot
GDP	Gross Development Product
GVP	Gross Value of Product
HIES	Household income and expenditure survey
ITPGR	International Treaty on Plant Genetic Resources
IUCN	International Union for the Conservation of Nature
LDC	Least Developed Country
MEA	Multilateral Environmental Agreement
mt	Metric ton (equivalent to one tonne)
NGO	Non Governmental Organisation
NVP	Net Value of Product
PIC	Pacific Island Countries
PICT	Pacific Island Countries & Territories
PIROP	Pacific Islands Regional Ocean Policy
IWC	International Whaling Commission
PIROP	Pacific Island Region Ocean Policy
PNG	Papua New Guinea
SIDS	Small Island Developing State(s)
SOPAC	Pacific Islands Applied Geoscience Commission
SPC	Secretariat of the Pacific Community
SPTO	South Pacific Tourism Organisation
TEU	Twenty-foot equivalent unit
TEV	Total Economic Value
UNCLOS	United Nation World Tourism Organisation
UNWTO	United Nations Convention on the Law of the Sea

Executive summary

In recent years economic arguments have been used increasingly as a policy and advocacy tool to demonstrate society's dependence on healthy and functioning ecosystems and the economic consequences of losses thereof. Very few such studies have been carried out for the Pacific Ocean despite it being the largest ecosystem in the world, covering almost half the globe's sea surface. The same holds true for the 22 Pacific Island countries and territories (PICTs) that govern approximately a third of this vast ocean. More critically for the PICTs, good baseline information about the economic values of key sectors dependent on the Pacific Ocean is not readily available, let alone measures of the economic cost on natural Pacific Ocean ecosystems under 'business as usual' scenarios.

For the 10 million Pacific islanders, the Pacific Ocean is their major economic, social, and cultural lifeline. Its coastal and marine environments sustain a multitude of important activities that fuel local, national, and international economies and provide livelihoods and food security for millions of islanders. Despite the importance of a healthy Pacific Ocean, evidence is mounting that this unique ecosystem is in peril from anthropogenic threats such as overfishing, habitat destruction, pollution, and probably the most severe threat of all, climate change and resulting rising sea level (Center for Ocean Solution 2009). Today, Pacific people already whiteness a loss of wellbeing due to unsustainable use of ocean goods and services.

While current threats to the Pacific Ocean have been identified and acknowledged, the challenge remains to gain political buy-in from Pacific leaders to opt for more sustainable solutions in the future. There is an urgent need to provide information to decision-makers that it make economic sense to avoid the costs that arise from environmental degradation and to continue being able to profit from ocean resources.

The purpose of this report is to provide an overview of the known economic contributions of sectors associated with the Pacific Ocean within the PICTs boundaries. Due to the difficulties in obtaining consistent sets of economic value measures, in this report gross value product measure has generally been used together with employment figures. Economic value estimates provided in this report reflect empirical data that could be accessed from published literature, national, and regional statistics and secondary data from national governments, NGOs, and independent consultants. Global, regional, and national databases were consulted for values on national statistics to ensure a consistent approach to estimation. This study has revealed that there are many data gaps and information challenges, which will require targeted primary research using a consistent methodology and value measures across the region. It is thus but a first step towards understanding the economic contribution of the oceans resources to the economies of the PICTs, as well as the economic value of healthy Pacific Oceans.

Results

Key economic activities of the PICTs reliant on the Pacific Ocean include subsistence and commercial coastal fisheries and industrial offshore fisheries, marine tourism, shipping and mining, and marine research and education. Consistent empirical information is mainly available for fishing and tourism sectors. Information on other sectors is either unavailable or limited at best. As a result it is not possible to provide an estimate for the total value of the contribution of the Pacific Ocean to the economies of the PICTs, without detailed primary research.

Ocean-health dependent activities: *Tourism and fishing*

The Pacific Ocean-based fishing and tourism sectors in the region are estimated to provide US$ 3.3 billion to the national economies in the PICTs, or more than 10 % of the regional GDP (Table I). They are both highly reliant on a healthy and functioning Pacific Ocean.

Table I: Economic contribution of tourism and fishing to the economies of the PICTs

Ocean health dependant sector	Gross Value of Product (GVP)*	As % of regional GDP
Tourism	2.27 billion	7.2%
Fishing	1.04 billion	3.3%
Total	**3.32 billion**	**10.5%**

Source: Section 4 of this report

The Pacific Ocean plays a disproportionately critical role in the wellbeing of the Pacific, producing much needed income, employment as well as for food security (Table II).

Table II: PICTs employment in tourism and fisheries

Ocean health dependant sector	Nr of Pacific islanders formally employed	As % of regional employment
Tourism	188,155	5.8%
Fishing*	48,949	1.5%
Total	**207,155**	**6.4%**

Source: Section 4 of this report; *also includes employment from post-harvest activities

Tourism

The Pacific way of life but first and foremost the scenic beauty of the Islands' coastal and marine environments attracted more than three million tourists to the Pacific island region in 2008, almost comparable to the number of locals, if Papua New Guinea is excluded from the equation. Since tourism in the Pacific is largely based on its natural assets, the Pacific Ocean is assumed to be the main basis of the tourism sector. Tourists spent about US$2.3 billion dollars, contributing 7 % to the regional GDP. International tourism receipt data, which includes in-country expenditures, is reported to be $4.3 billion. Tourism also generates the largest level of employment, contributing 188,500 job or 6 % of formal employment, with countries such as the Cook Islands reporting almost 60% of the workforce (see Table 7 in the text for more detail).

Fishing

Fishing plays a major role in generating revenue, export earnings, and provides food security for local communities. The total gross value product of the domestic fishing sector, including the access fees and other charges associated with foreign fishing is estimated to be $1.2 billion or 3.7% of regional GDP (Table III).

Table III: Economic value (GVP) of fishing in the PICTs

Ocean health dependant activities	Gross Value of Product (GVP)*	As % of regional GDP
Locally-based tuna fishing	596,800,000	1.9%
Access fees	78,800,000	0.2%
Commercial inshore fishery	165,700,000	0.5%
Mariculture	145,000,000	0.5%
Subsistence fishing	200,366,961	0.6%
Total	**1,186,666,961**	**3.7%**

*GVP in constant US$ at 2007 market prices
** household participation

The total domestic fishing production in the PICTs, including the subsistence fisheries and mariculture operations, is the most important sub sector, with a value of US$ 1.1 billion in 2007. In addition, the PICTs received US$78.5 million in access fees and other charges from foreign fishing vessels, giving a total fishing sector value of US$1.2 billion. Subsistence fishery plays a central role in Pacific island lifestyles and food production. Roughly half to two thirds of national households engage in subsistence fishery, estimated to be about US$200 million. If the value of foreign industrial tuna catches were to be included, the economic value of fish harvests within the Pacific island EEZs would be worth about US$4.3 billion.

Ocean-health independent activities: Shipping and mining

In addition to tourism and fishing that strongly depend on ocean health, the Pacific and its coastal areas are also used for shipping and coastal mining, and are explored for potential deep sea mining for minerals and fossil fuels. These activities are not dependant on a healthy ocean but they do nonetheless affect the state of the ocean. Economic value of these activities are either unavailable or incomplete.

Deep sea mining for minerals could occur in 12 PICTs that have confirmed the presence of mineral deposits, while another five countries have confirmed offshore fossil fuel occurrence. The GVP could be in the region of several billion US$, exceeding national GDP several fold. Reported values for coastal mining for aggregates and sand in countries such as Kiribati, Fiji, and the Cook Islands are in the area of US$ 150,000 to US$ 700,000 annually.

The GVP of shipping is very difficult to estimate as disaggregated data for the region is not available. PICTs generate money through port charges and other fees but trade of goods and transport of passengers without the shipping industry is unthinkable in the region due to the enormous cost of air fright fares. The economic value of the shipping industry to PICTs is therefore much higher than the sum of charges and fees earned, although such activities also produce externality costs through the destruction of habitats and pollution which are not captured in the market values of mining products.

Economic values of coastal ecosystems

The ocean and its coastal areas have strongly shaped and still influence Pacific island culture and spiritual identity. Healthy coastal areas such as coral reefs, mangrove forests, seagrass meadows, and associated ecosystems are their foundation.. They provide indirect use values to human well being, including biodiversity, protection against natural disasters, and climate regulations. Limited studies have estimated total (net) economic values (TEV) associated with the direct, indirect and non use benefits of coastal habitats in the PICT, though estimates vary considerably from study to study due to different methodologies used. Direct use values from tourism and fishing as ocean-health dependant activities are interdependent with coastal and offshore ecosystems. Extrapolating estimates from available Pacific case studies an annual TEV for coral reefs and mangroves is estimated to be about an US$ 3.8 billion and US$ 3.9 billion respectively for the entire PICT region (Table IV). These estimates included indirect and non-use value of US$ 1.6 billion per year for mangroves and an indirect and non-use use values for coral reefs of US$ 1.3 billion annually from coastal protection, biodiversity, and amenities. The remaining benefits stem from direct use values such as fishing and tourism and must not be added to the GVP of both sectors mentioned above to avoid double-counting.

Table IV: Total economic value of Pacific Ocean sub-ecosystems to PICTs

Sub-ecosystems	TEV	TEV / km2 / yr	Direct use value	Indirect & non-use values	Comment
Coral Reef	3.78 billion	73,300	2.05 billion	1.29 billion	From costal protection, amenities, biodiversity; fisheries in constant US$ 2008 prices (see Table 15)
Mangroves	3.86 billion	546,100	2.29 billion	1.57 billion	From costal protection, amenities, biodiversity; fisheries in current prices (see Table 17)

Source: see Section 5 of this report; values in current US$.

In considering the economic worth of the Pacific Ocean to the PICTs, it is emphasised that one cannot combine these TEV with the earlier gross values of the activities based on Pacific Ocean, because the two value measures are different, quite apart from the problem of double accounting. The TEV measures net economic benefits of the goods and services supported by ecosystems, where as gross values of products from the other sectors reflect the gross values of products and services, excluding the input costs. Also some of the direct use values included in the TEV may also have been captured in the gross value estimates reported earlier, as is the case for whale watching.

Business as usual – implications for the PICTs

If 'business as usual' of overexploitation, pollution, and destruction were to prevail in addition to predicted climate change effects, Pacific island economies face the prospect of becoming non-viable. The Pacific Rim and overseas economies will also suffer from the resulting loss of tuna stocks and a decline in the tourism industry since key players are often foreign nationals and large multinational corporations. However, the largest cost by far will be borne by the people of the Pacific islands themselves whose livelihoods, cultural identity, and security wold be at stake.

These costs of inaction arising through 'business as usual' approach are difficult to estimate in the absence of good baseline information. As mentioned above, little is known about the economic value of goods and services of the Pacific Ocean and there is a common lack of understanding about the incremental change in economic value as the health of the Pacific Ocean changes. The importance of the Pacific Ocean to the economies of the PICTs does however suggest that any further deterioration of its state of health could have a significant impact on the economic well being of Pacific Islanders, primarily of those reliant on the tourism and fisheries sectors that depend on healthy ecosystems. Even if the drivers of environmental and climate change were to result in 1% change in the economic activities, the PICTs economy and livelihoods would be significantly impacted, as reflected in the foregone values of goods and services associated with various ecosystems.

A few available case studies show that expected costs of climate change to national economies will be in the area of US$ 7 billion over the next 20 years (Table V). Additionally, costs of several hundred million dollars will be caused through increased natural disasters, coral bleaching, loss of mangroves and resulting needs to provide for artificial coastal protection. The costs presented in Table are indications of the magnitude only because the values are highly interdependent, as are the dynamics between these major environmental threat and climate change.

Table V: Cost estimates (loss in economic values) from environmental threats

Theme	Costs	Comment	Source
Habitat destruction (coastal protection)	US$ 88-373 million	Building & maintaining seawalls; Majuro Atoll, Marshall Island over 25 years	McKenzie et al. 2005
Overfishing (subsistence)	US$ 66.6 million	Importing protein equivalent for subsistence communities from 5 PICs; annually	World Bank 2000
Pollution (watershed, liquid and solid waste)	US$ 11.3 million	Solid waste pollution Palau; watershed pollution in Cook Islands; solid & liquid waste in Tonga; liquid waste in Tuvalu; annually	(Hajkowicz, Tellames et al. 2005; Hajkowicz 2006; Lal, Saloa et al. 2006; Lal and Takau 2006)
Pollution (Oil spills)	up to several hundred million US$	Indicative; total costs	(De Poorter, Darby et al. 2009)
Climate change (economic development)	ca. US$ 7 billion	Melanesia and Polynesia; in late 1990s value over 20 years	Hoegh-Guldberg et al. 2000
Climate change (natural disasters)	US$ 2.8 billion	Costs of natural disasters during 1990s	Bettencourt et al. 2006
Climate change (Coral bleaching)	US$ 7.6 billion	NPV over 50 years at 3% discount rate	Cesar et al. 2003
Climate change (Mangrove loss)	US$25-470 million	In Melanesia, NPV	Lal et al. 2009

Source: from Section 5 of this report; all values in current US$

Way forward

To address key environmental threats facing the countries and the region as a whole in an effective and timely fashion, increased political will and collaboration between and within countries at all governance levels is urgently needed. The PICTs and Pacific Rim countries need to agree to develop and implement coordinated multidimensional, partnership-based, and multi-pronged actions across the Pacific Ocean that would also mobilise public support. Such a process needs to be supported by robust information about economic values and arguments regarding the 'cost of inaction' in appealing to the conscience of decision-makers and the hearts and minds of the leaders of the Pacific region that urgent action is needed now and into the future. This review, however, highlights that this is not going to be easy, at least in the PICTs, as even basic information about the economic value of the Pacific Ocean to the PICT is not readily available and would require significant effort to collect primary information.

Therefore, as a first step towards any Pacific Ocean-wide response to the environmental threats, primary research using consistent methodology needs to be undertaken to develop baseline information on the economic contribution of key activities associated with the Pacific Ocean in the PICTs and other sub-regions. In addition, targeted economic valuation of goods and services associated with key ecosystems in the Pacific is also warranted if evidence based policy advice is to be provided in relations to the economic costs of business as usual on ecosystems.

Ultimately, it will be the responsibility of the Leaders of the Pacific nations, the politicians and governments, and all key stakeholders including the public at large, to take this information and act for the sustainability of the Pacific Ocean, even if it may mean moving beyond the traditional comfort zones.

1. Introduction

The Pacific Ocean is the largest feature of our planet occupying 180 million km^2 orroughly half of the Earth's sea surface and more than a third of the Earth's surface (Figure 1). It contains complex ecosystems and provides many direct and indirect goods and services, supporting a diverse range of economic activities of the 54 Pacific Rim and Island Countries, ranging from subsistence and commercial coastal fisheries and industrial offshore fisheries, coastal and marine tourism, defence, shipping and mining, to marine research and education. Further, the Pacific Ocean contributes to global climate regulation, provides atmospheric oxygen, and its circulation dynamics of ocean currents make our planet inhabitable. Coastal areas provide protection and a large proportion of the population's protein requirements. No matter where people live on this earth, they directly or indirectly benefit from the Pacific Ocean's goods and services.

Figure 1. The PICTs and their Exclusive Economic Zones

Despite these benefits, evidence is mounting to suggest that this unique ecosystem is in peril from anthropogenic threats. The recently published Pacific Ocean Synthesis Report and the Scientific Consensus Statement (Center for Ocean Solutions 2009a, 2000b) have summarised what is scientifically known about the biggest threats to the Pacific Ocean as a whole:

- **Habitat Destruction** – productive marine and coastal habitats are being lost to destructive fishing practices, inappropriate coastal development for aquaculture, tourism or agriculture.
- **Over fishing / harvesting** – Unsustainable resource use reduces fish stocks throughout the Pacific, limiting fish catches and threatening a critical food source.
- **Pollution** – Pollutants from sewage, fertilizer runoff from agricultural lands, plastics and other trash, shipping waste, toxic dumping and oil spills, runoff from streets and land, combine to create one of the most critical classes of ocean threats – threatening human health and ocean life.
- **Climate Change** – Carbon dioxide discharged to the atmosphere is both altering seawater chemistry resulting in ocean acidification and causing the ocean to warm leading to sea level rise, stronger storms, changing rain patterns, and coral bleaching.

Further, although **invasive species** can be categorised under both pollution and habitat destruction, the large research gaps in understanding its pervasiveness coupled with its potential devastating effects warrant drawing special attention to it.

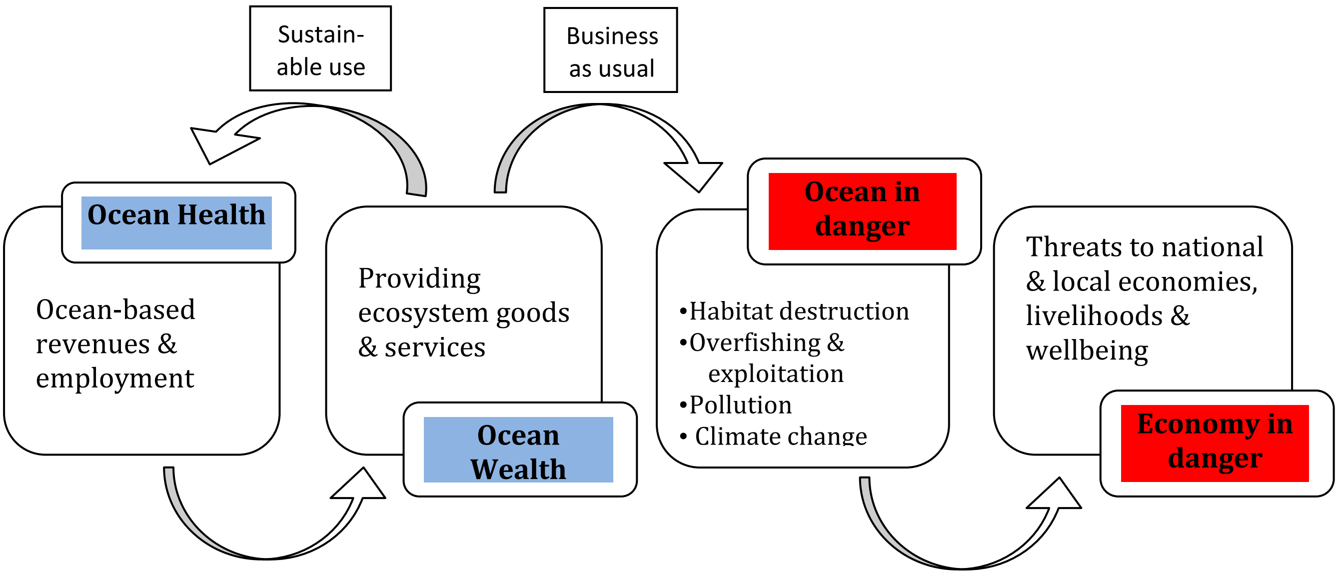
For the Pacific island region specifically, the report classified the following threats as having severe impacts: commercial, artisanal, and subsistence overfishing, sea surface temperature increase, and land-based sedimentation. Pollution from solid wastes, nutrients and chemicals and habitat destruction were identified as additional threats along with potentially serious yet not quantified impacts from invasive species introduced through shipping. Within the different sub-ecosystems there are often competing uses that may negatively affect one another, as well as the sustainability of the ecosystem itself. The overarching effects of climate change and resulting sea level rise exacerbate these threats and compound matters for all. The nature of ultimate outcomes though remains unclear as these would be a function of the complex interaction of drivers, causes, and effects as well as management responses

Ocean-based activities and their threats are spatially and temporally connected within and beyond the region. Shipping, the tuna fishery and tourism are operating on a regional scale. The threats they cause are therefore also regional; e.g. the introduction of invasive species through shipping traffic and ship-borne pollution such as oil spills, industrial and solid waste pollution, and the over-exploitation of migratory tuna stocks. Future habitat destruction through seabed mining due to unknown interactions of adjacent ecosystems may also occur. These threats that result from unsustainable use of ocean goods and services will result in the loss of wellbeing of Pacific islanders and Pacific island economies.

. Ocean health can only be maintained or achieved if urgent action towards sustainable region-wide use is taken.

Figure 2 illustrates the connectedness of ocean-based economies to ocean ecosystems. The consequences of unregulated use will lead to the demise of both the natural and the economic system. The ocean-based activities, while providing revenues and income for Pacific societies, cannot be sustained at current production rates. Unsustainable and unregulated use puts the ocean systems at risk which has strong negative impact on economic activities that rely on functioning ocean systems. Ocean health is therefore inextricably linked to ocean wealth as are the people who depend on and value the use of the resources. Ocean health can only be maintained or achieved if urgent action towards sustainable region-wide use is taken.

Figure 2. Connectivity between ocean health and economic wealth



Source: Authors of this report

In the PICTS, a multitude of initiatives and projects are underway that address environmental issues related to the Pacific Ocean at various governance levels, often focussing on fisheries management, climate change and alternative livelihoods (Pratt and Govan 2010). Activities under various regional instruments, such as the Pacific Plan, the Action Strategy for Nature Conservation in the Pacific Islands, the Pacific Islands Framework for Action on Climate Change, the Pacific Islands Regional Ocean Policy, and the Invasive Species Strategy for the Pacific address aspects of the management of the Pacific Ocean and contribute to environmental conservation in the region. Nonetheless, such efforts often remain piecemeal and repetitive of other projects or they fail to address threats at appropriate scales and governance levels.

IUCN in its *Pacific 2020 Challenge* has called for a long-term commitment of political leaders, the public sector, and Pacific communities to work together in facing these severe issues on the health and status of the Pacific Ocean and to ensure improved ocean governance and the sustainable use and management of ocean resources. To support this call, economic information can play an important role, as recently experienced in relation to climate change and biodiversity conservation fields. The Stern review on the *Economic costs of climate change* (Stern 2007) helped to increase attention by global leaders about the costs of inaction. Stern et al. estimated that failing investments into the prevention of the worst climate change effects would result in a catastrophic market failure of up to 20% reduction in global GDP. Other recent reports that produced significant impacts are the *Cost of policy inaction (COPI)* report (Braat, Brink et al. 2008) and the ongoing IUCN spearheaded report on *The economics of ecosystems and biodiversity (TEEB)* (Sukhdev 2008).

To convince leaders from the Pacific Rim countries and PICTS that urgent action is required to halt this trend, information about benefits of the Pacific Ocean, and economic losses from ocean degradation, needs to be provided to facilitate sustainable decision making. However, not much is known about the total economic value (TEV) of coastal and marine activities associated with the Pacific Ocean. Only a handful of studies have examined the economic contribution of the ocean resources to national economies. California's direct ocean economy, for example, is estimated to be US$22.1 billion, or 1.5 % of the Californian GDP, generating 369,444 jobs (National Oceans Economics Program 2009). Pacific Ocean associated economy in Australia (except Western Australia), is reported to be about A$21.9 billion (The Allen Consulting Group 2004). These reports provide estimates of the value of the marine sectors that depended directly on the ocean resources, including fisheries/ aquaculture, shipping, marine tourism, and oil and gas mining. Such economic estimates do not, however, reflect the indirect and non-market benefits derived from the ocean resources, which can be considerably higher than the direct market values (Kildow and McIlgorm 2010). Such aggregate information is not available for the PICTs.

The purpose of this report is to provide an overview of the known economic contributions of sectors associated with the Pacific Ocean within the PICT boundaries. This report, based on published and grey literature, provides some empirical information supporting the call for action by Pacific Leaders to better manage the Pacific Ocean. It is but a first step towards understanding the economic contribution of the oceans resources to the economies in the region, even while acknowledging that there are many data gaps and information challenges in the region. To provide an ecological perspective, the report also presents an overview of the total economic values of goods and services associated with the use of ecosystems, such as coral reefs and mangroves in the PICTs.

The report is organised as follows: Section 2 provides an overview of the Pacific peoples and their economies, followed by a discussion in Section 3 of the approach used to determine economic value of the Pacific Ocean to the PICTs. Gross economic value estimates of economic activities associated with the Pacific Ocean are provided in Section 4 followed by the presentation in Section 5 of the total economic (net) values of sub-ecosystems of the Pacific Ocean. Section 6 provides a discussion of the cost and management implication of 'business as usual', followed by some concluding remarks.

2. Pacific Ocean and Pacific Island economies

The Pacific Ocean is home to 22 PICTs and athe major economic and social lifeline for the people of the Pacific. These 17 states and 5 overseas territories comprise 200 high islands and 2,500 low lying islands and coral atolls. Due to their wide geographical range the PICTs encompass approximately 28% of global exclusive economic zones (EEZ) which include some of the most productive tuna fisheries in the Western and Central Pacific Ocean (WCPO) (Gillett, 2005). Rich cultural diversity and the "Pacific way of life" attract millions of tourists each year that together with revenues from the fisheries sector sustain local and national economies, provide employment, and livelihoods. Additionally, fishing for subsistence purposes largely prevails and provides the major source of protein in most PICTs.

The PICTs encompass 55 times more water than land mass, or 310 times more if Papua New Guinea (PNG) ,which makes up 85% of the total regional land mass (Table I), is excluded from the statistics. Of the nearly 10 million people in the region 6.6 million live in PNG (Table II). Additionally, with the exception of PNG, almost 100% of these people live within a 100 km corridor from the coast (Martinez, Intralawan et al. 2007). These statistics emphasise the paramount importance of the Pacific Ocean to the Pacific Islanders and have great implications on economies and daily lives.

Table I. PICTs and their geographical properties

Country or territory	Land area [km2]	Sea area / EEZ [km2]	Ratio of sea to land area	Island type
American Samoa (US)	199	390,000	1,960	High islands
CNMI (US)	457	1,823,000	3,989	High islands
Cook Islands	237	1,830,000	7,722	High islands & atolls
Fiji	18,272	1,290,000	71	High island with a few minor atolls
French Polynesia (Fr)	3,521	5,030,000	1,429	High islands
FSM	701	2,980,000	4,251	High islands & atolls
Guam (US)	541	218,000	403	Uplifted ophiolite
Kiribati	811	3,550,000	4,377	Predominantly atolls
Marshall Islands	181	2,131,000	11,773	Atolls
Nauru	21	320,000	15,238	Raised coral island
New Caledonia (Fr)	18,576	1,740,000	94	High island
Niue	259	390,000	1,506	Raised coral island
Palau	444	629,000	1,417	High islands & atolls
Pitcairn Islands (UK)	5	800,000	160,000	Atolls
PNG	462,840	3,120,000	7	High island with a few small atolls
Samoa	2,935	120,000	41	High islands
Solomon Islands	28,370	1,340,000	47	High island with a few atolls
Tokelau (NZ)	12	290,000	24,167	Atolls

Tonga	650	700,000	1,077	High island with a few small atolls
Tuvalu	26	900,000	34,615	Atolls
Vanuatu	12,190	680,000	56	High island with a few small atolls
Wallis and Futuna (Fr)	142	300,000	2,113	High islands
TOTAL	**551,390**	**30,571,000**	**55 / 310***	-

Source: SPC 2008 (land & sea area); Clarke 2005 (Island type); *without PNG

If the current population growth rate of 1.9% on average is maintained, PICT population will double by 2050, further increasing pressure on their limited natural resources, particularly in some of the resource limited small islands.

The PICTs share many economic characteristics and issues. They comprise many small islands spread across a vast ocean mass and are geographically isolated from major global markets. The Pacific island countries fall into what UNDP classifies as developing or least developed countries (LCD) categories. Countries such as Fiji and Tonga belong to the developing country category whereas Kiribati, Samoa, the Solomon Islands, Vanuatu, and Tuvalu belong to the LDC. Although the countries differ in the depth and balance of challenges, similar development challenges nonetheless apply across the region.

Pacific island economies are mostly based on primary industries characterised by narrow productive sectors (Duncan and Nakagawa 2009). Most are particularly dependent on coastal and marine resources for food and nutrition, as well as for export based income. Given the growing taste for western goods and luxuries, they are increasingly reliant on imported goods which are mainly transported across the ocean on large container ships. The islands are also generally characterised by low gross domestic product (GDP) per capita (Table II). Having the developing country status, the PICTs are also largely dependent on foreign aid y to support their development efforts. Such factors also make PICTs highly vulnerable to external economic and environmental shocks. The Pacific small island developing states (SIDS) are regarded as amongst the most vulnerable group to climate change (IPCC 2007). This is compounded by weak institutional and human capacity which poses additional challenge for sustainable management and resource use in conjunction with increasing demographic and economic pressures.

Table II. PICTs, populations, and economies

Country or territory	Population (2009 estimate)	Labour force	Year of estimate	National GDP [US$] (Latest statistics)	Per capita GDP [US$]	Year of estimate
American Samoa	65,113	17,395	2006	558,800,000	8,582	2005
CNMI	63,112	35,216	2005	948,659,000	15,031	2005
Cook Islands	15,636	5,928	2001	207,257,175	13,255	2008
Fiji	843,888	298,974	2007	2,761,599,459	3,272	2007
French Polynesia	265,654	95,258	2007	5,640,452,000	21,232	2004
FSM	110,899	29,175	2000	245,336,000	2,212	2008
Guam	182,207	54,980	2002	3,700,000,000	20,307	2005
Kiribati	98,989	34,715	2005	133,929,336	1,353	2008

Marshall Islands	54,065	10,141	1999	158,435,340	2,930	2008
Nauru	9,771	2,603	2006	21,475,715	2,198	2008
New Caledonia	250,612	80,685	2004	7,129,623,000	28,449	2004
Niue	1,514	755	2006	10,006,000	6,609	2003
Palau	20,397	9,777	2005	180,715,700	8,860	2008
Pitcairn Islands	50*	n.a.	n.a.	n.a.	n.a.	n.a.
PNG	6,609,755	2,344,734	2000	7,982,845,016	1,208	2008
Samoa	182,578	53,928	2006	534,432,771	2,927	2008
Solomon Islands	535,007	57,472	1999	529,076,518	989	2008
Tokelau	1,167	375	2006	n.a.	n.a.	n.a.
Tonga	103,023	35,290	2006	278,230,159	2,701	2008
Tuvalu	11,093	3,237	2002	17,514,000	1,579	2002
Vanuatu	238,903	75,110	1999	507,428,884	2,124	2007
Wallis and Futuna	14,183	3,104	2003	187,500,000	13,221	2005
TOTAL	**9,677,616**	**3,248,852**	**-**	**31,545,816,072**	**3,279**	**-**

Source: GDP in current prices (Asian Development Bank 2009)& (SPC 2008); population & labour force (SPC 2009)

3. Methodology

Generally, standard measures used for reporting on economic activities include measures of production, output GDP, value added, and employment (Kildow and McIlgorm 2010). In this study, direct production values associated with the different economic sub-sectors are reported together with the direct employment measures. This was done for all PICTs where consistent sets of information were available. This study is mainly based on national and regional statistics and secondary data from national governments, NGOs, and independent consultants. Global, regional, and national databases were consulted for values on national statistics to ensure a consistent approach to estimation. Additional information was obtained from peer-reviewed journal articles. Reported economic value information from published literature is the main source of the estimates provided in this report. Only a limited set of economic values could be aggregated across countries due to data issues discussed below. In addition, the total economic values (TEV) associated with ecosystem goods and services are reported separately to provide an ecosystem perspective. Nonetheless, the caution should be be heeded that these two different sets of economic values – the gross value product values associated with the ocean based sectors and the TEV estimates of ecosystems – cannot be aggregated as they represent two different types of value estimates. The former is a gross value estimate while the latter is a net value measure as described in the report.

Gross economic values

These are usually based on total production values generated from extractive activities, such as commercial fishing, aquaculture, and coastal mining. In the case of subsistence fishing, gross value products are also provided using market price of fish as a proxy measure for the economic value associated with subsistence consumption. In the case of the tourism sector, a similar measure, but gross expenditure value, is reported as a proxy for the value. Gross value product (GVP) measures are often used to explain the relative importance of an activity in the national economy, measured in terms of gross domestic product (GDP). GDP is commonly measured in terms of the total market value of all final goods and services produced in a country in a given year, equal to total consumption, investment, and government spending, plus the value of exports minus the value of imports. It is noted that GVP/ GDP measures normally do not include non-market benefits associated with the use of the resources, nor do they reflect the real price of unsustainable uses. Nonetheless it is one information set that is consistently available across sectors as well as between countries.

Net economic values

While gross economic values give an indication of the relative importance of these activities to the national economy, they are not the relevant economic measures to use to answer questions such as: What is the economic value (benefit) of *protecting* the Pacific Ocean? What is the economic value (loss) from further *degrading* the coastal habitats, such as mangroves and coral reefs*?* What is the economic value (benefit) of *restoring* a degraded ecosystem?

To answer such questions, the appropriate measure to use is the total (net) economic value (TEV) of uses of, and change in the uses of goods and services supported by the Pacific Ocean. Such values are derived from net benefits to consumers (consumer surplus) and producers (producer surplus) from the flow of market and non-marketed goods and services derived from direct and indirect use and non-uses. Marketed goods may include, for example, commercially harvested fish. On the other hand, non-marketed goods may include the subsistence fishery and/or coastal protection. Direct values may include, for example, commercial and subsistence fisheries, while indirect use values refer to the enjoyment derived indirectly from for example seeing ocean-based nature programmes on television.

Economists define value in terms of utility. Utility is a metric of satisfaction that a person derives from consuming a good or service or taking part in an activity. Utility is typically measured by a person's willingness to pay for the good, service or activity or their willingness to accept compensation to surrender it. Such economic measures are normally derived using peoples' revealed preferences in a market place through surveys through avoided costs (Lal 1990; Costanza, Perez-Maqueo et al. 2008), replacement cost measures (see Boyer and Polasky 2004) and productivity measure (Lal 1990; see http://noep.mbari.org/nonmarket/methodologies.asp, accessed 6/6/2010). It is important to note that the TEV of an ecosystem is a measure of the flow of the goods and services and not the total stock value of the habitat (Godden 2010). This willingness to pay or to accept values have rarely been determined in the Pacific. Estimation is theoretically possible for all goods and services and is practically possible for several. Alternatively, existing market data can be used to as proxies to determine the economic values of many of the goods and services either directly or indirectly. Accordingly, available data has been collected where reported.

Reported values were converted to constant 2008 values using CPI indices calculated from national inflation rates of consumer prices (see ADB; https://sdbs.adb.org/sdbs/index.jsp, accessed 10/2009). National CPI values, rather than individual sector CPI values, were chosen because national CPI values are commonly reported figures and displays highest level of homogeneity between countries. Where relevant, values in foreign currency were converted to US$ after CPI conversion using the ADB average-of-year exchange rates. Where CPI index for 2007- 2008 was not available, 2007 figures are reported.

Data challenges

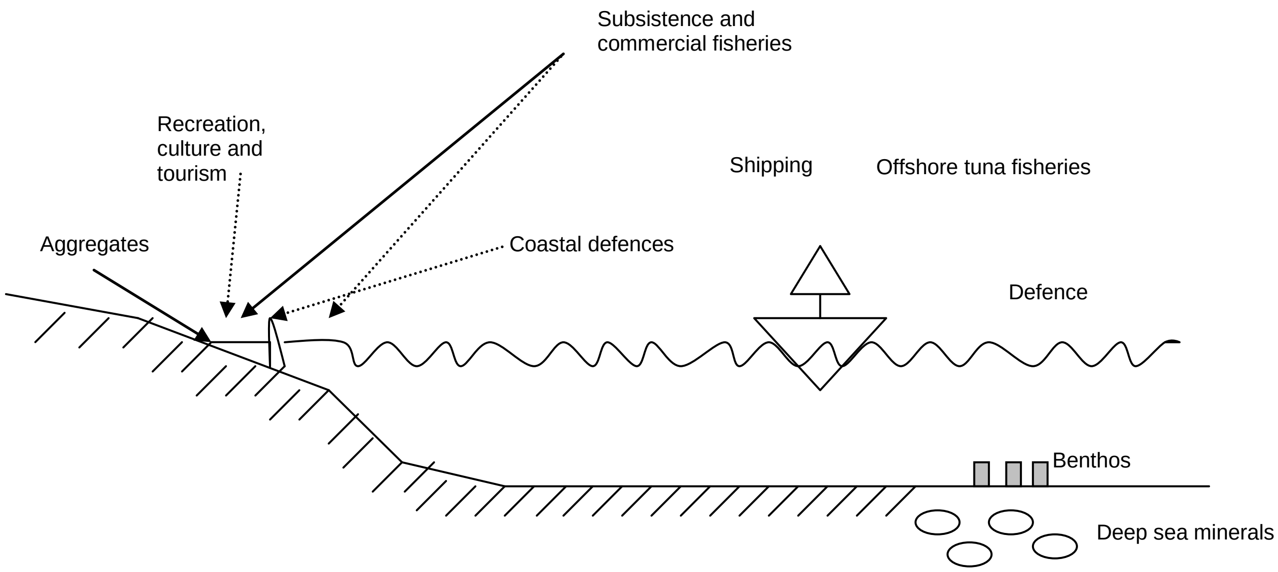
A few key challenges were faced in producing this overview. These included inconsistency in the reported use of terms and value measures, confusion between gross and net economic value measures, as well as irregularities in data coverage. National statistics in the PICT region are often subject to the effects of limited human and financial capacity and major changes over time. Contributing factors are, for example, high turn-over of staff, political instability, short-term import of foreign labour force, and natural disasters. As a result national statistics are often incomplete, outdated or inconsistent, which makes country comparisons challenging. Definitions of national statistics also differ between countries, for example, on what comprises formal employment or how certain economic sectors are treated, such as whether fisheries is treated on its own or included with agriculture. Consistent time series data is largely lacking, making it difficult, if not impossible, to extrapolate into the future and to develop scenarios according to different development and management models.

4. Importance of Pacific Ocean-based activities to PICT economies

PICTs have a long cultural and subsistence association with the sea. Their island economies are particularly dependent on coastal and ocean resources that are used beyond the PICT region. The Pacific Ocean and its coastal habitats such as coral reef and mangrove systems are the main life support to Pacific Islanders providing food, income, and shelter.

Ocean based activities in the Pacific include subsistence and commercial inshore fishing, offshore tuna fishing, tourism, coastal mining of aggregates and shipping (Figure 3).

Figure 3. Ocean and coastal uses within the PICT region



Source: Paula Holland (pers comm.. July 2010)

Available empirical information suggests commercial and subsistence fisheries and tourism generated a combined estimated GVP of more than US$ 3.46 billion annually to PICTs. This contributes 11% to regional GDP.

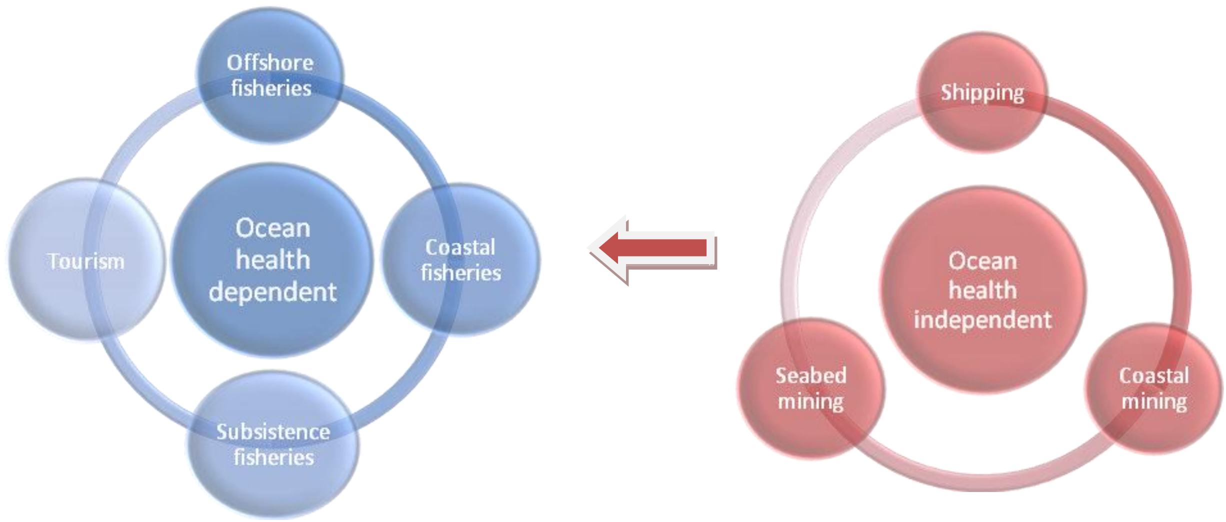
Table III. GVP of ocean-based sub-sectors to PICTs

Ocean-based revenues	Gross Value of Product (GVP)*	As % of regional GDP
International tourism expenditures	US$ 2.27 billion	7.2%
Locally-based tuna fishing	US$ 596.8 million	2.0%
Access fees	US$ 78.5 million	0.2%
Mariculture	US$ 145 million	0.5%
Commercial inshore fishery	US$ 165.7 million	0.5%
Subsistence fishing	US$ 200.4 million	0.6%
Coastal mining	n.a.	n.a.
Deep-sea mining	n.a.	n.a.
Shipping	n.a.	n.a.
Total	**US$ 3.46 billion**	**10.9%**

*in constant US$ at 2007 market prices; tourism in constant US$ at 2008 market prices.
n.a. not available

There are also ocean-based activities, such as coastal mining, shipping, and potential deep-sea mining for minerals and hydrocarbons (Figure 4) that affect the health of the ocean ecosystems posing threats and economic costs to other ocean-health dependant activities if they are not rigorously regulated and controlled Figure 4.

Figure 4. Ocean-based activities can be dependent or independent of ocean health



Source: Authors of this report.

4.1 Tourism & recreational activities

The region's tropical, exotic appeal, its culture and its way of life, attract millions of tourists but mostly visitors come because of the scenic beauty of the islands' coastal and marine environment. Spending time on the beach, boating, game fishing, scuba diving and snorkelling, and spotting marine mega-fauna are some of the most popular reasons for the tourists showing the importance of an undisturbed environment to the success of the tourism industry. Therefore, in this report tourism revenues (or tourism expenditures in country) are used as a proxy to show economic benefits of goods and services provided by the Pacific Ocean to the PICTs.

Economic contribution

Tourism is the biggest economic sector in the Pacific island region. It is also an important contributor of foreign exchange receipts[1] besides often being the most important export earner. A total of US$ 4.3 billion was made in international tourism receipts (Table IV).

[1] Foreign exchange earnings or international tourism receipts is the money earned by a destination country from inbound tourism resulting from expenditure made by visitors from abroad, on lodging, food and drinks, fuel, transport in the country, entertainment, shopping, etc.

Table IV. Economic scale and contribution of the tourism industry to PICT (in 2008 constant prices)

Country or territory	Visitor arrivals	per head of population	per capita expenditure [US$]	Total expenditure [US$]	as % GDP contribution	Int. tourism receipts [US$]	as % GDP contribution	Industry employment	as % of total labour force
American Samoa	30,268	0.46	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CNMI	385,000	6.10	841	400,000,000	n.a.	771,819,420	69%	n.a.	n.a.
Cook Islands	94,152	6.02	1,062	88,509,239	44.1%	105,133,191	50.0%	3,500	59.0%
Fiji	582,602	0.69	965	489,467,114	18.0%	718,091,539	27.7%	33,000	8.6%
French Polynesia	196,496	0.74	3,272	693,297,835	8.9%	933,770,760	13.9%	15,000	15.7%
FSM	19,136	0.17	339	6,484,710	2.6%	17,548,387	7.2%	n.a.	n.a.
Guam	1,225,000*	6.72	n.a.	n.a.	n.a.	1,131,427,550*	n.a.	5,140	9.3%
Kiribati	3,871	0.04	533	1,587,294	1.3%	3,682,850	4.8%	600	2.3%
Marshall Islands	6,959	0.13	475	1,710,000	2.2%	8,481,422	4.8%	n.a.	n.a.
Nauru	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
New Caledonia	103,672	0.41	2,303	*229,200,000*	6.9%	*258,000,000*	3.6%	3,640	4.5%
Niue	4750	3.14	600	1,560,126**	13.0%	1,190,579	10.0%	80	10.6%
Palau	83,114	4.07	2,612	2,511,076	1.5%	104,093,449	57.5%	n.a.	n.a.
Pitcairn Islands	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
PNG	114,182	0.02	2,651	156,510,714**	3.2%	3,353,125	0.1%	104,000	4.4%
Samoa	121,578	0.67	729	71,405,600	14.9%	106,998,109	20.2%	10,755	20.3%
Solomon Islands	16,264	0.03	2,981	17,914,646**	4.3%	10,105,718	2.2%	3,000	1.70%
Tokelau	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Tonga	49,400	0.48	739	30,404,214**	11.0%	16,435,152	5.8%	1,300	3.9%
Tuvalu	1,130	0.10	476	528,528	3.3%	n.a.	n.a.	40	1.2%
Vanuatu	90,675	0.38	1,373	83,200,710	22.4%	118,653,482	26.2%	8,100	13.20%
Wallis and Futuna	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
TOTAL	3,128,249			2,274,291,807		4,308,784,734		188,155	
Regional Average		0.3/1***	1,214		7.2%		13.6%		5.8%

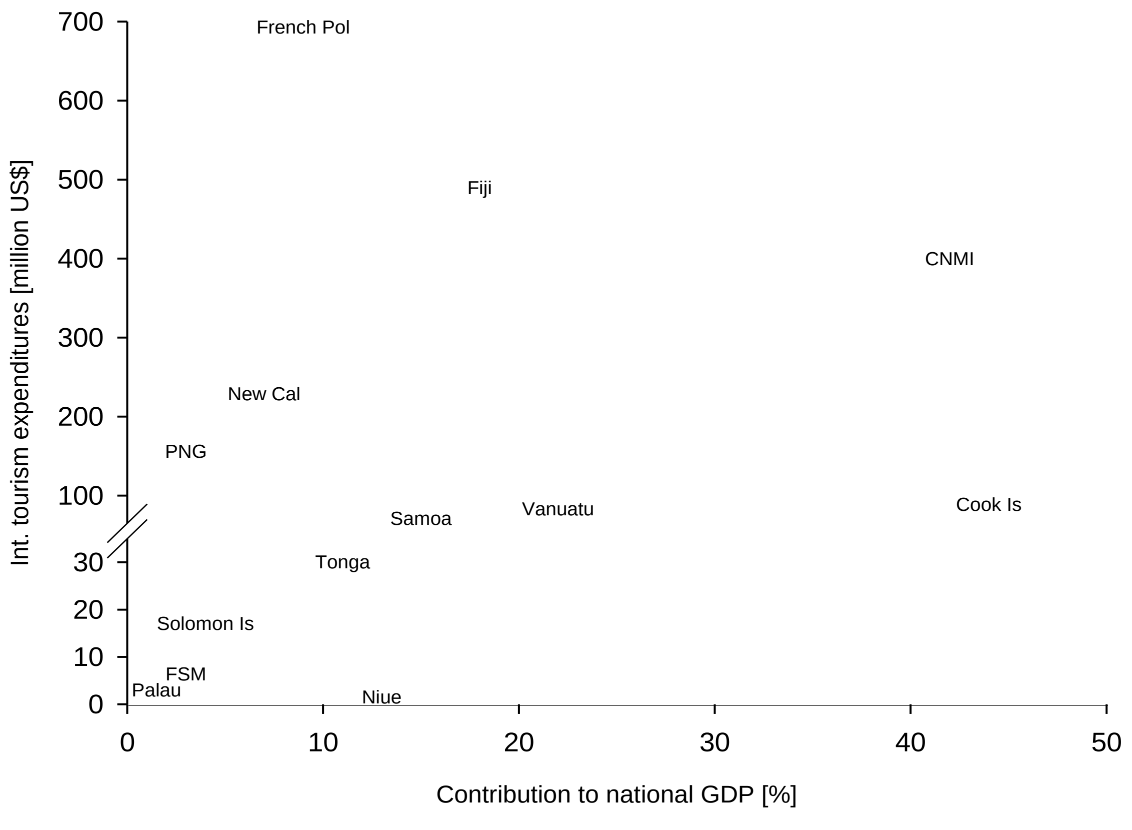
Source: (Milne 2005; UNWTO 2005; UNWTO 2006; World Resource Institute 2007), National Statistics.
Values in italics are in most recent current market prices.
*Guam statistics include military personnel arrivals and their expenditures.
**Higher values of international tourism receipts than tourist expenditures could be due to the use of different definitions and methodology.
n.a. not available

Half of the value stems from total tourism expenditure in-country which amounted to almost US$ 2.3 billion according to latest statistics (see references listed under Table IV). Total tourist expenditure is highest in French Polynesia and Fiji, the percent contribution to national GDP is however highest in the Cook Islands and the Commonwealth of Northern Mariana Islands (CNMI) with 44% and 42% respectively (Figure 5).

The average per capita tourism expenditure is highest in French Polynesia and New Caledonia as well as in PNG and the Solomon Islands. While the French territories are known for up-market tourism, high visitor expenditures in PNG and the Solomon Islands are possibly due to an underdeveloped tourism industry and very high costs in transport/carriers.

The economic contribution of visitors to national value statistics are often incomplete due to the lack of developed satellite tourism accounting systems, different survey methodology, inconsistent approaches, and differences in definitions across countries. The values therefore need to be interpreted cautiously.

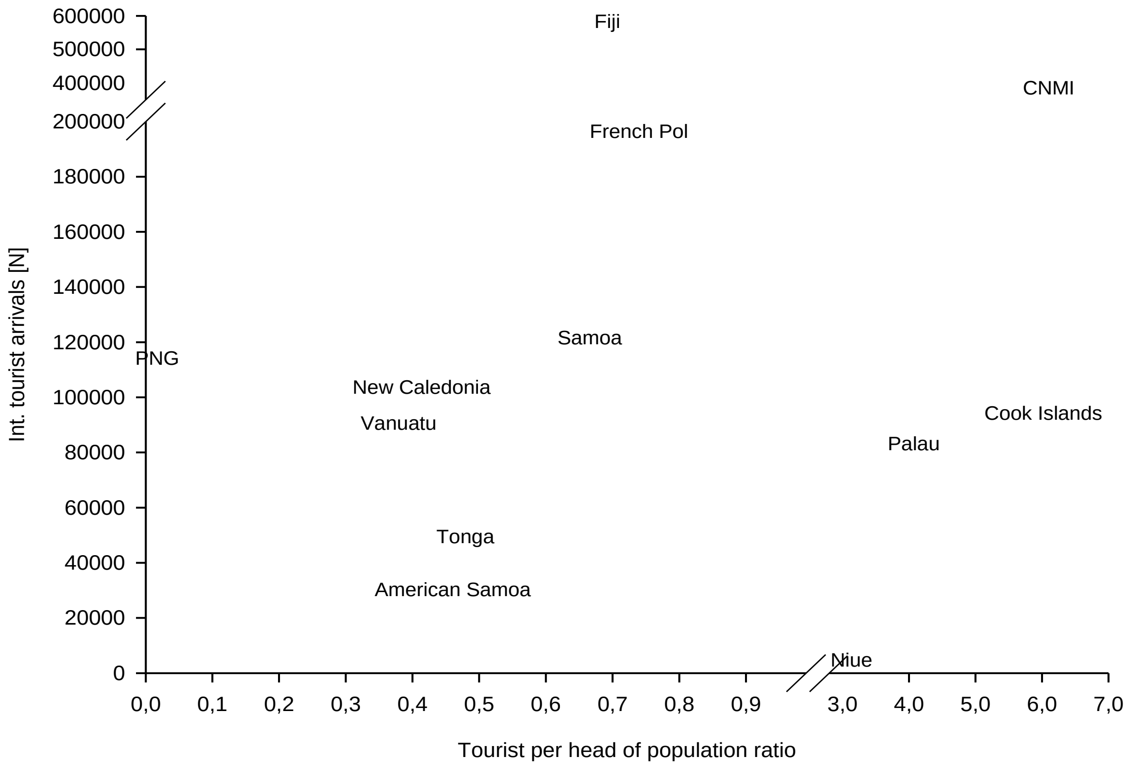
Figure 5. International tourism expenditure



Source: Milne 2005, National statistics

The latest available statistics (from 2006 to 2008) show that more than 3 million people visited the PICTs annually (Table IV). Fiji receives the highest number of tourist, more than half a million per year, which relates to a fifth of all tourists in the PICTs. In countries like Palau, the Cook Islands, and CNMI, four to six times more tourists visit these countries than people actually living there (Figure 6).

Figure 6. Annual total and per unit population tourist arrivals



Source: Milne 2005, National statistics

A word of caution is warranted in comparing tourist numbers between countries as well as trends over time because of differences in what is classified as 'tourists.' High visitor numbers for Guam are generated through the inclusion of military personnel into the visitor statistics, whereas for places like the Cook Islands and Niue, tourist numbers also include nationals living abroad visiting family and friends. Some PICTs publish number of visitors per annum without clearly defining whether this equals the number of tourists.

PICT tourism trends

In the mid 1990s, tourism in the region was dominated by Fiji, French Polynesia (Tahiti) and New Caledonia. However, tourism is now widespread in the region and has become a significant economic contributor to employment and GVP in countries like Samoa, Palau, the Cook Islands, and Vanuatu (Table V). Other destinations are also developing niche opportunities albeit on a much smaller scale, such as Niue, where visitor arrivals increased from 1,000 to 4,750 over 18 years. Thjs change, however, needs to be treated with caution because of uncertainties in the data and change in the definition of what comprises visitor arrivals. Tourism in SPTO member countries has more than doubled over the time span with an average increase in visitor arrivals of 133% (for additional visitor arrival statistics refer to Appendix I). However, one needs to be careful to conclude from an increase in tourist numbers to an increase in GVP of the tourism sector. For example, Fiji has seen an increase between 2003 and 2008 in the total numbers of tourist arrivals of 26 %, while the total earnings have decreased from FJ$ 819 million to FJ$ 651 million (US$ 514 million to US$ 408) in 2008 market prices which corresponds to a 20% loss (Fiji Ministry of Finance and Planning 2008). This can be explained through the popularity of the backpacking industry which has introduced tourists with lower expenditure patterns.

Table V. Visitor arrivals to SPTO member countries between 1990 and 2008

PICT	1990	1995	2000	2005	2008	% change between 1990 and 2008
Cook Islands	34,000	48,000	73,000	88,405	94,184	177
Fiji	279,000	318,000	294,000	549,911	582,602	109
French Polynesia	132,000	172,000	252,000	208,067	196,496	49
Kiribati	3,000	4,000	5,000	4,137	3,871	29
New Caledonia	87,000	86,000	110,000	100,412	103,672	19
Niue	1,000	2,000	2,000	2,793	4,750	375
PNG	41,000	42,000	58,000	69,251	114,182	178
Samoa	48,000	68,000	88,000	101,807	121,578	153
Solomon Islands	9,000	12,000	n.a.	12,533	16,264	81
Tonga	21,000	29,000	35,000	41,862	49,400	135
Vanuatu	35,000	44,000	58,000	62,082	90,654	159
TOTAL	**691.990**	**826.995**	**975.000**	**1.241.260**	**1.377.653**	**133% average**

Source: Milne 2005; SPTO (South Pacific Tourism Organization)

Despite positive trends in the tourism sector, the industry is highly sensitive to external shocks and has suffered from the recent financial crisis and increases in international fuel prices; particularly in the North Pacific US states and territories of Hawaii, Guam, and the Northern Marianas (Saipan). Visitors to the South Pacific nonetheless continued to grow at a moderate 3% growth rate in 2008, probably due to an earlier recovery of Australia from the financial crisis which is the main source market for South Pacific tourism (Allcock 2006).

Marine-based eco-tourism is becoming increasingly popular in the region and plays an important role in providing alternative livelihood options particularly for coastal communities. In Fiji, the Waitabu conservation area, a village-run snorkelling operation in a locally managed marine reserve, generated

FJ$40,000 over a period of 6 years for the community's 20 households (Sykes and Reddy 2007). Although growing in popularity, these micro-operations still make up a minute fraction of the sector.

Whale and dolphin watching-based ecotourism has become a popular tourist attraction in the region and commercial whale watching operations are found in 14 countries, especially in those areas where breeding grounds exist, such as the Cook Islands and Tonga. In 2005, more than 110,000 visitors took part in tourism operations to watch whales and dolphins, an almost ten-fold increase from seven years earlier turning cetacean watching into a multi-million dollar industry (O'Connor 2008).

Tourism benefits could be higher if leakage of profits out of the country were reduced; many of the particularly large tourist ventures are foreign owned and operated (Allcock 2006). Furthermore, high leakage occurs through the high import content of tourists' consumption bundle as a result of a narrow production base in most PICTs and preferences. Benefits could also be better sustained if negative impacts on cultural and heritage values of communities and the fragile natural environments could be kept to a minimum, and other negative effects are contained, such as increased waste, as discussed later in the report.

Employment

Tourism is a highly labour-intensive industry with formal employment ranging from 36,000 to 213,000 people employed (Milne 2005). The wide range reflects the uncertainty of these statistics. Additionally, it is not known whether this reflects full time, part time of or both kinds of employment. The highest percent of formal employment in tourism is in the Cook Islands with an estimated 60%, followed by Samoa and French Polynesia with 20% and 16% respectively. The tourism industry also provides many flow-on benefits for other sectors in terms of revenue and employment (see Table VI) with GDP contribution and employment being roughly three times higher for the entire economy than just for the tourism industry.

Table VI. Industry and economy employment and economic contribution

PICT	Industry employment	as % of total labour force	Economy employment	as % of total labour force	Industry GDP	as % GDP contribution	Economy GDP	as % GDP contribution
Fiji	33,000	8.6%	91,000	23.5%	317,000,000	8.9%	911,900,000	25.6%
Kiribati	600	2.3%	2,300	8.3%	2,000,000	2.8%	7,000,000	10.1%
Solomon Is	3,000	1.7%	11,000	6.1%	14,000,000	2.1%	48,700,000	7.4%
Tonga	1,300	3.9%	3,500	10.5%	14,000,000	4.4%	39,100,000	12.2%
Vanuatu	8,100	13.2%	21,000	33.6%	81,000,000	14.3%	212,800,000	37.5%

Source: (WTTC 2009a; 2009b; 2009c; 2009d; 2009e)

The tourism sector has the potential for large increases in employment in many Pacific island countries, as it has proven to be internationally competitive. A big part of the projected 20% increase in Fiji's formal employment sector between 2004 and 2015 is attributable to the tourism industry (UNESCAP 2008). Again, statistics vary significantly between sources since national statistics define employment differently. Also, many jobs are part-time or seasonal. Statistics on total industry employment in Kiribati range from 1% to 23% and from 4% to 21 % in Vanuatu for the year 2005 (Milne 2005).

4.2 Fishing sector

The fishing sector[2] in the PICT, comprising oceanic tuna fishing, coastal commercial and subsistence fishing, and mariculture, is an important contributor to national economy, foreign exchange, household income, employment, as well as much needed protein.

Table VII. Economic contribution from fishing sector

Activity	Gross Value of Product (GVP)*	Catch volume [mt]	Employment [%]
Locally-based tuna fishing	596,800,000	401,096	0.6%***
Access fees	78,500,000	-	-
Commercial inshore fishery	165,700,000	109,933	n.a.
Mariculture	145,000,000	2,984	n.a.
Subsistence fishing	200,366,961	44,789	54-63%**
Total	**1,186,366,961**	**558,802**	

Source: adapted from Gillett 2009
*GVP in constant US$ at 2007 market prices
** household participation
***includes employment from tuna processing plants

4.2.1 Oceanic tuna fishing

The oceanic or industrial tuna fishery is a major economic activity throughout the Pacific island region, second only to tourism in value, underpinning economic wealth creation. Tuna operations are either locally-based or foreign-based, meaning they are based at a port in or outside the Pacific island area. The waters of the Pacific island region host about 50% of all tuna catches within the West Central Pacific Ocean (WCPO), which is home to the world's largest tuna fishery currently estimated at US$ 3.1 billion in GVP (Hanich and Tsamenyi 2006; Williams and Terawasi 2008). Some Pacific island governments also receive payments (access fees) from foreign-based operators for the fishing

[2] An important point is that, for national accounting purposes, the sector is "fishing", rather than the more inclusive "fisheries". Post-harvest activities, including fish processing, are not included in the fishing sector when estimating GDP. This definition is in accordance with the International Standard Industrial Classification of All Industrial Activities (ISIC).

rights to their EEZs. The only other economically noteworthy industrial fishery is shrimp trawling in PNG which reported an export of 600 mt worth US$ 4 million in 2004 (Gillett 2007).

GVP and catch volumes

Local and foreign-based operators generated tuna yields worth US$ 1.68 billion in GVP in 2007, catching 1.27 million mt of Skipjack, Yellowfin tuna, Bigeye, and Bluefin tuna within PICT waters (Table VIII). This is an overall increase in catch levels of 210% from 1999 when the catch was reported to be 600,000 mt and valued at US$ 657 million (Gillett and Lightfoot 2001). Most of the tuna is caught within the EEZs of PNG, Kiribati, the Federated States of Micronesia, the Solomon Islands, the Marshall Islands, and Nauru.

Foreign nations' distant water fishing vessels (DWFV) obtain the highest volume of tuna from the Pacific EEZ, catching almost two times more than what is caught by locally-based fleet. The most prominent foreign fishing nations in number of DWFV are Japan, Taipei, Korea, China, the United States and the Philippines. In 2007, these nations and others caught 865.000 mt worth more than US$1 billion in Pacific island EEZs, which corresponds to 3.4% of regional GDP. In 2000, 919 vessels registered within the FFA register were foreign-flagged and which had obtained fishing rights to Pacific EEZ(s) by paying access fees to the respective governments. Tuna is therefore a commonly used economic good from which many Pacific Rim countries profit.

In order to increase their share of the value of tuna caught from their national waters, several countries have introduced other forms of licensing, including access arrangements to favour PIC involvement and onshore investment into the tuna fishing such as in PNG, the Cook Islands, and Fiji. This is one of the factors which lead to an increase of 341% in catch volume by locally-based fleet over the last ten years (FFA 2009). This also coincided with a general increase of catches within the WCPO region of almost 150%.

The locally-based industrial tuna fleet, comprising 327 active vessels from 13 out of 22 PICTs, landed more than 400,000 mt in 2007, or about a third of the total tuna harvested from the Pacific EEZ, valued at almost US$ 600 million. This contributes an average of 2% to the region's GDP (Gillett 2009)[3]. The biggest economic impact of the locally-based tuna fishing is in the Marshall Islands and Niue where the GVP make up more than half and a fifth respectively of total national GDP.

[3] The Forum Fisheries Agency Forum Fisheries Agency (2009). Economic Outlook and Prospects for the Tuna Fisheries. FFA Ministerial forum fisheries commitee fifth meeting. Alofi, Niue. gives a slightly higher production estimate of 467,000 mt.

However, not all locally-based enterprises have provided a stable or additional contribution to the national economies. Many locally-based fleet have displayed a boom-and-bust-cycle, as happened in the Cook Islands (Barclay and Cartright 2007). Further, many of the locally-based vessels are still foreign owned and operated, though data to differentiate these from the nationally reported statistics are difficult to obtain.

Table VIII. Offshore tuna fishing production and catch values in 2007

	Production [mt]		Value [US$]		As % of GDP
PICT	**Locally-Based**	**Foreign-Based**	**Locally-Based**	**Foreign-Based**	**Locally-Based**
American Samoa	6,632	0	14,135,083	0	2.5%
CNMI	0	0	0	0	0.0%
Cook Islands	3,939	0	5,772,059	0	2.7%
Fiji	13,744	492	29,293,750	527,500	1.1%
French Polynesia	6,308	0	28,247,299	0	0.5%
FSM	16,222	143,315	23,908,377	177,195,590	10.1%
Guam	0	0	0	0	0.0%
Kiribati	0	163,215	0	197,051,374	0.0%
Marshall Islands	63,569	12,727	81,210,390	19,572,712	54.3%
Nauru	0	69,236	0	80,001,361	0.0%
New Caledonia	2,122	0	8,563,218	0	0.1%
Niue	640	0	1,844,118	0	18.4%
Palau	3,030	1,464	13,779,656	4,947,496	8.4%
Pitcairn Islands	0	0	0	0	0.0%
PNG	256,397	327,471	345,976,228	386,361,944	5.5%
Samoa	3,755	25	8,362,836	49,300	1.5%
Solomon Islands	23,619	98,023	32,662,077	153,548,868	7.6%
Tokelau	0	318	0	397,415	0.0%
Tonga	1,119	0	3,081,498	0	1.2%
Tuvalu	0	35,541	0	40,924,370*	0.0%
Vanuatu	0	12,858	0	26,003,657	0.0%
Wallis and Futuna	0	0	0	0	0.0%
Total	**401,096**	**864,685**	**596,836,589**	**1,086,581,587**	**1.9%**

Source: adapted from Gillett 2009;
*GDP contribution calculated from 2007 GDP values (ADB, SPC), Tuvalu in 2002 current market price

Net economic benefits from access fees

Access fees represent a large part of the direct economic benefits derived by Pacific countries from foreign fishing vessels fishing in their EEZs. Other direct gross benefits include the revenue earned from the supply of fuel, food, maintenance, and other services expenditure etc, as well as associated employment.

The access fees paid to the 15 PICTs by foreign-based operators amounted to a total of US$ 78.5 million in 2007 (US$ 85 million in 2008$) which on average is about 4.7% aggregate regional GVP of tuna caught in the Pacific EEZs. The importance of access fees to national economies though show a large variation between countries, ranging from 0.01% GDP in Fiji to almost 24% of the national GDP in Nauru (Table IX).

Access fees play an important role in the government's ability to provide its services to the country, as some governments in the region rely on access fees as an important income source for government expenditures. In Kiribati, for example, access fees contribute more than 40% to the national revenue (Table IX). In nominal terms, total access fees have not changed significantly since 1999, when they amounted to US$60–$70 million (US$ 81 to 96 million in 2008$) (Gillett and Lightfoot 2001; Gillett 2009). The Kiribati Ministry of Finance has received US$ 25 million to US$ 27 million annually between 2001 and 2007 in access fees and other charges. Such tuna based access fees in countries such as Kiribati and Tuvalu exceed all other export earnings.

Table IX. Access fees received in PICTs in 2007

PICT	Access fees [US$]	As % of GDP	As % of government revenue
American Samoa	0	-	-
CNMI	0	-	-
Cook Islands	262,000	0.1%	0.4%
Fiji	256,985	0.01%	0.03%
French Polynesia	0	-	-
FSM	14,757,221	6.3%	10.2%
Guam	0	-	-
Kiribati	21,361,214	16.8%	41.7%
Marshall Islands	1,953,644	1.3%	5.4%
Nauru	5,147,899	24.3%*	17.2%
New Caledonia	0	-	-
Niue	263,983	2.6%*	2.3%
Palau	1,121,281	0.7%	3.2%
Pitcairn Islands	0	-	-
PNG	14,966,216	0.2%	0.6%
Samoa	256,985	0.05%	0.15%
Solomon Islands	11,764,705	2.7%	4.8%
Tokelau	1,478,676	n.a.	11.2%
Tonga	132,206	0.1%	0.2%
Tuvalu	3,445,378	19.7%*	11.3%
Vanuatu	1,359,700	0.3%	6%
Wallis and Futuna	0	-	-
Total	**78,528,093**	**-**	**-**

Source: adapted from Gillett 2009; in 2007 market prices; GDP contribution calculated

*The percent contribution of access fees to GDP should be lower than the percent contribution to government revenue. This is an anomaly that needs to be explores further.

Employment in the fisheries sector[4]

Tuna fishing is an important employment generator in the islands though most people are employed in post-harvest activities. About 1,170 Pacific islanders were reported to be formally employed on tuna vessels as well as another 11,000 job in tuna processing plants in 2008 within the Forum Fishing Agency (FFA) region (Gillett 2008). In addition, approximately 6,300 people worked in shore-based tuna processing facilities in the French territories and American Samoa. Of these, 5000 people worked at the Pago Pago tuna cannery in American Samoa, which represents 27% of formal employment of the territory. Thus more than 18,500 people region-wide are currently estimated to find direct employment in the tuna industry (Forum Fisheries Agency 2009). Additionally, wages earned by Pacific seafarers on foreign ships often exceed local salaries. In Kiribati, remittances from sea farers support many households and contribute to the national economy. The presented statistics have to be interpreted cautiously due to a range of issues; for example sources of information on fisheries employment range from informal estimates to structured surveys. Definitions differ between countries and studies on what is categorised as employment, inconsistency is observed across countries on how to deal with fish processing and data quality issues are common or data credibility is hard to determine.

Other flow-on benefits

There are other flow-on benefits of the foreign and locally-based tuna fleet operating out in the region. These include the multiplier effects of other dependent activities that supply, for example, other inputs such as fuel, and food, and port charges. The economic values of such contributions are though not known. Other revenues arise through flow-on benefits such as providing services etc to the fleet, but also from post-harvest activities such as tuna processing. In American Samoa, literally 100% of all exports comprise fishing products, canned tuna, pet food, and fish meal from the cannery in Pago Pago. The export value of these products was about US$ 439 million in 2007 which was almost 80% of national GDP.

4.2.2 Coastal fishing

Coastal waters underpin valuable commercial and subsistence fishing with an estimated annual GVP of US$ 366 million, and provide employment, household income, and food for the Pacific island people. With the emerging mariculture businesses this number increases to over half a billion US$ annually (Gillett 2009).

[4] The fisheries sector is defined here to also include post-harvest activities such as processing of tuna.

4.2.2.1 Coastal fishing and mariculture

Coastal commercial fishing is carried out in lagoon, reef, deep-slope or shallow sea areas. It also includes fish caught from small vessels in the open sea adjacent to islands. Most of these operations are relatively small scale. Coastal fishing contributes significantly to local economies, which in some coral atoll nations and territories is the most important economic activity and source of employment for communities and households. Mariculture of some marine species is emerging as a new industry, which currently contributes significantly towards export earnings; mariculture is though practices in a limited number of countries. Ornamental finfish, invertebrates, coral, and live rock are also being harvested for the marine aquarium trade. A small proportion of reef fish is also traded in the life reef food fish trade.

Coastal fishing

Coastal commercial fishing has produced a total of 44,700 mt in the region with a value of US$ 165.8 million in 2007, contributing on average 0.5% to regional GDP (see

Table X). There is though a large variation between countries. On the one end of the spectrum are the Tokelauans, who do not engage in commercial coastal fishing and the population relies on 100% subsistence activities. On the other hand, the contribution of coastal fishing to national GDP is highest in Kiribati with 15%. In terms of catch level and value it is highest in Fiji with an estimated 9,500 mt annually.

Table X. Coastal commercial fishing production & mariculture

	Production				Value [US$]		As % to national GDP	
PICT	**Coastal commercial [mt]**	**Mariculture [kg]**	**Mariculture [pieces]**	**Farmed species**	**Coastal commercial**	**Mariculture**	**Coastal commercial**	**Mariculture**
American Samoa	35	0	0	-	166,000	0	0.0%	0.0%
CNMI	231	10,909	0	Shrimps	950,000	192,000	0.1%	0.0%
Cook Islands	133	1,320	189,783	Black pearl & giant clam	1,029,412	2,212,421	0.5%	1.0%
Fiji	9,500	80,000	48,100	Black pearls, brackish water prawns, seaweed	33,750,000	936,070	1.2%	0.0%
French Polynesia	4,002	54,500	0	Black pearls, penaeid shrimp	23,004,598	123,708,046	0.4%	2.3%
FSM	2,800	0	16,000	Giant clams, black pearls	7,560,000	80,000	3.2%	0.0%
Guam	44	12,000	0	Shrimps (from ponds)	195,000	345,000	0.0%	0.0%
Kiribati	7,000	139,000	100	Black pearls, seaweed	18,487,395	66,063	14.5%	0.1%
Marshall Islands	950	0	25,000	Giant clams, black pearls	2,900,000	130,000	1.9%	0.1%
Nauru	200	8	0	-	840,336	0	4.0%	0.0%
New Caledonia	1,350	1,931	0	Penaeid shrimps, oysters, freshwater crustaceans*	8,689,655	16,594,253	0.1%	0.2%
Niue	10	0	0	--	58,824	0	0.6%	0.0%
Palau	865	0	3,100	Giant clams	2,843,000	45,600	1.7%	0.0%
Pitcairn Islands	5	0	0	-	37,500	0	n.a.	0.0%
PNG	5,700	5,000	0	Prawns	27,027,027	59,015	0.4%	0.0%
Samoa	4,129	0	0	-	19,557,592	0	3.6%	0.0%
Solomon Islands	3,250	165,000	8,202	Coral, seaweed, post larval capture	3,307,190	40,654	0.8%	0.0%
Tokelau	0	0	0		0	0	0.0%	0.0%
Tonga	3,700	0	12,334	Giant clams, black pearls	11,287,129	18,317	4.4%	0.0%
Tuvalu	226	0	0	-	616,526	0	3.5%	0.0%
Vanuatu	538	18,000	2,589	Giant clams, coral, marine shrimp	2,176,923	746,124	0.4%	0.1%
Wallis & Futuna	121	0	0	-	1,206,897	0	0.0%	0.0%
Total	**44,789**	**487,668**	**305,208**	**-**	**165,691,004**	**145,173,563**	**0.5%**	**0.2%**
Regional mean	**2,036**	**-**	**-**	**-**	**7,531,409**	**6,598,798**	**-**	**-**

Source: adapted from Gillett 2009

The degree of commercialisation varies across countries. Many fishermen are largely engaged in artisanal fishing, going out on day trips without a strong organisation of fishing activities. Increasing western influence and the introduction of the cash economy has led to increasing demand for money.

Access to modern fishing equipment and motorised fibreglass boats have greatly increased catches and have led to local overfishing (e.g. Newton et al 2007). In some regions, a bigger proportion of the catch is already being sold rather than consumed locally. The transition is more pronounced in urban areas close to market outlets whereas in rural areas non-market based subsistence fishing prevails (Kronen, Sauni et al. 2006).

Surveys on the participation in the commercial small scale fishing aren't always readily available. In Fiji, an estimated 2,137 people work as full time fishermen (Hand, Davis et al. 2005). This number is most likely conservative because often fish is sold at roadside markets from unlicensed fisherman. An additional 3,000 people work as suppliers, processors, vendors and in the Fishing Department. In other countries such as Kiribati, FSM and Tuvalu numbers do not exceed a few hundred (refer to Gillett 2009).

Mariculture

Mariculture has developed over recent years in some PICTs and is now estimated to be valued at about US$ 145 million annually. Several invertebrates such as the pearl oyster, penaeid shrimps, prawns, giant clams, seaweed and coral have been cultured (see

Table X). In the mid 1990s, pearl oyster culture in French Polynesia and the Cook Islands made up 98% of all mariculture operations (Adams, Bell et al. 2001). Particularly the farming of the blacklip pearl oyster (*Pinctada margaritifera*) for black pearl production in French Polynesia has developed into one of the major export earners making up 97% of all exports in the country. Despite a considerable decline in value from a record U$ 252 million in 2000 to US$ 123.7 million in 2007, French Polynesia is still the biggest producer world-wide and 7,000 people find direct and indirect employment (Berthe and Prou 2007; Gillett 2009). Operations of black pearl culturing are also carried out in Fiji and the Cook Islands. However, it should be noted that mariculture is the most subsidised fisheries sub-sector with the result that apparent benefits can actually turn into a liability. Additionally, in 2007 95.5% of the GVP from mariculture were generated in the two French territories which are much more developed than the rest of the PICT. It is therefore questionable whether mariculture will be a viable economic activity for most PICTs.

Box 1. Marine aquarium trade in PICTs

PICT	Nr of households involved	Nr of companies
Cook Islands	10	1
Fiji	600	5
French Polynesia	10	3
FSM	20	1
Kiribati	200	12
Marshall Islands	50	5
New Caledonia	2	2
Palau	30	1
PNG	50	1
Solomon Islands	250	2
Tonga	150	4
Vanuatu	100	3
12	**1,472**	**40**

Source: adapted from (Kinch and Teitelbaum 2008)

Aquarium live fish and non-fish trade

The marine aquarium or ornamental trade based on ornamental finfish, coral and other sea products, such as live rock, had its modest start in the 1970s but has expanded to at least 12 PICTs with 40 companies (see Box 1) supplying to markets mainly in Asia, Europe and the United States (Kinch and Teitelbaum 2008). The estimated wholesale value from these countries ranges between US$ 40-60 million per year. The market share for ornamental fish in the PICT region lies around 10-15% of the global trade and is valued at US$ 30 million, while comparative numbers for live rock[5] are 80% and US$ 18 million (pers. comm. Being Yeeting, Senior Fishing Scientist at SPC). This generates annual revenues for involved PICT in the range of US$ 30-40 million. It is further estimated that the extraction of wild harvested organisms provides employment for about 1000 people, often community members, and 1,472 households (Kinch and Teitelbaum 2008). In Fiji, the biggest supplier from the region, aquarium trade operators employed about 600 mainly community members (Lindsay, Ledua et al. 2004) who derived a gross income of FJ$1.4 million or US$ 828,000 (Lal and Cerelala 2005). However, the industry has been criticised for unsustainable behaviour and

[5] Mariculture is the production from the farming of marine organisms including fish, molluscs, crustaceans, and marine plants. Farming implies some sort of intervention in the rearing process to enhance production.

reef destruction (Yeeting and Pakoa 2005). Furthermore, management issues arise partially due to a lack in scientific data on the status of stocks.

Some companies have ventured into the culturing of ornamental species of coral and live rock. Giant clams are exclusively cultured due to a CITES ban in commercial trading of live harvested pieces; some species of hard corals are also banned under CITES[6]. Culture of live coral and live rock has also been promoted as a substitute for coral harvested from the wild, because of concerns about the sustainability of the wild fishing. Two financial viability studies, carried out in Fiji and the Solomon Islands (Lal and Cerelala 2005; Lal and Kinch 2005), though suggest that only at certain production levels are mariculture based live coral and live rock operations more profitable than those based on wild fishing, due to high transportation costs. Additionally, the trade is sensitive to external shocks which are mirrored in demand. For a regional review on financial viability of the ornamental trade refer to (Lindsay, Ledua et al. 2004).

[6] CITES Appendix II, refer to www.cites.org

4.2.2.2 Coastal subsistence fishing

Coastal or inshore fishing for home consumption plays a vital role in Pacific islanders' lifestyles and provides food security throughout the PICT (Bell, Kronen et al. 2009). Typically, 10 to 20 times more people fish for subsistence than for commercial purposes despite increased commercialisation of coastal fishing supporting mainly urban dwellers. Marine resources are one of the most vital sources of dietary protein with the average annual per capita consumption of 50 kg reef fish (Box 2) being significantly higher than the global average. This is particularly the case in countries with limited possibilities for agriculture, particularly atolls and low lying island states where land is limited and communities rely on the coastal waters for food supply. It has to be mentioned however, that the values presented in Box 2 are conservative and have been generated through household income and expenditure surveys (HIES) which are suspected to underestimate fish consumption in the Pacific (Gillett 2009). Gillett and Lightfoot (2001) for example present a much higher range of 72-207 kg annual per capita consumption for Kiribati.

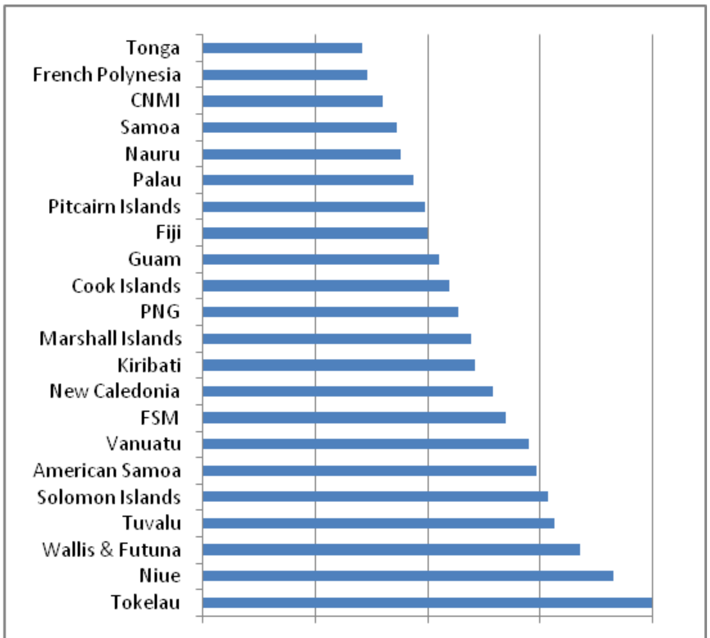
Box 2. Annual per capita fish consumption in PICT

Tuvalu	110.7 kg
Samoa	87.4 kg
Niue	79.3 kg
French Polynesia	70.3 kg
FSM	69.3 kg
Kiribati	62.2 kg
Nauru	55.8 kg
Cook Islands	34.9 kg
New Caledonia	33.4 kg
Palau	33.4 kg
Solomon Islands	33.0 kg
Fiji	20.7 kg
Tonga	20.3 kg
Vanuatu	20.3 kg
PNG	13.0 kg
Average	50 kg

Source: adapted from (Bell, Kronen et al. 2009)

Values of subsistence catch are often not readily available for an entire nation but are usually based on localised socio-economic case studies. Again, HIES have provided some useful estimates of subsistence catches which are however believed to be lower than actual catches. Gillett (2009) has compiled those values together with re-estimations of socioeconomic surveys recently undertaken by Secretariat to the Pacific Community (SPC) under the PROCFISH project (www.spc.int). In 2007, total estimates of subsistence catch levels

Box 3. Subsistence contribution of total coastal fishing production in %



Source: adapted from Gillett 2009

were 110,000 mt valued at US$ 200.4 million using a shadow value[7]. This contributes 0.6% to regional GDP. Not surprisingly, PNG and Fiji, with large populations, produced the highest amount of subsistence fishery. On the other hand, the greatest importance of subsistence fishing lies in coral atoll island nations, such as in Tokelau and Kiribati. Kiribati's subsistence catches are estimated to be worth US$ 28.6 million which would correspond to 22.5% of national GDP. In 15 PICTs, coastal subsistence catch is still greater than coastal commercial fishing (Box 3). The values range from 100% in Tokelau to 35% in Tonga (

Table XI) with an average of 70% retained for home consumption. In most PICTs a large proportion of subsistence fish is caught by women using nets to fish from the beach or to glean for invertebrates (Vunisea 1997) and thus providing food security in their communities.

Table XI. Subsistence fishing in the PICT

PICT	Catch volume [mt]	Catch value [US$]*	% GDP contribution	% of coastal fishing
American Samoa	120	478,000	0.1%	77%
CNMI	220	631,700	0.1%	49%
Cook Islands	267	1,250,000	0.6%	67%
Fiji	17,400	33,812,500	1.2%	65%
French Polynesia	2,880	13,208,276	0.2%	42%
FSM	9,800	15,732,000	6.7%	78%
Guam	70	217,000	0.0%	61%
Kiribati	13,700	28,571,429	22.5%	66%
Marshall Islands	2,800	4,312,000	2.9%	75%
Nauru	450	661,345	3.1%	69%
New Caledonia	3,500	15,770,115	0.2%	72%
Niue	140	617,647	6.2%	93%
Palau	1,250	2,511,000	1.5%	59%
Pitcairn Islands	7	36,765	n.a.	58%
PNG	30,000	35,472,973	0.6%	84%
Samoa	4,495	14,903,842	2.7%	52%
Solomon Islands	15,000	10,980,392	2.6%	82%
Tokelau	375	711,397	n.a.	100%
Tonga	2,800	6,182,178	2.4%	43%
Tuvalu	989	2,232,686	12.7%	81%
Vanuatu	2,830	5,740,385	1.1%	84%
Wallis & Futuna	840	6,333,333	3.4%	87%
Total	**109,933**	**200,366,961**	-	-
Average (country)	**4,997**	**9,107,589**	0.6%	71%

Source: adapted from Gillett 2009

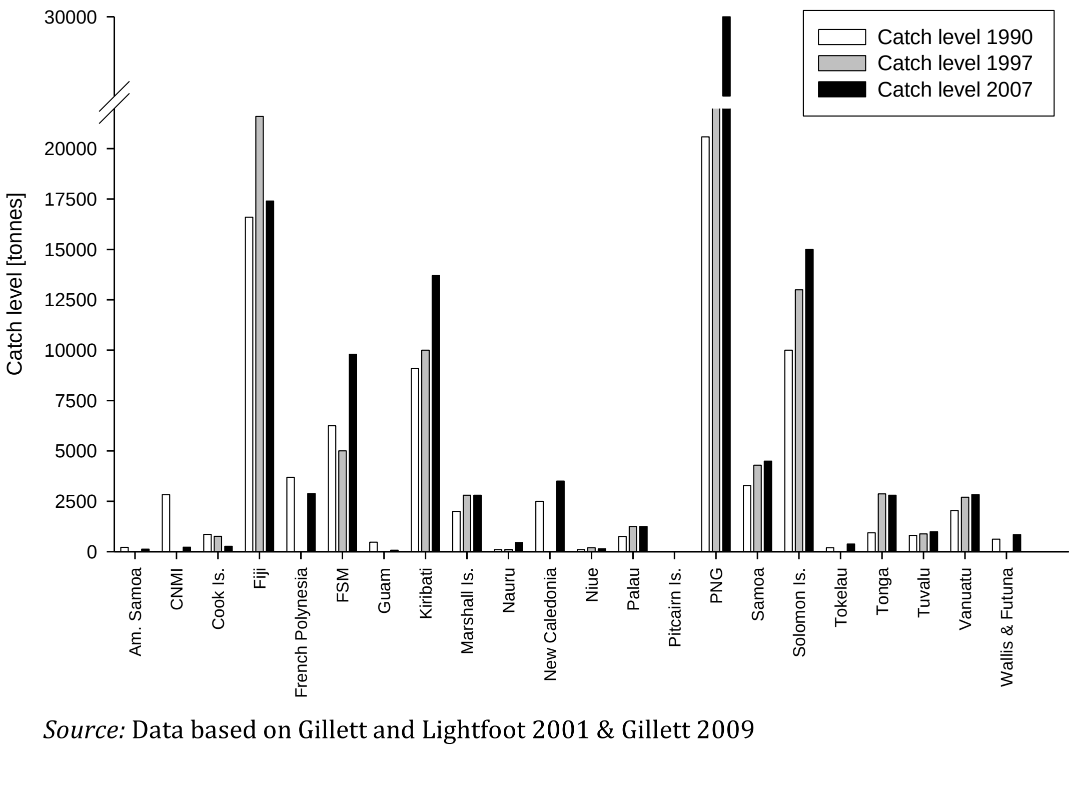
* in current 2007 market prices

[7] For simplicity, Gillett (2009) considered the catches from recreational fishing as production for home consumption and therefore as a component of subsistence fisheries.

The number of individuals or households participating in subsistence fishing is not comprehensively assessed for many countries. One estimate reported 3000 individuals taking part in subsistence fishing in Fiji (Hand, Davis et al. 2005); this seems extremely low given the amount of catch levels and the proximity of Pacific islanders to the coast. Gillett and Lightfoot (2001) reported that 22% of the population in the Cook Islands and 61% of fishing households in Kiribati engaged in subsistence fishing. Often more traditional gear is still used. At times less economically valuable fish from commercial catches are retained for subsistence purposes.

In the early 1990s, 80% of total coastal catches were retained for subsistence consumption. Approximately 84,000 mt were caught, valued at US$ 180 million (Dalzell, Adams et al. 1996). About 15 years later, only 60% of catches were still kept for home consumption (Gillett 2009). Figure 7 illustrates the changes in subsistence yield in PICT over a period of 17 years. While catches have increased in seven countries, they remained stable in four and decreased in further six PICT, despite increases in populations.

Figure 7. Changes in subsistence catch levels between 1990 until 2007



Source: Data based on Gillett and Lightfoot 2001 & Gillett 2009

The subsistence fishing is also of great cultural importance and is central to the Pacific Island way of life. These social and cultural values are essentially non-market based in nature, the economics of which are not known.

4.3 Shipping

The economic value associated with shipping is poorly understood, although shipping is the main lifeline in the Pacific, effectively transporting passengers and imported goods and exporting domestically produced commodities.

Shipping in the islands is either domestic, international (between Pacific islands and between PICTS and the outside world), or transit (without calling at a port). The shipping sector can be further disaggregated into passenger transport, cruise shipping, military shipping, and merchant shipping of goods for trade (import, export). Although today most foreign visitors arrive by planes, local passenger transport is often possible only via shipping between islands and to more remote locations. Movement of military fleet is generally small, except in the North Pacific waters where their contribution to the local economy and employment is large. Recreational sailing on private yachts also generates revenues for port authorities, and local economies through purchase of supplies and services.

Despite the importance of the shipping sector to the local economy, in terms of various port fees and other charges, limited published empirical information is readily available. In addition, little disaggregated information exists on the shipping sector, or it is difficult to access because of the data is maintained on the basis of "commercial in confidence". Some anecdotal information though does give an indication of the relative importance of merchant shipping to national economies.

Contribution to national economies

The major provider for shipping services in the PIC region is the regionally owned Pacific Forum Line (PFL). It connects the islands with Australia and New Zealand. The number of merchant ships operated in the region ranges from one in Samoa to 1,049 in the Marshall Islands (see Appendix II), the third biggest merchant fleet in the world. However, approx. 89% of these fleet are foreign owned (Meyrick and Associates 2007). Main trade routes are with Australia and New Zealand and Asia due to their proximity to the South Pacific and the equatorial west Pacific respectively (see Table XII).

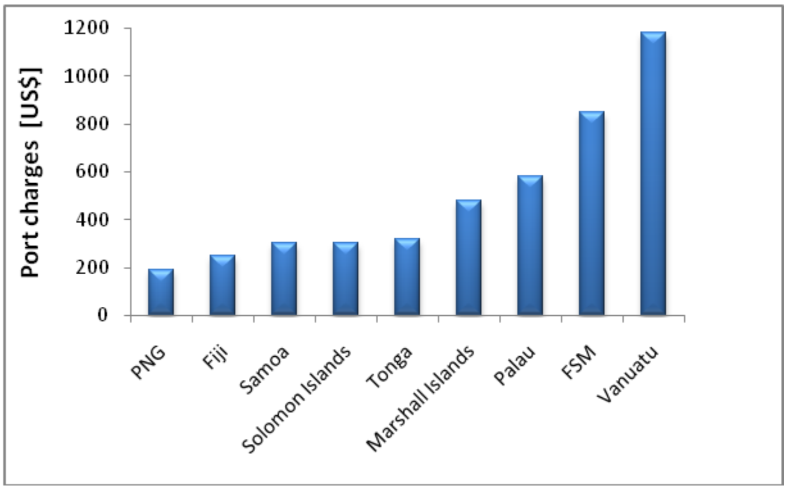
Table XII. Trading routes and shipping companies in the PIC region

Trade regions	Nr of trading routes and port calls	Nr of companies
Australia & New Zealand	17	11
Asia and around-the-world	6	11
North America	2	4
Europe	1	1

Source: adapted from (ADB 2007)

The FSM have set up an entry insurance system (EIS) based 5-year license that allows foreign ships to clear port, requires a payment of US$5,000 per year per vessel and is linked to bond payments of US$75,000 to US$1 million dependant on the size of the ship (Howes and Morris 2008). In Fiji port tariffs are US$250 per twenty-foot equivalent unit (TEU)[8], or with average size of 200 to 250 TEU per ship value of US$50,000 to 62,500 per ship-visit[9]. Port fees, which comprise general, facility and service tariffs, though vary greatly between countries (see Figure 8).

Figure 8. Port charges in selected PIC



Source: adapted from (Howes and Morris 2008)

Indirect benefits from the Pacific Ocean –training of seamen

A Pacific network of 12 maritime training institutions across the region supplies skilled seafarers for the international shipping sector, creating jobs for many islanders. In 2003, an estimated 4,000 seamen[10] trained in the Pacific were employed on international ships, remitting roughly US$19 million in foreign exchange earnings to their home countries (Commonwealth of Australia 2006). Often internationally employed Pacific seamen earned higher wages relative to their national counterparts, and remittances made up to 25% of national GNP in some countries.

Kiribati and Tuvalu in particular have invested in the training of seafarers, supplying a large number of seamen to international shipping companies. In Tuvalu 542 men or about 15% of the country's male population was working as seafarers for international companies in 2006. These activities injected remittances of US$4 million (US$4.1 million in constant 2008 prices) into local Tuvaluan

[8] Standard unit for containers (20ft x 7.9ft x 8.5ft)

[9] Pers. comm. Kailesh Kumar, PFL manager

[10] Part of this figure are likely to be seamen who work on commercial fishing vessels

economies (CIA 2009). Every seafarer has provided an average of US$ 7,380 per year to their family, which is more than 4.5 times the average national per capita GDP value. In Kiribati comparable figures are even higher. Remittances totalled US$ 12 million in 2008 (ADB 2009). Partly, this might be due to Kiribati people earning relatively high wages of US$ 1,000 per month due to their internationally recognised training. This is four times higher than seamen from Vanuatu where those frameworks are currently not in place (SPC 2006). Seafaring can keep local unemployment down and ameliorate local living standards through remittances. Such wages allow many families to avoid migration to urban centres in search for paid employment. There are, however, also a range of social impacts of seafarer training industry associated with the pacific Oceans, including the effects of separation of male members from their families and sexually transmitted diseases (SPC 2006).

Other employment benefits from shipping include those related to land-based facilities such as ship refuelling, shipbuilding and repair, and port services. However, no information is readily available for this kind of employment.

4.4 Mining in marine waters

Mining activities in the Pacific region comprise extraction of aggregates in inshore coastal water and deep sea mineral exploration. Coastal areas provide an important, albeit small but growing, source of aggregates for local development. On the other hand, deep sea mining is not a major activity in the region but shows growing interest both in terms of revenue and employment. Mining is also a source of concerns because of their potential negative impacts on offshore and coastal ecosystems through pollution, habitat destruction, and impacts on commercially exploited fish stocks (Morgan, Odunton et al. 1999; Halfar and Fujita 2007; Danovaro, Gambi et al. 2008).

4.4.1 Coastal mining

Coastal mining of sand and aggregates and dredging of coral reefs is a common activity in PICT, particularly in Kiribati, Fiji, FSM, Marshall Islands, Samoa, Tonga and Tuvalu providing an important source of building material or as landfill. Coral sand and limestone is also used for cement manufacturing and is often preferred over river gravel or quarry mining due to its lower prices and easy accessibility (Colbert 2000). Aggregate mining of carbonate sand, coral rubble, gravel, rocks, shells, and other reef materials occurs on the beach or in shallow waters seldom exceeding 25 m depths (Tuqiri 2001). With increasing population and growth in tourism the demand for such aggregates is expected to increase over time.

The economic value of coastal mining is difficult to estimate because of poor information. Official records on aggregate or sand production supply and demand are often incomplete or non existent. This makes any estimation of the economic benefits of aggregate mining at a national or region level challenging. Available information do give an idea of the economic value of coastal mining activities in the Pacific islands, particularly when one considers employment generated locally and that in the absence of local mining, much of the material may be imported from other countries.

In Fiji, for example, coral sand was mined in the 1990s at Laucala Bay at the rate of about 70,000 m^3/yr as a major ingredient for cement production; the aggregate was valued at FJD$ 1 million or US$ 693,000 per year (Howorth 1997). In 2006, production for limestone was 215,000 mt and an additional 300,000 m^3 of sand and gravel were mined (U.S. Geological Survey 2006)[11] providing paid work for 3,222 people (Fiji Islands Bureau of Statistics 2008). In the Marshall Islands, the aggregate mining and quarrying industry accounted for an average gross value of 0.3% of total GDP, or approximately US$300,000 per year between 1991 and 2001 (McKenzie, Woodruff et al. 2006). In Tongatapu, Tonga, beach sand sold at US$10 per m^3 made a domestic industry of annually US$150,000 (Howorth 1997).

Mining is often small-scale in character and done manually by households but companies also mine industrially using dredges and other machinery. On Majuro Atoll, almost 70% of the surveyed households collected aggregates for domestic uses and sale. Additional commercial demand was supplied by two companies (McKenzie, Woodruff et al. 2006). On Funafuti Atoll in Tuvalu, every second household was engaged in small-scale aggregate mining mainly for private construction with extractions being carried out from every few years to several times a week (Ambroz 2009). The overall reliance on this activity for household income is still very low; less than 1% of the households sell aggregates with a net gain of US$ 1.7 per 20kg bag of aggregates (Ambroz 2009). However, the coastal aggregates play an important role in meeting the housing needs of the locals.

In Kiribati, approximately 70,000 m^3 are being mined from coastal areas for housing (Greer Consulting Services 2007). Outsiders have to gain consent from traditional landowners in addition to a US$ 1.5 royalty per m^3 and a 3-months licence (US$ 27) which accounted to US$ 2,550 in 2005. However, a small proportion of aggregate mining, about 2%, is done by outsiders and therefore attract little overall royalties.

[11] Information on coral sand production was too incomplete for estimation. An unknown proportion of the sand and gravel production was mined from river beds or quarries

4.4.2 Seabed mining

Deep-sea or seabed mining is currently not a major activity in the region, although prospecting of mineral deposits and hydrocarbons could potentially be one of the most lucrative emerging ocean-based activities in the future. The next global metal rush, according to a recent peer-reviewed article, will concentrate on the seafloor targeting many EEZs and extended continental shelves of many PICs (Gleason 2008). Deep-sea minerals are of three types: manganese nodules, cobalt-rich manganese crusts or polymetallic sulphite deposits (Colbert 2000). Additionally, hydrocarbons (petroleum & gas) have been discovered in the region (Erry, Johnston et al. 2000). Seabed mining could provide higher grades of minerals along with a smaller footprint (reduced production of overburden/ waste) compared to land-based operations and limited social disturbance (Smith, Nautilus scientist).

Scale and economic potential of seabed mining

Confirmed mineral occurrence, mainly manganese nodules, exists within the EEZ of the following countries: PNG, Tonga, Solomon Islands, Vanuatu, Samoa, Fiji, Kiribati, Tuvalu, FSM, Marshall Islands, Palau, Cook Islands. Clearly for Fiji, Federated States of Micronesia, Palau, Papua New Guinea, Solomon Islands, Tonga, and Vanuatu, the potential for seabed mining is now becoming a new and rapidly emerging economic opportunity. For others, in particular Cook Islands, Marshall Islands and Kiribati, interest in manganese nodules and cobalt rich crusts remain. Ten years ago, first indications were made about the potentially high gold content of PIC polymetallic sulphide deposits with an extracted value potentially as high as US$ 2,000 per m^2 which have led to increased foreign investments (World Bank 2000).

Hydrocarbons have further been investigated in Fiji, Solomon Islands, Tonga, and Vanuatu whereas commercial production has started in PNG (Howorth 1997). An evaluation of Fiji's petroleum potential in the early 1990s had identified over twenty prospects which could contain oil and gas in Bligh Water Basin and Bau Waters Basin. It was estimated that if oil were to be present, each prospect could contain reserves in the order of 300 million barrels of oil (Energy Current 2009). Government revenues, in the form of royalty and corporate tax, from only one such oil field were reported to be in the order of US$ 5.8 billion over twenty years (or US$ 1.4 billion discounted), which could have major impacts on the national economy of Fiji (Rodd 1993). Additionally, a recent discovery of mineral resources at thermal vents associated with the EEZ of Fiji has attracted many investors who are interested in further explorations.

The economic potential of offshore minerals in the PICs is believed to be significant but the actual dollar value can only be estimated once the mineral resource/reserve is confirmed. The excavation of offshore minerals is extremely costly and capacity intensive, currently only allowing foreign investors to explore and mine in the region.

Pacific island government revenue from the mining industry will be received from royalty and corporation tax and other payments associated with the extraction of a "zero-value" or to date "unutilised" resource base. Mining operations can also contribute to the creation of additional permanent jobs and skills transfer as well as new capital investment into infrastructure including power, water, as well as port and road facilities. Therefore, the region would need to attract investment in the offshore mining industry that will enable mining companies to undertake extensive marine mineral exploration to determine their potential economic value and feasibility. Seabed explorations are currently underway in search for oil, gas and minerals such as manganese nodules (SOPAC 2009). To date, two companies are commercially investing in the region, Nautilus Minerals and Neptune Mining, though there is growing interest expressed by f a number of possible investors. The most advanced exploration in the region is the ongoing Solwara Seabed Massive Sulphide prospect in the Manus Basin within PNG's territorial waters. The exploration company Nautilus is working towards mineral production by 2012. It is the first company worldwide to venture into offshore mining of massive sulphide systems, a potential source of high-grade copper, gold, zinc and silver (Lipton 2008).

Some PICs have also logged their extended seabed claims to the International Seabed Authority (ISA) during the first half of 2009 to claim resource ownership beyond national EEZs. The extension of the coastal shelves under the UN Convention of the Law of the Sea (UNCLOS) may gain considerable resources to national economies. Those extended "legal" continental shelves (ELCS) have high potential in manganese nodules and crusts, oil, gas, and gas hydrates. Estimates value the resource potential within ELCS worldwide at US$ 11.93 trillion (at 2001 raw commodity prices excluding operational and other costs) (Murton 2001). However, interest will depend on world market prices and demand. Swamping of market price would result in instant losses making PICs again vulnerable to outside dynamics. Environmental effects of such mining activities are also unknown, although communities have raised many concerns and scientific research shows that environmental threats of seabed mining may in fact be manifold, depending on the scale and nature of mining activities. Environmental regulations pertaining to deep sea mining is almost non existent in the region, with a few exceptions such as the Cooks Islands.

5. Total Economic Value of Pacific Ocean sub-ecosystems

Limited detailed economic studies suggest a total economic value of the Pacific Ocean sub-ecosystems to be well over several billion US dollars, as discussed below. TEV for coral reefs from five PICTs (2 at provincial level) is estimated to be about US$ 758 million annually and US$ 250 million for mangroves from three PICTs (see Table XV and Table XVI). From these studies a regional TEV of more than US$ 7.6 billion from coral reefs and mangroves was calculated. This value is a conservative estimation of the true economic values since it is based on only a handful of studies of TEV of coral reefs and mangrove forests and swamps in only a limited number of countries. Therefore, it is only presented here to provide an idea of the magnitude of the TEV of these systems. Additionally, values are much higher for those countries where studies only estimated parts of the national sub-ecosystem area. Values for other sub-ecosystems such as seagrass beds, estuaries, sandy and rocky shores, and beach systems as well as deep sea resources are not available for the region. All of the economic activities mentioned in Section 4, except shipping and mining, are directly or indirectly dependant on these healthy coastal and/or adjacent offshore ecosystems; shipping and mining activities are likely to also produce negative impact on the functioning of the other subsystems, even if their market benefits may be considerably high.

Ocean sub-ecosystems generate many goods and services directly valued by people. As seen in Section 4, these include fisheries products consumed as food, mining products used in construction, and non-consumptive uses of healthy reefs and other habitats valued by tourists. They also provide many ecosystem services that sustain ecological processes such as protection against erosion and carbon sequestration (Table XIII).

Table XIII. Diversity in economic value of goods and services supported by mangroves in selected countries (US$/ha/yr)

	Fiji	Indonesia	Philippines	Kosrae (FSM)	Thailand
Forestry	6	67	251	178	140–1,059*
Fisheries	100	117	60	461	8–63**
Biodiversity		15			
Erosion		3			2,990
Nutrient filter (human waste treatment)	2,600				
Carbon sequestration					86
Total	2,706	102	311	426–640	3,206–4,112

Source: Lal 2003
*Includes non-timber products plus coastal fishery
** Offshore fisheries

Table XIV. Coral reef and mangrove areas in PICTs

PICT	Reef area [km2]	Mangrove area [km^2]
American Samoa	67	57
CNMI	102	7
Cook Islands	212	0
Fiji	10020	385
French Polynesia	3000	0
FSM	3172	86
Guam	183	0,94
Kiribati	1967	n.a.
Marshall Islands	1995	n.a.
Nauru	10	1
New Caledonia	4573	456
Niue	15	n.a.
Palau	709	n.a.
Pitcairn Islands	39	0
PNG	13840	5399
Samoa	200	7
Solomon Islands*	5750	642
Tokelau	97	n.a.
Tonga	3587	10
Tuvalu	872	n.a.
Vanuatu	708	16
Wallis and Futuna	425	n.a.
Total	**51,543**	**7,067**

Source:
Mangrove area (Spalding, Ravilious et al. 2001)
Coral reef area (Andréfouët, Chauvin et al.)

The services provided by healthy ecosystems are not directly markets and therefore information on their value in monetary terms does not readily exist.

5.1 Coastal sub-ecosystems

Economic valuation studies of coastal sub-ecosystems are limited, with the majority focusing on national level direct and indirect uses of coral reefs and or mangrove ecosystems. Pacific-wide value of subsystems, let alone total value of the PICTs are poorly understood. Only a handful of regional estimates are available and these are equally based on a range of methodologies, and value measures.

Regional TEV

A wide ranging TEV have been reported in the literature, largely because of different methodologies used, and approximation made in the light of poor baseline information. Cesar et al. (2003) estimated a net present value (NPV) of the Pacific (excluding the USA and Australia) coral reefs to be US$ 2.08 billion[12], including US$ 751.000 million from non-market values such as coastal protection and biodiversity value. Using primary data reported in Tables 16 and 17, TEV of coral reefs is estimated to be US$ 3.8 billion per year, including about US$ 1.3 billion were contributed from indirect or non-use values. These results are similar to Cesar et al (2003). Similarly the TEV of PICT mangrove forests is with US$ 3.9 billion annually the same as for coral reefs.

National level TEV of sub-ecosystems

Country specific economic valuation information on ocean based subsystem is also very limited, providing a wide range of value estimates, sometimes only valuing a certain area, island or province of the national ecosystem. Where these are available estimates reflect often only a subset of use and/or non-use values (Table 13). Such variations in values considered and different approaches used make it difficult to derive an aggregate economic value of the sub-ecosystems in the PICT. The

[12] Note that these values also capture some fot eh direct market values associated with ecotourism

following economic value information is provided to only give an idea of the range in values that have been estimated, and approaches used.

The TEV of coral reefs and mangroves, for example, in Fiji, was estimated, at US$ 439.2 million annually at 1994 prices (Sisto 2000) of this US$ 229 million was attributed to recreational uses of reefs, beaches, and lagoons. This estimate was, however, not based on primary information from Fiji but on global mean estimates by Costanza et al. (1997) multiplied by coastal ecosystem area from Fiji. Coastal resources in Palau were estimated at US$ 41.4 million annually relating to 25% of national GDP (World Bank 2004, unpublished cited from (Thomas 2007). In Samoa tourism based net economic value was estimated to be US$ 947,000 with a TEV or benefit associated with all terrestrial and marine resource to the residents of Samoa of US$12 million (Mohd-Shahwahid and McNally 2001). If values of global benefits generated by these resources, particularly on climate regulation services, nutrient cycling, and biological control were incorporated, the TEV raises to US$ 137 million annually.

The TEV of coral reefs ranges from US$ 5 million in American Samoa to more than US$ 137 million in Guam (Table XV). The annual value per km^2 is again lowest in American Samoa and 28 times higher in the Moorea Atoll, French Polynesia. Table XVI shows the few available values for ecosystem goods and services for mangroves in the region.

Table XV. Ecosystem goods and services (in NPV) of coral reefs in PICT

PICT or location	TEV of coral reefs/yr	As % of GDP	TEV per km^2/yr	Direct use value	Indirect & non-use value	Indirect & non-use value per km^2/yr	Comments	Method used	Reference
American Samoa*	*5,093,000*	1.2%	*76,015***	*3,814,000*	*1,279,000*	19,090	From fishing; diving/snorkelling; shoreline protection	Contingent valuation method + GIS-based economic model	(Spurgeon, Roxburgh et al. 2004)
Saipan* (CNMI)**	68,520,518	6.4%	896,279 - 10,083,137	50,019,978	18,500,540	640,157	For coral reefs and adjacent habitat tourism, coastal protection, diving, snorkelling, fisheries, amenities, research (biodiversity)	Household survey, Discrete choice experiment, Total Economic Value Calculation, Spatial analysis, Sustainable financing	(van Beukering, Haider et al. 2006)
Fiji	*439,200,000*	28%	*43,832***	*229,492,521*	*209,282,266*	20,886	From recreational uses of reefs, beaches, lagoons and coastal protection (In 1994 market prices!)	Based on secondary literature on global mean values (e.g. Costanza et al. 1997)	Sisto 2000
Moorea Atoll* (French Polynesia)**	107,742,799	1.5%	2,154,900	65,938,593	41,804,206	836,084	For reefs & lagoons from tourism & recreation, coastal protection, aesthetics, biodiversity, subsistence	Willingness to pay (WTP) method used	(Charles 2005)
Guam	137,827,077	3.4%	753,153**	116,173,177	21,653,901	118,323	For coral reefs and adjacent habitat tourism, coastal protection, diving, snorkelling, fisheries, amenities, research (biodiversity)	Household survey, Discrete choice experiment, Total Economic Value Calculation, Spatial analysis, Sustainable financing	van Beukering et al. 2007
Total	758.383.395	-	-	465.438.269	292.519.103	-	-	Case study values added together	-
TEV per km2/yr	**73.282**	-	-	**44.975**	**28.266**	-	-	Total value divided by total mangrove area from case studies (458 km2)	
Total value for PICTs	**3.777.150.741**	-	-	**2.318.128.952**	**1.456.899.973**	-	-	TEV per km2/yr multiplied by total PICT reef area (7,067 km2)	-

Values in constant US$ at 2008 market prices; values in italics are in current US$ market prices.
* The TEV is $10.057 million if the value of the mangroves conservation to the US public at large is considered.
**Unit value per km^2/yr calculated from values given in Table XIV.
***Reef area for Saipan: 28.9 km^2; reef and lagoon area for Moorea: 50 km^2

Table XVI. Nominal Values of Ecosystem goods and services of mangroves in PICT

PICT or location	Annual TEV of mangroves	% of GDP	per km^2/yr	Direct use value	Indirect & non-use value	Indirect & non-use value per km^2/yr	Comments	Method	Ref
American Samoa*	*754,000**	0.2%	13,228**	*213,000*	*573,000*	10,053	Subsistence & artisanal fishing, shoreline protection, cultural & social value	Contingent valuation method + GIS-based economic model	Spurgeon et al, 2006
Fiji****	*140,616,889*	9%	178,961**	*71,715,433*	*68,901,456*	178,959	(in 1994 market prices)	Benefit Transfer	Sisto 1997
Fiji	247,375,999	21%	642,535**	147,257,999	*100,100,000***	260,000	From commercial and subsistence fishery and fuelwood production; nutrient filtration (in 1994 market prices)	Survey Based Production	Lal 1990, Lal 2003
Kosrae (FSM)	*1,666,000-2,260,000*	1%	106,658 - 144,686**	*666,000 - 1,000,000*	*1,000,000 - 1,260,000*	64,020-80,666**	WTP for protection of mangroves for fish, fuel, wood, crabs & future existence value (in 1996 market prices). NB Lal 1990b reported only direct use value	Contingent valuation method (Naylor and Drew 1998); Production Method (Lal 1989)	Naylor and Drew 1998; Lal 1991
Palau****	-	-	-	*1,800,000*	n.a.		??	??	World Bank 2004 (unpublished cited in Thomas 2007)
Malekula Island (Vanuatu)****	-	-	-	*130,000*	n.a.		From fuelwood, fence posts, building material and food in Vanuatu's main mangrove area	Production method	Vanuatu Environment Unit (2007) using Lal 1990 data
Total	250.092.999	-	-	148.321.999	101.803.000	**-**	-	Case study values added together	
TEV per km2/yr	**546.055**	**-**	**-**	**323.847**	**222.277**	**-**	-	Total value divided by total mangrove area from case studies (458 km2)	-
Total value for PICT	**3.858.967.741**	**-**	-	**2.288.627.879**	**1.570.833.627**	**-**	-	TEV per km2/yr multiplied by total PICT reef area (7,067 km2)	-

In constant US$ 2008 market prices; values in italics in US$ current market prices.
* The TEV is $1.4 million if the value of the mangroves conservation to the US public at large is considered.
**Unit value per km^2/yr calculated from values given in Table XIV.
***Mangrove area for Kosrae: 16 km^2.
****Values excluded from calculation

The variations in the total economic values presented in the previous tables reflect many different factors, including the quality and location of the ecosystem and its varying degree of human uses, benefits and activities. Generally the higher the use values derived from an ecosystem, the higher the monetary values, as has been documented in Indonesia, where TEV of reefs ranges from US$ 829 in low population density areas (reliant on alternative agriculture for their livelihood) to US$ 1 million per km^2 where tourism is the main activity (Cesar 1996).

Similar variations in use and non-use values associated with mangrove sub-ecosystems have been reported in the region. In American Samoa TEV of US$ 13,000 per km^2 was estimated based on contingent valuation by Spurgeon et al. 2004 whereas in Fiji, Lal (1990) reported the average TEV of US$ 195,000 per km^2 using survey based production valuation of mangrove dependent fisheries and forestry products harvested for commercial purposes and average subsistence values.

Indirect use values

In addition to direct use values, coastal ecosystems, as mentioned above, also provide indirect use and non-use values. For example, coastal protection by mangroves and coral reefs was estimates in American Samoa, CNMI and Guam to respectively be US$447,000, US$8.2 million and US$8.4 million respectively. Biodiversity was valued at US$779,000 in Guam and US$2 million in American Samoa. Additional values such as amenities from reefs were worth US$9.6 million in Guam, US$3 million in CNMI and the aesthetic value of reefs in Moorea Lagoon, French Polynesia was valued at US$25 million annually. If ecosystem services were included, Lal (1990) reported a TEV of US$ 643,000 per km^2, or a TEV of mangroves of US$ 247 million annually in Fiji.

Non-use values of coral reefs account for a third of the TEV in American Samoa and Saipan but non-use values make up three quarters of the TEV of mangroves in American Samoa. These non-use values accrue due to potential future uses and benefits (option value), or benefits for future generations (bequest value) or simply from the knowledge that reefs and mangroves continue to exist (existence value). These values also reflect social, cultural, and historical significance of these sub-ecosystems to Pacific islanders.

Direct use values

Available data from the region suggests that marine ecotourism is often the most valued use of coral reefs, ranging from about US$ 947,000 in Samoa (Mohd-Shahwahid and McNally 2001) to US$140 million in Fiji (Sisto 2000) (Table XVII). In Guam and French Polynesia, ecotourism represented 60% and 75% of coral reef TEV. The high net economic value of coral reef-based ecotourism is in part due to increasingly popular scuba diving. That activity alone has contributed, for example an annual value of US$ 10.5 million in Guam and US$6.5 million in Saipan, CNMI (11% and 15% of TEV of recreational coral reef-based activities) (van Beukering, Haider et al. 2006; van Beukering, Haider et al. 2007).

Table XVII. Net benefits of coral reef related tourism in PICTs

PICT	Value [US$]*	Comments	Year	Reference
CNMI	47.4 million	Reef-associated tourism on Saipan (70% of TEV of coral reef)	2006	van Beukering, Haider et al. 2006)
Fiji	*140 million*	Reef related tourism	1994	Sisto 2000
French Polynesia	63.4 million	Recreational value of Moorea atoll (60% of TEV of reef value)	2006	Charles 2005
Guam	114.4 million	Reef associated tourism (75% of reef TEV)	2005	van Beukering, Haider et al. 2007
Samoa	946,900	Recreational value of marine resources (international & domestic visitors)	2001	Mohd-Shahwahid and McNally 2001

*In constant US$ 2008 market prices; values in italics in current market prices

Other ecosystem values: Cetacean watching-based ecotourism

Other specialised use values associated with the Pacific Ocean include enjoying what nature has to provide such as whale watching. Whale and dolphin watching has become a popular tourist attraction in the PIC region and commercial whale watching operations are found in 14 countries; mainly those were breeding grounds exist, including Samoa and Tonga. In 2005 more than 110,000 visitors took part in tourism operations to watch whales and dolphins, an almost ten-fold increase from seven years earlier (O'Connor 2008). The economic contribution of such activities is often included in the tourism statistics. However, the non-market values of enjoyment are not captured there. The total economic value of whale watching in the Pacific islands region in 2005 was estimated to be about US$ 21 million, which was over 200 fold more than US$ 1.2 million in 1998 (O'Connor 2008).

In conclusion, information about TEV associated with Pacific Ocean ecosystems to the PICTs is very limited and incomplete. More targeted assessment is required to understand the importance of direct and indirect and market and non-market values of the Pacific Ocean to the PICTs.

6. Implications of 'business as usual' approach

The Scientific Consensus Statement (Center for Ocean Solution 2009) noted that "*the best science indicates that over the next century we can expect to see dramatic declines in the health of the Pacific Ocean, its ecosystems, and the people that rely on this shared resources, unless concerted and prompt action to address known threats is taken."* These key environmental threats to Pacific ecosystems, as noted earlier, from land-based and marine-associated activities are pollution, habitat destruction, overfishing and exploitation, and climate change (Center for Ocean Solution 2009). Additionally, invasive species are seen as potential severe threat. These threats are caused by a range of activities, agriculture, industry, urban development, mining, shipping, but also ocean-health dependent activities such as tourism and fishing that cause damage through over-exploitive, unregulated or insufficiently managed behaviour.

These activities and their damaging effects are rarely linear. They are inter-linked and can cause multiple and multidimensional threats to marine ecosystems and dependant economies at various temporal and spatial scales. Discharge of ballast water from shipping carries around 7,000 species per day can not only cause localised pollution and significant disruptions of local ecosystem, it can also threaten fisheries (De Poorter, Darby et al. 2009). Climate change as the overarching threat is expected to increase overall vulnerability of the environmental and economic system. While small-scale subsistence activities are likely less harmful than commercial activities, their cumulative impact can still be significant but is often not adequately acknowledged or addressed in national policy or management plans.

6.2 Management implications of 'business as usual' approach

The scientific assessment of the business as usual scenarios reported in the Ocean Solutions report assume that the recent trend of pollution, overfishing and exploitation, habitat destruction and looming climate change will continue despite ongoing management efforts at the national and regional levels, some guided by various international and regional instruments. Throughout the region, countries have committed to various international and regional agreements, and have adopted various national legislative frameworks that guide the use and management of ocean resources. The ratification status of each of these treaties and regional policies by independent states in the Pacific Islands region is summarised in Appendix 3 and 4.

Many Pacific island countries have developed their *National Environmental Management Policy and Strategy*, and sector specific legislations to guide their sustainable environmental management efforts including effective governance of their ocean resources and ecosystems. There is also much legislation that provides the framework for land based and other activities that also affect the health of the Pacific Ocean. In most cases, however, the policies and strategies have not adequately addressed the issues concerning their oceans development challenges including management and conservation of biodiversity, controlling issues of fishing licenses, waste and marine pollution control, to name a few (see for example, http://www.sprep.org/publication/pub_detail.asp?id=759http://www.sprep.org/publication/pub_detail.asp?id=759). As a result, a number of countries have recently begun to review their existing policies and strategies to make them more comprehensive and adaptive to contemporary environmental challenges and priorities (Clarke, Miller et al. 2008).

In the light of the significant challenges faced by resource and capacity constraints, the Pacific Leaders have also endorsed a Pacific Islands Regional Ocean's Policy (PIROP). The purpose of the PIROP is to guide the regional effort *"....to achieve responsible ocean governance* [for a] *healthy ocean that sustains the livelihoods and aspirations of Pacific Island communities"*. The policy defines ocean to broadly include *"waters of the ocean, the living and non-living elements within, the seabed beneath and the ocean-atmosphere and ocean-island interfaces."* Its implementation framework is defined in a compendium document called, the Pacific Islands Regional Ocean Framework for Integrated Strategic Action (PIROF-ISA), outlining the following key principles and associated strategies: a) improving our understanding of the Ocean, b) sustainably developing and managing the use of the Ocean resources, c) maintaining the health of the ocean, d) promoting the useful use of the ocean, and e) creating partnerships and promoting cooperation.

The list of such instruments, declaration and frameworks, commitments, and approaches to the management of the Pacific Ocean at both the national and regional level is long, as is the list of project-based activities undertaken by international and regional NGOs, regional intergovernmental organisations and bilateral and multilateral development partners. Again, while some have produced certain positive outcomes, the key issues persist while goals remain largely unmet. Partially, this is due to the inconsistency of the level and scope of existing ocean governance instruments within country and across the region that, where they exist, lack coherence. Often existing laws are, as mentioned earlier, outdated and ineffective. Further, international, regional and national institutions and organisations often fail in building human and institutional capacity or providing long-term effective support to island nations. Many countries also lack the human capacity and financial resources to implement, manage, and enforce environmental laws, policies, and activities within the existing Pacific Islands oceans governance framework (Chasek 2010). In part, this is due to a clear lack of political will of Pacific Island leaders to address environmental and oceans governance issues while prioritising national economic development goals (FAO 2004; Chape 2006). As a result many coastal and ocean governance and management activities are in conflict with each other and are ineffective, endangering both the marine and human population.

In summary, the existing multitude of national, regional, and international agreements, and policies have not shown desired successes. In the meantime, management failure and increased economic exploitation of the regions' resources continue to incur further costs and resulting losses for local, national, and regional economies along with additional societal costs such as cultural losses and malnutrition.

6.2 Cost implications of 'business as usual' practices

If urgent action is not taken to improve the governance of the Pacific Ocean across all levels, the economic costs associated with 'business as usual' approach will be large, affecting the livelihoods of the people of the PICTs and the Pacific Rim countries as well as the world at large.

The extent of the loss in value is difficult to project because no studies to our knowledge have explicitly addressed this question empirically for the Pacific Ocean as a whole or within the PICTs boundaries. Also, technical cause and effect understanding is limited about incremental changes in ocean health on the ecosystem and directly and indirectly dependent economic activities. Furthermore, the economic value of any decrease in such activities will be influenced by the change in market price of the goods and services supported by a healthy Pacific Ocean. Nonetheless, the decrease in wellbeing would be large under 'business as usual' scenarios. The extent of damages would depend on the continued path of uses and the effectiveness of current and future management regimes.

Generally speaking, the PICTs would expect to find a decrease in gross and net[13] economic values of activities associated with the Pacific Ocean discussed in Section 4 and 5 if recent trends of habitat destruction, overexploitation, and pollution were to continue. Overexploitation and destruction of habitats as well as pollution would also cause a decline in the net economic values associated with direct use values (McKenzie, Woodruff et al. 2006). The flow-on effects of habitat destruction can also be large because such practices can impact on other economic activities indirectly associated with these ecosystems.

Some specific case studies carried out in the region discussed below do exemplify some of the expected costs of inaction if we fail to act immediately to mitigate these threats with effective and timely management actions.

[13] Assuming the returns are consumed today and not banked.

6.2.1 Habitat destruction, overfishing and exploitation

As mentioned earlier, productive coastal and marine habitats are lost to poor agricultural land use, coastal mining, and inappropriate coastal development, for example for housing and tourism purposes. Such practices cause erosion and inundation and put communities at risk, for example, of increased flooding and exposure to cyclones. Damages to infrastructure, residential areas and coastal protection occur and can produce substantial costs in repairs and maintenance. Habitat destruction reduces coastal ecosystem health and impairs local productivity causing reduced fisheries yields and therefore insecure food supply and reduced income for coastal communities. While a destroyed habitat leaves less "room" for fish populations, several fishing methods are destructive of the habitat. For example, the cost of 'inaction' on blast fishing has been estimated at US$ 3.8 billion in Indonesia over the last 25 years (Cesar, Burke et al. 2003). Although this fishing method is not as wide-spread in the Pacific islands it does occur locally along with other harmful practices such as the use of fish poison or beating corals to scare out fish. Local overfishing is witnessed in most PICTs, particularly where population and market participation have increased (Bell, Kronen et al. 2009). Limiting fish species below a threshold can cause ecological shifts, further reducing biodiversity and productivity. Similarly, the over-exploitation of tuna and the by-catch from the tuna fishery further reduces fish stocks, again with severe cost consequences and economic losses to PICTs.

As discussed in Section 5, the economically most valued coral reefs are those that are used extensively for tourism purposes. With the decline in healthy reefs, their market or scarcity value will accelerate while local livelihoods are sinking. The monetary incentive may encourage some traditional land owners to sell out use rights to foreign investors leaving them with even fewer resources to make a living.

While there are few cost estimates available for habitat destruction and over-exploitation, detrimental effects of coastal mining have been well documented (Howorth 1997). While small-scale household mining per se appears to be harmless it can have cumulative effects if not managed. In their study on the 'true' economic costs of aggregate mining McKenzie et al. (2006) put forth the dilemma that the resulting coastal damage meant that the public had to bear the increased risk of coastal erosion, flooding or respond by replacing coastal protection by artificial means such as through sea walls. These latter costs were estimated to be between US$ 88-373 million over 25 years in Majuro Atoll, Marshall Islands if current erosion patterns would persist, the cost of protection against coastal erosion in the Majuro Atoll was estimated to be approximately US$236 million. In Kiribati, costs of building seawalls to counter erosion result in several million US$ with another US$ 100,000 in annual maintenance cost (Greer Consulting Services 2007). Increasingly, replanting mangroves as natural solution for coastal protection is carried out; however annual mangrove rehabilitation costs can be quite high and range from US$ 225 to as high as US$ 216,000 per ha (Gilman, Lavieren et al. 2006).

Another severe form of habitat destruction and over-exploitation could arise from deep-sea mining activities. Currently, while the effects of deep-sea or offshore mining are poorly understood, scientists predict that deep sea mining processes could potentially endanger and alter habitats and life forms in the surrounding sea water column and may even place threats to coastal biodiversity (Howorth 1997; Morgan, Odunton et al. 1999; Roberts, Aguilar et al. 2005; Danovaro, Gambi et al. 2008). As such, this activity would not only pollute and destroy habitat, it could also pose additional threats to ecosystem functionality and fish stocks. The contaminated, warm, sediment and nutrient-loaded bottom water may cause algal blooms and threatening commercial fishing. These effects are likely to influence not only jurisdictional waters but also damage ecosystems and the food-chain within the economic zones of other nations (Halfar and Fujita 2007).

6.2.2 Pollution

Pollution in the PICT seems to develop into an omnipresent threat. Nutrient and sediment pollution from agriculture, sewage, logging and urban runoff along with plastic marine debris, watershed and solid waste disposal, toxic dumping and oil spills are an increasing threat to PICTs. These forms of pollution can create dead zones, algal blooms, and acidic areas, alter the basic ecosystem structure, pose human health risks, and stress economies. While much of the pollution is land-based, e.g. through increased production of litter and effluents, it can also be ship-borne, or can stem from mining activities.

Two economic valuation studies estimated the market costs or gross benefits that would be avoided in the absence of watershed pollution in the Cook Islands (Hajkowicz 2006) and solid waste pollution in Palau (Hajkowicz, Tellames et al. 2005). In the Cook Islands, costs were estimated to be NZ$ 7.4 million or US$ 5.8 million in 2008 prices, accounting for 3.1% of national GDP. Most of the costs were generated through losses in tourism, healthcare and illness costs and the provision of bottled water and public water filters as well as the loss in coastal fish stocks. Solid waste pollution in Palau, estimated at US$ 1.9 million annually (best estimate, US$ 2.3 million in 2008 prices) accounts for 1.6% of national GDP with similar cost causes: losses in tourism, healthcare and illness costs, operation of dump sides and losses in fisheries yields. In both cases the biggest costs would accrue to tourism; however tourism particularly big resort type businesses often produce increased solid waste and watershed pollution which can negatively impact coastal habitats and have negative impacts on the industry itself. Solid waste in Tonga causes annual costs of US$ 2.7 million (in 2005$) whereas total economic costs of poor human waste management to Tuvaluan nationals was estimated to be at least US$ 262,000 to US$495,000 a year (Lal, Saloa et al. 2006; Lal and Takau 2006).

Shipping can be a major source of pollution through the introduction of invasive species. It is estimated that 7,000 invasive species, such as invertebrates or algae, are introduced daily via a series of vectors but foremost by extensive global and regional shipping activities. These organisms get trapped through bio-fouling (attachment of organisms on the hull of a ship) and ballast water (carried and expelled at the port of destination). A recent IUCN report on marine invasive species indicates that today's trade and shipping industry is moving more organisms around the world via ballast water in one month, than we used to in an entire century (De Poorter, Darby et al. 2009). The economic costs of such impacts are though not known. However, estimates of the best documented case of the invasive zebra mussel, a European freshwater species, caused cost of controlling of US$ 10 billion over ten years to North America (De Poorter, Darby et al. 2009).

Oil spills can cause not only severe environmental but also economic damage. While large scale oils spills have not been experienced in the Pacific, there are through small scale oils pollution, the costs of which are not known in the region. Global experience though suggests that the clean-up costs can cause billions of dollars, often with unknown or continuing detrimental effects on the affected ecosystems. The most expensive oil spill, the *Exxon Valdez* before Alaska in 1989 generated cleanup costs in the region of US$2.5 billion and total costs (including fines, penalties and claims settlements) estimated at US$9.5 billion (International Maritime Organization 2008). The average container ship travels about eight times around the world, consuming large amounts of fossil fuels and their inevitable impact on resources, air quality and production of waste and green house gases (National Geographic 2009).

6.2.3 Climate change & sea level rise

In the face of climate change, resulting sea level rise, (sea) temperature warming and ocean acidification, entire island populations and coastal as well as marine ecosystems are threatened. We are already beginning to changes in ocean circulation and abrupt shifts in precipitation patterns (Busuioc, Chen et al. 2007; Herr and Galland 2009). The warming temperatures and change in ocean and atmospheric currents can create massive dead zones and can change distribution of reef fish as well as migration patterns of tuna and marine mammals. Ocean acidification and temperature warming can lead to severe coral bleaching and reduced calcium accretion of reef organisms and certain plankton. Climate change is pervasive, a global, overarching threat that will influence all aspects of our lives, economically, politically, and socially. It is one of the biggest challenges that people face all around the world, while Pacific Islanders are expected to suffer strongly despite having contributed little to nothing to current CO_2 levels. Nevertheless, the costs will be carried by everyone, the public and industry alike.

As coastal communities begin to witness changes and increasing flooding causing salt water intrusion of fresh water lenses, destruction of crops and properties one of the adaptation strategies proposed is the resettlement of an entire country such as Tuvalu. Resettlement because of rising sea level has so far only happened in the Cataret Islands in PNG where 300 people were moved to the mainland in 2004. The direct and indirect costs of resettlement but also the social challenges and losses in cultural values and identities coupled with potential land rights issues and lacking resources for relocated communities are serious problems and have not been adequately assessed to date.

Economic costs of climate change

Economic cost estimates of climate change on marine resources in the Pacific are currently unavailable. However, a range of studies have looked at several aspects such as declining coral reef productivity or the costs of increased disasters, such as increased rate of hurricanes and their associated costs. Many of those costs are attributable not just to climate change but also to the cumulative sum of threats such as habitat destruction, pollution and over-exploitation that have already weakened our ecosystems leaving them more vulnerable to climate change.

Hoegh-Guldberg et al. (2000) estimated a worst case scenario for Melanesian nations of economic losses to be between 15% and 20% of national GDP or, in absolute terms, about US$ 1.9 to US$ 2.5 billion in late-1990s dollars. This would result from comparison with expected uninterrupted growth over the next 20 years in the absence of climate-change impacts. For Polynesia and Micronesia, estimates were higher, between 40% to 50%, or US$ 4 to US$ 5 billion respectively due to the absence of an undeveloped resource base which could curb some of the economic losses.

Increased natural disasters such as hurricanes, droughts, storm surges, and floods have caused losses of US$ 6.2 billion to PICTs during the 1950-2008 in 2008 US$ (Hay 2008). Cyclone Heta in 2004 caused total estimated costs of US$ 31.8 million in 2008 prices; more than US$ 3 million were due to losses in coastal fisheries. Cyclone Ami caused total damages of almost US$ 80 million in 2008 prices in Fiji in 2003. The list of destructive cyclones, associated floods, and tsunamis in the Pacific island region is long. While such weather events occur naturally, their frequency and intensity is predicted to increase along with the damage costs (Bettencourt et al. 2006). More recently, the one-in-fifty year weather event in Fiji caused at least US$ 15 million due flooding of the low lying sugar belt areas, including reclaimed mangrove lands, (Lal 2010) plus an additional US$ 188 million in the coastal towns and peri urban areas of Nadi and Ba (Ambroz 2009; Holland 2009).

Sea temperature warming will put great pressure ono coral reefs and may lead to severe bleaching events. The total NPV of cost of severe coral bleaching in the Pacific (excluding Hawai'i) has been estimated at US$ 7.6 billion, calculated over a 50-year time horizon with a 3% discount rate (Cesar, Burke et al. 2003). The loss and destruction of coral reefs will lead to low productivity of associated fisheries, impact on adjacent ecosystems and potentially lead to system collapse. Also, the wide range of economic activities associated with healthy reefs will suffer.

Tuna are migratory fish with a home range of several thousand km. Seasons and climate influence their whereabouts as well as extreme whether events such as the ENSO. Through climate change, stocks are predicted to change their distribution patterns in moving east-wards out of many Pacific Island EEZs into international waters that are open access. This will cause great economic deficits to PICTs. Coastal fish populations are also expected to be greatly impacted, particularly those that depend on healthy coral reefs for food or shelter. These changes may not be immediately apparent, but result in slow, long-term (decadal) declines in yields as resilience and productivity are gradually eroded (Gillett 2009).

Not only coral reefs and associated fauna are vulnerable to climate change, mangrove ecosystems will be likewise affected. While mangroves generally have the ability to migrate land-wards to mitigate potential sea-level rise, in many places infrastructure is now blocking the way. Lal, Kinch et al. (2009) estimate that by 2100 525,000 ha will be irrevocably lost due to sea-level rise which would incur costs of US$ 25 million to US$ 470 million. Furthermore, mangrove destruction can release large quantities of stored carbon and exacerbate global warming trends (Kauppi, R. Sedjo et al. 2001).

6.2.4 Other livelihood costs under 'business as usual'

Business as usual approach will also incur costs other than just financial or economic. Continued loss of habitats, pollution, and overharvesting will also result in insecure food supply and malnutrition for coastal communities. A recent study by Bell et al. (2009) has concluded that 16 of 22 PICT will not be able to meet the forecasted national demand of fish in 2030 required to meet recommended per capita fish consumption, or to maintain current consumption. Localised overfishing (Newton, Côté et al. 2007) and increasing demand influence fish production negatively and thus availability of much needed protein. Other drivers of change, such as economic and fisheries development, governance and political stability issues as well as climate change, can be expected to add to this negative trend.

Increased vulnerability to climate change-related storm surges and cyclones will incur further costs to coastal communities. While the physical damage to infrastructure can be expressed in monetary terms, a measure for hardship or hunger stretches beyond what we can easily capture in dollar values. A recent study in Fiji demonstrates that with climate related disasters, such as floods, one in two families affected by the 2009 floods fell below the basic poverty line; having to choose between providing food or paying for transport to send their children to school was a resulting social issue (Lal 2010).

As noted earlier, subsistence fishery is crucial part of Pacific Islanders' lives. But it is more than a lifestyle; in its absence, PICT communities would have to spend millions of dollars (, e.g. US$ 18 million in Kiribati and US$ 14.7 million), annually to import foods of equivalent protein content causing severe dietary, cultural, and economic challenges (World Bank 2000). Socio-economic studies (e.g. Scourse and Wilkins 2009) already show that local diets are changing and increasingly include imported and processed food like tinned tuna and dishes made from flour and sugar also because an increased portion of the catch is being sold.

The decline in coastal fish stocks is aggravated through habitat destruction of coral reefs and mangroves, which in return is also caused through destructive fishing methods. Dwindling stocks and few coral reefs or mangrove forests left will increase their demand and therefore market value or scarcity value. This will not only mean that communities will have less resources available while growing in population, it may also encourage some to sell out too many fishing rights accelerating coastal overfishing.

Despite such concerns, a recent study by the United Nations Environment Programme – World Conservation Monitoring Centre (Corrigan, 2009) suggests that in comparison to other regions of the world "the Pacific is relatively healthy". While this may be true, proactive actions on the part of PICT can help curb the decline and continue to generate economic benefits for their people and the global community at large.

7. Governance of the Pacific Ocean – PICTs and beyond

For the Pacific islanders to sustain their lifestyles and livelihoods, and sustain the wider economic benefits to the global community at large, particular attention needs to be paid to addressing the importance as well as the potential costs of inaction against the key threats to the health of the Pacific Ocean and associated coastal and deep sea sub ecosystems.

While some of these threats originate within countries – population pressures, over fishing, habitat destruction, coastal mining, and land based pollution – others, such as shipping and climate change cut across national borders. Furthermore, key players in tourism and offshore fisheries are mostly foreign nationals and large multinational corporations in deep-sea mining explorations even if they occur within PICT jurisdiction. Their actions need to be better regulated and controlled, if the Pacific Island countries and territories are to achieve sustainable development.

Realising the wider geographical dimension of many of the threats to the Pacific Ocean, and the need to take a broader spatial approach, several "oceanscape" level efforts have recently been initiated, including the Coral Triangle Initiative (www.cti-secretariat.net/about-cti/about-cti accessed on 6.4.2010) and the Micronesian Challenge (http//www.micronesiachallenge.org, accessed on 6.4.2010) see Box 4. Additionally, the Kiribati government in 2009 called for the *Pacific Oceanscape* initiative to focus on integrated marine and terrestrial protected area development, conservation and sustainable development (http://www.marinenz.org.nz/documents/pacific_oceanscape.pdf, accessed on 28.06.2010).

Box 4. CTI and Micronesia Challenge

The *Coral Triangle Initiative (CTI)* with PNG and the Solomon Islands as PIC partners, is aiming to conserve the coral triangle, place of highest global marine biodiversity, against common threats like over-fishing, destructive fishing methods, sedimentation and climate change effects by attracting high-level political commitments and implementation by governments and support from private sector, international agencies and civil society. Processes are developed for the development and implementation of Regional Action Plans under the CTI.

The *Micronesia Challenge* including the Federated States of Micronesia, the Republic of the Marshall Islands, the Republic of Palau, Guam, and the Commonwealth of the Northern Marianas Islands aims to preserve the natural resources against severe threats of climate change, deforestation, unsustainable fishing and invasive species by effectively conserving at least 30% of the near-shore marine resources and 20% of the terrestrial resources across Micronesia by 2020. Key approaches are to secure continues sources of funding while each jurisdiction is developing their own strategies for implementation focusing on protected area management.

Most recently, the Pacific Islands Leaders approved a concept for a Pacific Oceanscape and have called for the development of a framework to build on the Pacific Islands Regional Ocean Policy (PIROP) as a priority area for attention under the Pacific Plan. The PIROP and its Integrated Strategic Action Plan, as seen earlier, cover a broad range of issues related to ocean management, all of which are still highly relevant today and require attention for implementation. A stock take of progress of PIROP implementation highlighted significant progress has been made in most areas. However this progress was not attributed to the concerted implementation of PIROP, but more as a result of the work programmes of respective regional organisations and direction from their governing councils. The lack of a strong integrated governance and dedicated partnership mechanism to facilitate a coordinated and holistic approach to the implementation of PIROP was acknowledged as a significant contributing factor to this ad hoc implementation of the policy.

Many of the threats to the Pacific Ocean, as well as the capacity required to effectively address these threats, come from countries outside the scope of PIROP and the Framework for Pacific Oceanscape. To this end, the importance of engaging and building partnerships with these entities has recently been emphasised (Pacific Islands Forum Secretariat 2010). The need to organise a trans-Pacific response to address key threats to the Pacific Ocean has taken on an even greater urgency in the face of climate change. This is also consistent with the concept of the *Pacific Ocean 2020 Challenge* which calls for urgent and unified action by the Pacific governments and communities to address the Pacific Oceans environmental threats in a decisive manner.

Way Forward

The Scientific Consensus Statement on the Pacific Ocean Synthesis have attracted 400 signatures from scientists and experts. While this has been important in raising the profile of the issues about the health of the Pacific Ocean, the more critical challenge is to obtain commitment from Leaders from the Pacific Rim and Island nations to act urgently and collectively in addressing the threats. Those who control public purses need urgently to adopt a governance framework that focuses on the Pacific Ocean as a whole and adopt a governance system that transcends sovereign boundaries, jurisdictions, and mandates. There is an urgent need for Leaders to agree to develop and implement coordinated multidimensional, partnership-based, and multi-pronged actions across the Pacific Ocean. Ocean-wide action is required to strengthen the governance over the Pacific Ocean across all levels, national, regional, and across all Pacific Rim and PICT.

In mobilising high level political support, several recent experiences in dealing with global and regional issues, such as climate change, the PRIOP implementation, Coral Triangle Initiative, and the Micronesian Challenge, have highlighted many lessons. Included among them are 1) the importance of adopting a stakeholder based political process supported by technically robust information in getting political buy-in, and 2) broad-based ownership of the process as well as the solutions.

The proposed *Pacific Ocean 2020 Challenge* is, as a first step, focussing on getting the political buy-ins for taking a Pacific Ocean-wide approach to tackling the challenges across all governance levels. This process needs to be supported by robust information. The Stern Report, and developments following the release of the report - debate and seriousness about climate change mitigation and adaptation strategies - have particularly highlighted the role and relevance of translating scientific information into economic values and arguments regarding the 'cost of inaction' in appealing to the conscience of decision-makers. Similarly, TEEB report has generated discussion and debate and focussed peoples attention on the economic benefits draw attention to the global economic benefits of biodiversity, to highlight the growing costs of biodiversity loss and ecosystem degradation, and to draw together expertise from the fields of science, economics and policy to enable practical actions moving forward.
Similar types of approaches would be required if the hearts and minds of the Leaders of the PICT and

the Pacific Rim Countries are to be won over and convinced about the need for urgent action. The next step is to identify the economic costs to the Pacific, and to the world, if the current trend in declining Pacific Ocean conditions continues. This calls for a compelling body of evidence on the economic costs of inaction and the benefits of investing in improved management of the Pacific Ocean. This review has, however, demonstrated that this is not going to be easy, as even the most basic of the information about the economic value of the Pacific Oceans to the PICTs is not readily available. Where information is accessible, these are either incomplete, reflect different definitions of economic values or require extensive further analysis.

Similarly, to identify strategic points of intervention, it is critical to understand the current governance arrangements in the Pacific Rim countries and PICTs, and strengths of current regional and international governance instruments that guide and support national efforts. This needs to be done systematically to identify priority actions to move onto a sustainable path.

In conclusion, an effort needs to be made to engage with PICT and the Pacific Rim Countries at a political level, while a parallel program of work needs to help produce a "Stern like" report on the Pacific Ocean, "Pacific Ocean Report - The Cost of Inaction". The Report will provide empirical information supporting the call for action and the basis for policy briefs and advocacy materials, to better manage the Pacific Ocean. Secondly, a review of the national, sub-regional and Pacific Ocean-wide review of current management of economic activities, ecosystems, and the Ocean ecosystem as a whole is required. Ultimately it will be upto the leaders of the Pacific nations, their politicians and governments, and all key stakeholders including the public at large, to take this information and act for the sustainability of the Pacific Ocean.

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Appendices

Appendix I: Tourist arrivals to PICT between 1990 and 2008

PICT	1990	1995	2000	2004	2005	2006	2007	2008
CNMI	426,000	669,000	517,000	n.a.	498000	435,000	n.a.	n.a.
Cook Islands	34,000	48,000	73,000	83,333	88,405	92,082	97,019	94,184
Fiji	279,000	318,000	294,000	502,765	549,911	545,168	539,255	582,602
French Polynesia	132,000	172,000	252,000	211,893	208,067	221,549	218,241	196,496
Guam	780,000	1,362,000	1,287,000	n.a.	1,228	1,212	n.a.	n.a.
Kiribati	3,000	4,000	5,000	3,404	4,137	4,406	4,709	3,871
Marshall Is	5,000	6,000	5,000	n.a.	n.a.	6,000	n.a.	n.a.
New Caledonia	87,000	86,000	110,000	99,515	100,412	102,198	103,363	103,672
Niue	1,000	2,000	2,000	2,558	2,793	3,008	3,463	4,750
Palau	33,000	53,000	58,000	n.a.	86,000	86,000	n.a.	n.a.
PNG	41,000	42,000	58,000	59,013	69,251	77,731	104,122	114,182
Samoa	48,000	68,000	88,000	98,155	101,807	115,882	122,250	121,578
Solomon Islands	9,000	12,000	n.a.	11,116	12,533	11,482	13,748	16,264
Tonga	21,000	29,000	35,000	41,208	41,862	39,451	46,040	49,400
Tuvalu	1,000	1,000	1,000	n.a.	n.a.	n.a.	n.a.	n.a.
Vanuatu	35,000	44,000	58,000	61,454	62,082	68,179	81,345	90,654
Total	**1,936,990**	**2,917,995**	**2,843,000**	**1,174,414**	**1826488**	**1,809,348**	**1,333,555**	**1,377,653**

Appendix II: Merchant shipping and fleet in the PICTs

PICT	Ports/ Terminals	Merchant marine [Nr of ships]	Capacity of merchant fleet [mt]	Nr of foreign owned ships	Export of merchandise* [US$]	Ship types
American Samoa	1	n.a.	n.a.	n.a.	n.a.	n.a.
CNMI	2	n.a.	n.a.	n.a.	n.a.	n.a.
Cooks	1	26	n.a.	17	12,878,328	cargo 14, chemical tanker 1, petroleum tanker 1, refrigerated cargo 8, roll on/roll off 2
Fiji	2	9	23,000	1	823,280,844	passenger 3, passenger/cargo 4, roll on/roll off 2
French Polynesia	1	15	n.a.	2	172.874.984	cargo 6, passenger 2, passenger/cargo 5, refrigerated cargo 1, roll on/roll off 1
FSM	1	3	9,000	n.a.	n.a.	cargo 1, passenger/cargo 2
Guam	1	n.a.	n.a.	n.a.	64,098,893	n.a.
Kiribati	1	43	4,000	31	30,524,889	bulk carrier 2, cargo 18, chemical tanker 3, petroleum tanker 6, refrigerated cargo 14
Marshall	1	1,049	15,167	990	n.a.	barge carrier 1, bulk carrier 284, cargo 71, carrier 1, chemical tanker 191, combination ore/oil 4, container 188, liquefied gas 47, passenger 5, passenger/cargo 1, petroleum tanker 221, refrigerated cargo 13, roll on/roll off 14, specialized tanker 2, vehicle carrier 6
Nauru	1	n.a.	n.a.	n.a.	n.a.	n.a.
New Cal	1	2	n.a.	n.a.	n.a.	cargo 1, passenger/cargo 1 (2008)
Niue	none	n.a.	n.a.	n.a.	n.a.	n.a.
Palau	1	n.a.	n.a.	n.a.	n.a.	n.a.
Pitcairn	1	n.a.	n.a.	n.a.	n.a.	n.a.
PNG	5	21	73,000	6	2,858,324,842	bulk carrier 2, cargo 17, petroleum tanker 2
Samoa	1	1	10,000	1	19,904,000	cargo 1
Solomon	3	n.a.	7,000	n.a.	165,597,566	n.a.
Tokelau	1	n.a.	n.a.	n.a.	n.a.	n.a.
Tonga	1	13	170,000	4	n.a.	bulk carrier 1, cargo 8, carrier 1, liquefied gas 1, passenger/cargo 1, refrigerated cargo 1
Tuvalu	1	80	61,000	63	n.a.	bulk carrier 7, cargo 30, chemical tanker 14, container 2, passenger 2, passenger/cargo 1, petroleum tanker 22, refrigerated cargo 1, specialized tanker 1
Vanuatu	3	54	1,618,000	54	44,973,357	bulk carrier 1, cargo 8, carrier 1, liquefied gas 1, passenger/cargo 1, refrigerated cargo 1
Wallis/Futuna	2	8	n.a.	8	n.a.	chemical tanker 2, passenger 6

Source: CIA factsheet 2008 & ESCAP 2005 (capacity)
*free on board (fob) at 2008 constant market prices

Appendix III: Ratification status of MEAs in PICs

Country	IWC	Ramsar	WHC	CITES	CMS	UNCLOS	CBD	ITPGR
Cook Islands	-	-	-	-	-	✓	✓	✓
Fiji	-	✓	✓	✓	-	✓	✓	
Kiribati	✓		✓	-	-	✓	✓	✓
Marshall Islands	✓	✓	✓	-	-	✓	✓	s
FSM	-	-	✓	-	-	✓	✓	-
Nauru	✓	-	-	-	-	✓	✓	-
Niue	-	-	✓	-	-	✓	✓	-
Palau	✓	✓	✓	✓	-	✓	✓	-
PNG	-	✓	✓	✓	✓	✓	✓	-
Samoa	-	✓	✓	✓	-	✓	✓	✓
Solomon Islands	✓	-	✓	✓	-	✓	✓	-
Tonga	-	-	✓	✓	-	✓	✓	-
Tuvalu	✓	-	-	-	-	✓	✓	-
Vanuatu	-	-	✓	✓	-	✓	✓	-

Source: (Clarke, Miller et al. 2008); Key: ✓ = signed and ratified; s = signed but not ratified

Appendix IV: Ratification status of environmental conventions in PICs

Country	Apia Convention	SPFF Convention	Noumea Convention	Protocol 1 Dumping	Protocol 2 Emergencies	Waigani	PIROP
Cook Islands	✓	✓	✓	✓	✓	✓	✓
Fiji	✓	✓	✓	✓	✓	✓	✓
Kiribati		✓				✓	✓
Marshall Islands		✓	✓	✓	✓	✓	✓
FSM		✓	✓	✓	✓	✓	✓
Nauru		✓	✓	✓	✓	s	✓
Niue		✓				✓	✓
Palau		✓	s	s	s	s	✓
PNG	s	✓	✓	✓	✓	✓	✓
Samoa	✓	✓	✓	✓	✓	✓	✓
Solomon Islands		✓	✓	✓	✓	✓	✓
Tonga		✓				✓	✓
Tuvalu		✓	s	s	s	✓	✓
Vanuatu		✓	✓			s	✓

Source: (Clarke, Miller et al. 2008); Key: ✓ = signed and ratified; s = signed but not ratified