



Fisheries of the Pacific Islands

Regional and national information



Fisheries of the Pacific Islands: Regional and national information

Cover photograph:

A local fisherman with hand lines catching fish near the wharf in Noro, Western Province of the Solomon Islands.

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Preparation of this document

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Abstract

The Pacific Island region consists of fourteen independent countries and eight territories located in the western and central Pacific Ocean. In this area there are about 200 high islands and some 2 500 low islands and atolls.

The main categories of marine fishing in the area are:

- offshore fishing. This is undertaken mainly by large, industrial-scale fishing vessels. Approximately 1 100 of these vessels operate in the exclusive economic zones (EEZs) of Pacific Island countries, mainly using purse-seine and longline gear to catch tuna.
- coastal fishing. This can be divided into three categories: (1) small-scale commercial fisheries (also referred to as “artisanal”), which can be further subdivided into those supplying domestic markets, and those producing export commodities; (2) subsistence fisheries, which support rural economies and are extremely important to the region’s nutrition and food security; and (3) industrial-scale shrimp fisheries, which in the region occur only in Papua New Guinea.

The region’s fishery resources can be broadly split into two main categories: oceanic, and coastal or inshore. Oceanic resources include tunas, billfish and allied species. They are characterized by an open-water pelagic habitat and potentially extensive individual movements. Coastal or inshore resources include a wide range of finfish and invertebrates. They are characterized by their shallow-water habitats or demersal lifestyles, and restriction of individual movements to coastal areas. This paper discusses these resource categories, with a focus on the major types of fishing, the important species, the status of the resources, and the fisheries management that occurs. This report also provides information on the fisheries in each of the 14 independent Pacific Island countries in the following categories:

- Overview and main indicators
- Production sector
- Post-harvest sector
- Socio-economic contribution of the fishery sector
- Trends, issues and development
- Institutional framework
- Legal framework

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Abbreviations and acronyms

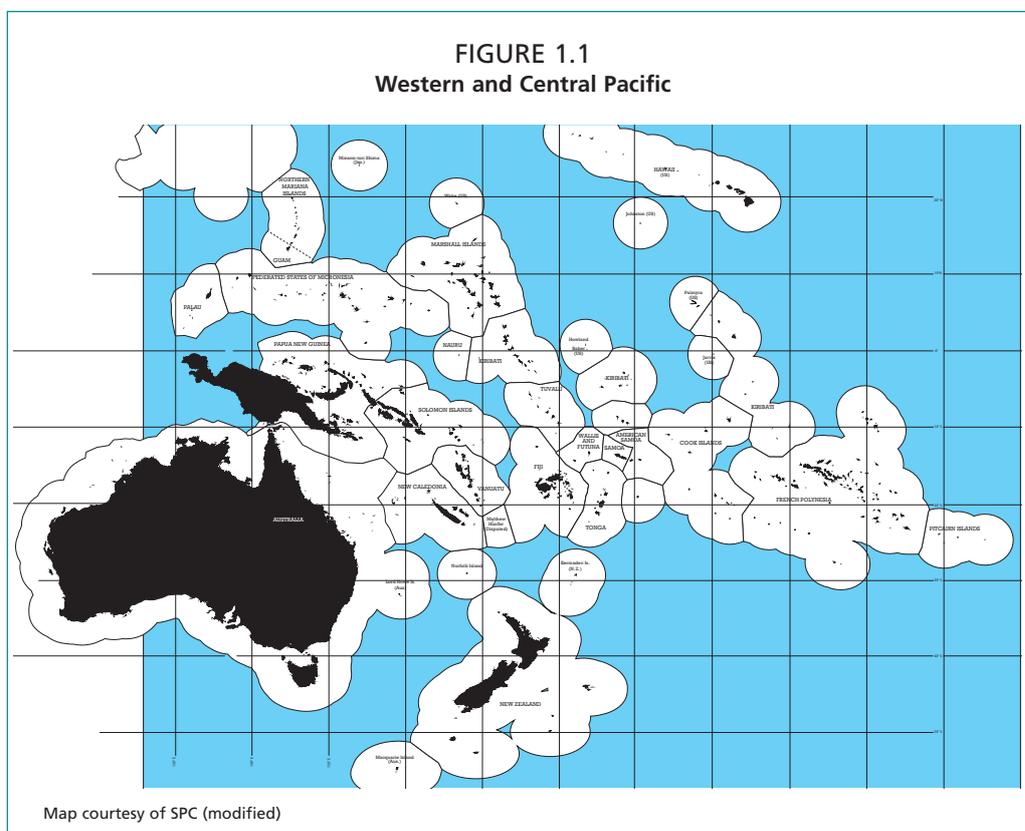
ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
CCM	Conservation and management measure
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPUE	Catch per unit effort
DCC	Data Collection Committee
DWFN	Distant water fishing nation
EAFM	Ecosystem approach to fisheries management
EEZ	Exclusive economic zone
ESCAP	Economic and Social Commission for Asia and the Pacific (UN)
EU	European Union
FAD	Fish aggregation device
FAO	Food and Agriculture Organization of the United Nations
FFA	Forum Fisheries Agency
FOB	Free on board
FY	Financial (or fiscal) year
GDP	Gross domestic product
GEF	Global Environment Facility
HIES	Household income and expenditure survey
IAS	Institute of Applied Science of the University of the South Pacific
IMF	International Monetary Fund
IUCN	International Union for Conservation of Nature
IUU	Illegal, unreported and unregulated (fishing)
JICA	Japan International Cooperation Agency
LMMA	Locally managed marine area
MPA	Marine protected area
MSG	Melanesian Spearhead Group
MSY	Maximum sustainable yield
MT	Metric tonne
MTCs	Minimum terms and conditions (of access)
NFA	National Fisheries Authority
NGO	Non-governmental organization
NZODA	New Zealand Official Development Assistance
OFP	Oceanic Fisheries Programme of the Pacific Community
PIFS	Pacific Islands Forum Secretariat

PIMRIS	Pacific Islands Marine Resources Information System
PNA	Parties to the Nauru Agreement
PROCFish-C	Pacific Regional Oceanic and Coastal Fisheries Project
SPC	Pacific Community
SPREP	Secretariat of the Pacific Regional Environment Programme
TMP	Tuna management plan
UNCDF	United Nations Capital Development Fund
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNSD	United Nations Statistics Division
USA	United States of America
USAID	United States Agency for International Development
WCPCF	Western and Central Pacific Fisheries Commission
WCPO	Western and Central Pacific Ocean
WTO	World Trade Organization

1. Regional information

1.1 THE PACIFIC ISLANDS REGION

The Pacific Islands region consists of fourteen independent countries and eight territories located in the western and central Pacific Ocean. There is also a substantial amount of international waters (high seas) in the area. Figure 1.1 shows these countries within the larger western and central Pacific. Table 1.1 gives summary details of the countries.



The Pacific Islands region contains about 200 high islands and some 2 500 low islands and atolls. Apart from the Pitcairn group and the southern part of French Polynesia in the east of the area, all the islands of the area lie in the tropical zone.

In general, the islands increase in size from east to west, with Papua New Guinea at the westernmost edge having most of the region's land area. The islands mostly rise steeply from the deep ocean floor and have very little underwater shelf. Coral reefs characteristically surround the islands, either close to the shore (fringing reef) or further offshore (barrier reef), in which case a coastal lagoon is enclosed. The area includes many atolls, which are the remnant barrier reefs of islands that have subsided. Some of the more recent islands in the area lack coral reefs. Mangrove forests often border the inshore waters, especially of the larger islands, and provide habitat for the juveniles of many important food fish.

TABLE 1.1
The 22 Pacific Island countries and territories*

	Country/territory	Land area (km ²)	Area of 200-mile zone (km ²)	Estimated population (mid-2016)
Independent Pacific Island Countries	Cook Islands	180	1 830 000	15 200
	The Federated States of Micronesia	702	2 978 000	104 600
	Fiji	18 376	1 290 000	880 400
	Kiribati	726	3 550 000	117 194
	The Marshall Islands	720	2 131 000	55 000
	Nauru	21	320 000	10 800
	Niue	258	390 000	1 600
	Palau	500	629 000	17 800
	Papua New Guinea	461 690	3 120 000	8 151 300
	Samoa	2 934	120 000	194 000
	Solomon Islands	29 785	1 340 000	651 700
	Tonga	696	700 000	100 600
	Tuvalu	26	900 000	10 100
	Vanuatu	12 189	680 000	289 700
Pacific Island Territories	American Samoa	197	390 000	56 400
	French Polynesia	3 521	5 030 000	273 800
	Guam	549	218 000	169 500
	New Caledonia	19 103	1 740 000	277 000
	Northern Marianas Islands	475	1 823 000	55 700
	Pitcairn Islands	5	800 000	50
	Tokelau	12	290 000	1 400
	Wallis and Futuna Islands	124	300 000	11 800

Source: Gillett and Preston (1997); SPC (2008a); SPC PRISM website (<https://prism.spc.int>).

* Unless otherwise stated, the remainder of this report deals with the fishery resources and associated fisheries of the 14 independent Pacific Island countries.

Because of the relatively small size of most islands, major bodies of fresh water are not widespread in the region, with substantial rivers and lakes only being found in some of the larger islands of Melanesia. The small land areas of most islands create limited fresh-water and nutrient runoff, resulting in low enrichment of the nearby sea. The ocean waters of the region are usually clear and low in productivity. Upwelling occurs in the boundaries between currents and in other localized areas, and has important implications for the harvesting of marine resources.

The dispersed nature of the region's land among this vast area of water has several consequences for fisheries management. In regard to coastal resources, the presence of numerous patches of land and their associated coastal and coral reef areas, separated by large distances and sometimes abyssal depths, means that many species with limited larval dispersal can be effectively managed as unit stocks. On the other hand, management of shared stocks of highly migratory species, such as tunas, can only be effective if carried out on a multi-country basis. The presence of extensive areas of international waters among the region's EEZs greatly complicates the region's fishery management efforts.

Pacific Island countries have three regional organizations with major involvement in fisheries (Box 1.1). At least some knowledge of those organizations is a prerequisite to appreciating the management of the fisheries of the area.

BOX 1.1

Fisheries and the regional organizations in the Pacific Islands

Compared to other fishing regions of the world, an important feature of the area is the strong regional organizations active in the fisheries sector. The three main ones are the:

- Pacific Community (SPC), based in Noumea, New Caledonia, which assists its member countries and territories in matters relating to (a) coastal fisheries development and management, and (b) scientific research and compilation of catch data on the tuna resources of the region.
- Forum Fisheries Agency (FFA), based in Honiara, Solomon Islands, which assists its member countries in matters dealing with the management of the region's tuna resources, including economics, surveillance and legal aspects.
- Parties to the Nauru Agreement (PNA). The PNA secretariat office is located in Majuro, Marshall Islands. The organization's members are the eight Pacific Island countries where much of the tuna resources of the region are located.
- "The Western & Central Pacific Fisheries Commission (WCPFC) also plays a central role in fisheries management in the region, and in neighboring regions, through its capacity as an RFMO to address issues in the management of fisheries for highly migratory species in the high seas"

Other regional organizations also have responsibilities in fisheries including the Secretariat of the Pacific Regional Environment Programme (SPREP), based in Apia, Samoa; the University of the South Pacific (USP) based in Suva, Fiji; and the Melanesian Spearhead Group (MSG) Secretariat, based in Port Vila, Vanuatu.

1.2 FISHERY STATISTICS IN THE REGION

With respect to the quality and coverage of statistics, there are major differences between the region's offshore fisheries and coastal fisheries. The following, taken largely from Gillett and van Santen (2008), Gillett (2014a) and the websites of the Pacific Community (SPC) and Western and Central Pacific Fisheries Commission (WCPFC), summarizes the situation.

Offshore fishery statistics

The offshore statistical systems are in relatively good condition, both at a national and regional level. Since the mid-1980s, SPC has had a major role in the collection, analysis and dissemination of data on the tuna fisheries of the region. Currently, as a part of SPC's fisheries services to the region, its Oceanic Fisheries Programme (OFP) has an Oceanic Fisheries Data Management Section, with subsections on (a) data management services for WCPFC, (b) data acquisition and quality control, and (c) national data management services and capacity building. One of the factors responsible for the high quality of offshore fisheries statistics in the region is the Tuna Fishery Data Collection Committee (Box 1.2).

Good production information on offshore fisheries is readily available on the WCPFC website (www.wcpfc.int). Regional information is provided annually in the website's section on the Scientific Committee: for example, "Overview of tuna fisheries in the Western and Central Pacific Ocean, including economic conditions – 2016" (Williams *et al.*, 2017). The website also has detailed national annual reports for all the countries of the region. As an example, the recent Tuvalu annual report to WCPFC for 2016 (Fisheries Department, 2016a) includes the following categories of information:

- Flag state reporting
 - Domestic fleet
 - Catch and effort data

BOX 1.2 Data Collection Committee

Before the establishment of the Tuna Fishery Data Collection Committee (DCC), tuna fishery data collection forms were developed in an ad hoc fashion by a number of distant water fishing nations, some Pacific Island countries and territories, and fishery organizations. As a consequence, there was a plethora of different forms circulating in the region, resulting in complex data management procedures that affected the quality, accuracy and timeliness of tuna fisheries information. To address this situation, SPC and the Forum Fisheries Agency (FFA) initiated the DCC during 1995 with the stated objective of ‘developing standardized tuna fishery collection forms to reduce the complexity of data collection, processing and analysis’ in member countries. Over the following two decades, the outputs of the DCC were harmonized paper copy forms for logsheets, unloadings, observer reports, port sampling and other types of data. The annual DCC report is formally adopted by member countries through FFA’s Forum Fisheries Committee and SPC’s Heads of Fisheries meetings.

Source: <http://www.spc.int/oceanfish/en/meetingsworkshops>

- Fishing pattern and distribution
- Catch and fishing effort for purse seiners
- Catch and fishing effort for longliners
- Artisanal fisheries
- Species of special interest
- Non-target associated or dependent species
- Coastal state reporting
 - Fishing licences
 - Catches in the EEZ
- Socio-economic factors
- Disposal of catch
- Onshore developments
- Future prospects of fishery
- Status of tuna fishery and data collection
 - Logsheets data collection
 - Observer programme

Coastal fishery statistics

The situation for coastal fisheries statistics is considerably different. The quality of coastal fisheries statistics furnished to FAO by national governments is generally not very good (i.e. often based on inadequate or non-existent fisheries statistical systems). In fact, estimations of production from coastal fisheries by government fishery officers in about half of the Pacific Island countries are largely guesswork. Typically, government fisheries agencies give low priority to estimating the amount of coastal catches. In general, the smaller the scale of the fishing, the less is known about the production levels, with quantitative information being especially scarce for the subsistence fisheries in most countries.

Short-term support to enhance fisheries statistical systems has been provided by FAO, SPC and several bilateral agencies. Typically, once external support is withdrawn, the statistics systems usually degenerate and eventually become dysfunctional. Despite the importance of data on coastal fisheries, the reality is that in the prioritization of

scarce government funding, the ongoing, routine collection of fisheries data has not received much priority.

Even though most of the countries in the region attach great importance to their subsistence and small-scale commercial fisheries, it is these fisheries that present the greatest difficulties for the collection of production information. Although some countries collect statistics from their small-scale fisheries, there is some concern over the cost effectiveness and practicalities of regularly collecting this catch data in Pacific Island countries.

Attention is now being focused on the collection of coastal fisheries production information using surveys *outside* the fisheries sector. Many fisheries specialists in the region support the concept that well-conducted censuses, especially household income and expenditure surveys (HIES), can provide basic information on the composition, quantity and estimated value of coastal fisheries – often at little or no cost to government fisheries agencies. Box 1.3 gives some information on the use of HIES in fisheries.

BOX 1.3

Improved HIES for fisheries purposes

In 2009, SPC convened a workshop on the use of HIES in fisheries. A paper was subsequently published on the results of the workshop. It contained the statement: “HIES should be modified to collect information in ways that are simple to understand and that make it easy to quantify, for each household, the fish caught for subsistence, purchased at local markets, sold, received as gifts and given as gifts.” (Bell *et al.*, 2009a).

In 2013, SPC’s Statistics for Development Division made major changes to the type of household income and expenditure survey it promotes in the Pacific Islands region. The new type of HIES is standardized across the countries in the region with respect to the questions asked, sampling methodology, data set, outputs and reporting. Another feature of this HIES is that the survey is more fisheries-relevant, especially for subsistence and small-scale commercial activities. It is easier to capture home production and household income from fisheries and to disaggregate by various types of catch (i.e. ocean fish, lagoon fish, invertebrates). Since 2017, the new HIES has been used in the Cook Islands, the Federated States of Micronesia, Nauru, Niue, Palau, Solomon Islands, Tokelau, Tonga and Tuvalu (M. Sharp, SPC, personal communication, November 2017).

Sharp (2017) gives more details of the results of the Federated States of Micronesia HIES, including fisher participation, fishing effort, catch and income.

1.3 MAIN CATEGORIES OF FISHERIES IN THE REGION

Fishing activity in the Pacific Islands can be classified both by the area in which the fishing is undertaken and by scale. Although the terminology used is not standardized across the region,¹ one system of classification is as follows:

Offshore fishing

Offshore fishing is undertaken mainly by large, industrial-scale fishing vessels.² About 1 100 of these vessels operate in the EEZs of Pacific Island countries, mainly

¹ A lengthy discussion of classifying fisheries in the region is presented in Gillett (2005).

² The term “industrial fishing vessel” is often used in the region and is loosely understood to mean large vessels that operate offshore. A more encompassing and robust definition could be formulated in detail, but for the purpose of this paper, an industrial fishing vessel is defined as a fishing craft that is generally greater than 15 m in length.

using purse-seine, longline, and pole-and-line gear to catch tuna.³ Table 1.2 show the number of industrial vessels licensed to operate in August 2016. A fourth type of tuna fishing, trolling, is not undertaken on an industrial scale in the Pacific Islands, but some industrial tuna trollers are based in the region and troll in temperate waters to the south. The amount of tuna captured by offshore vessels in the region is many times greater than the catch from coastal fisheries. Offshore fishing in the region can be further subdivided into two categories:

- Locally based offshore fishing: Table 1.2 shows that in 2016, 119 longliners, 78 purse seiners, and 2 pole-and-line vessels were flagged in Pacific Island countries.
- Foreign-based offshore fishing: Approximately 740 foreign-based fishing vessels operate in the waters of Pacific Island countries. Although most of those vessels are longliners, about three-quarters of the tuna catch is taken by purse seiners. Most foreign-flagged fishing vessels are based in Asia, while some purse-seine vessels flagged to the United States of America are based in American Samoa. The licence fees paid to Pacific Island countries by these foreign-based vessels are substantial, and in some cases, are the major source of government revenue.

TABLE 1.2
Number of industrial vessels licensed to operate in the region in August 2016

	Flag	Total vessels	Bunker	Fish carrier	Light seiner	Long-line	Mother-ship	Pole-and-line	Single purse-seine
Pacific Island Countries	Cook Islands	12	4			8			
	The Federated States of Micronesia	37		1		18			18
	Fiji	58				58			
	The Marshall Islands	15	6	1					8
	Papua New Guinea	29		1					28
	Republic of Kiribati	28	9	6		1			12
	Republic of Vanuatu	47	1	11		32			3
	Solomon Islands	10						2	8
	Tuvalu	4	1			2			1
Distant Water Fishing Nations	China	290		6	2	264			18
	Ecuador	5							5
Distant Water Fishing Nations	El Salvador	2							2
	Fishing Nations	117		1		62		23	31
	Liberia	3		3					
	Netherlands	1		1					
	New Zealand	2							2
	Panama	80	3	77					
	Philippines	48	1	16			4		27
	Russian Federation	1		1					
	Republic of Korea	159	9	30		95			25
	Spain	3		1					2
	Taiwan Province of China	161		3		126			32
	United States of America	36				2			34
Total		1 148	34	159	2	668	4	25	256

Source: FFA website (www.ffa.int/node/42).

³ The fisheries legislation of many Pacific Island countries specifies that vessels that support fishing (e.g. bunkers, fish carriers) are also “fishing vessels”.

Coastal fishing

Coastal fishing is of fundamental importance in the Pacific Islands. Much of the region's nutrition, welfare, culture, employment and recreation are based on the living resources in the zone between the shoreline and the outer reefs. The continuation of current lifestyles, opportunities for future development, and food security are all highly dependent on coastal fishery resources. Although dwarfed in both volume and value by the offshore tuna fisheries, the Pacific Island fisheries that are based on coastal resources provide most of the non-imported fish supplies to the region. Coastal fisheries harvest a very diverse range of finfish, invertebrates and algae. Unlike the tuna fishery, virtually all the coastal catch is taken by Pacific Islanders themselves, with very little access by foreign fishing vessels.

Coastal fishing in the region can be placed mostly in three categories:

- Small-scale commercial fisheries (also referred to as “artisanal”), which can be further broadly subdivided into those supplying domestic markets, and those producing export commodities.
- Subsistence fisheries, which support rural economies and are extremely important to the region's nutrition and food security.
- Industrial-scale shrimp fisheries, which in the region occur only in Papua New Guinea.

In 2016, an SPC project estimated the fishery production in each Pacific Island country. All readily available sources of production information for each country were scrutinized to come up with a best estimate of national catches in the four fishery categories (Table 1.3).

TABLE 1.3
Marine fishery production in Pacific Island countries in 2014 (tonnes*)

	Coastal commercial	Coastal subsistence	Offshore locally based	Offshore foreign-based	Total
Kiribati	7 600	11 400	510	701 067	720 577
Papua New Guinea	6 500	35 000	216 896	217 871	476 267
Nauru	163	210	0	177 315	177 688
The Federated States of Micronesia	1 725	3 555	40 838	124 481	170 599
The Marshall Islands	1 500	3 000	85 918	29 754	120 172
Solomon Islands	6 468	20 000	41 523	36 573	104 564
Tuvalu	300	1 135	0	96 898	98 333
Fiji	11 000	16 000	17 079	0	44 079
Cook Islands	150	276	194	20 342	20 962
Vanuatu	1 106	2 800	568	10 942	15 416
Samoa	5 000	5 000	1 254	0	11 254
Tonga	3 900	3 000	1 363	1 891	10 154
Palau	865	1 250	3 987	4 017	10 119
Niue	11	154	0	547	712
Total	46 288	102 780	410 130	1 421 698	1 980 896

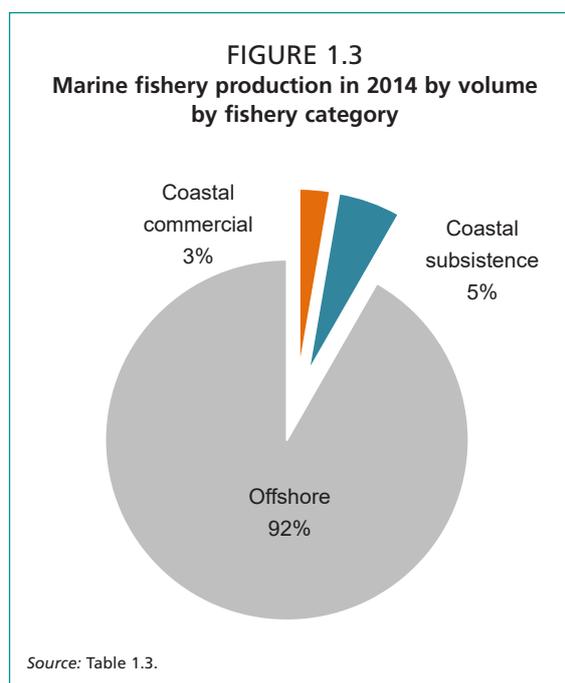
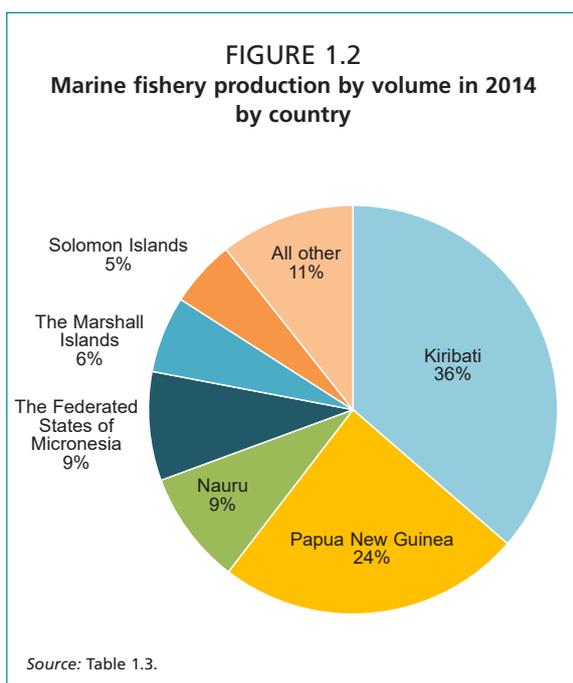
Source: Gillett (2016).

*In this report, unless otherwise noted, 'tonne' refers to metric tonne (1 000 kg).

The results are shown graphically in Figure 1.2. The six countries that have the most production have large tuna fisheries and, with the exception of Papua New Guinea, most of the tuna catch in those countries is taken by foreign-based vessels. Table 1.3 also highlights that:

- tuna production in 2014 was affected by the El Niño, which tends to displace the purse-seine fishery to the east – hence the large offshore catches in Kiribati that year;
- most of the offshore production is from countries located close to the equator;
- there is a relatively large contribution from non-tuna production in Fiji.

Figure 1.3 below shows that production from the offshore fisheries is over 10 times greater than that from coastal fisheries (commercial and subsistence combined). It is easy to conclude that offshore fishing, and the tuna resources they are based on are very important to the region.

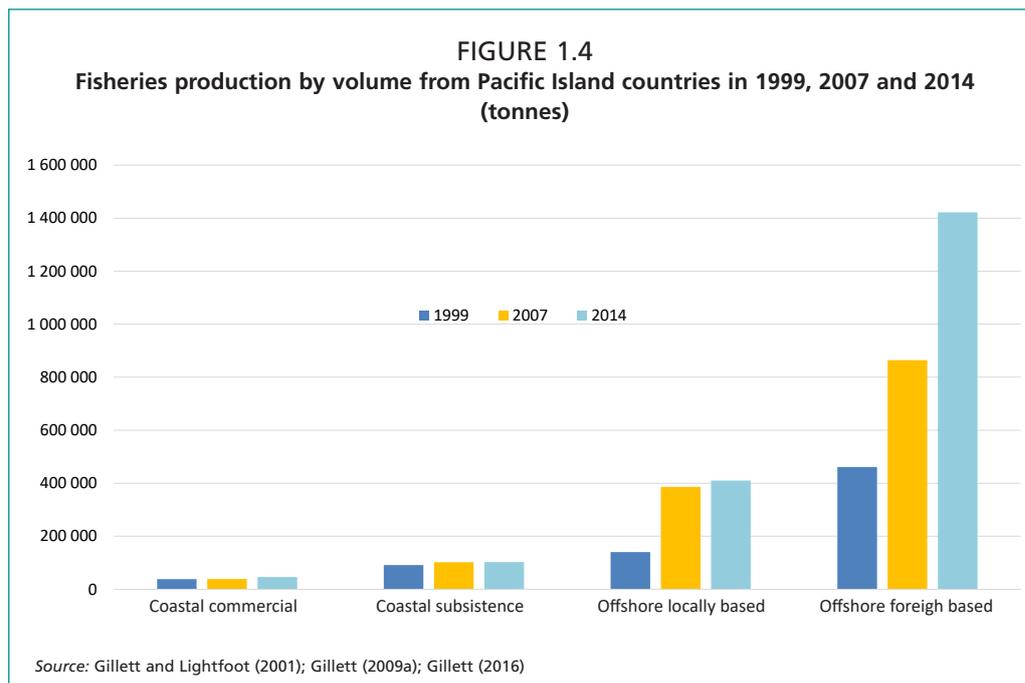


The change over time in quantities of production from the various categories has important implications for fisheries management. Figure 1.4 is compiled using data from three studies in the region that used a comparable methodology. Comparing 1999, 2007 and 2014 reveals an important point: offshore fisheries production continues to expand, but coastal fisheries production is largely stable – despite increasing coastal fishing effort in most countries of the region.

With respect to catch value, the 2016 SPC study determined that the unit price across the region (value at first sale) in 2014 equated to:

- coastal commercial: USD 4.00 per kg
- coastal subsistence: USD 2.10 per kg
- offshore locally based: USD 1.76 per kg
- offshore foreign-based: USD 1.57 per kg.

The very high unit value of coastal commercial production is due to high prices paid for invertebrate species (e.g. beche-de-mer, aquarium fish). The high unit value of offshore, locally based production relative to offshore foreign-based production reflects a larger proportion of high-quality sashimi production and less of cannery-grade tuna.



1.4 FISHERY RESOURCES

The region's marine fishery resources can be broadly split into two main categories: coastal (or inshore) and offshore (or oceanic):

- Coastal resources include a wide range of finfish and invertebrates. They are characterized by their shallow-water habitats or demersal lifestyles, restriction of individual movements to coastal areas, and in most cases, more restricted larval dispersal. Because of their relative accessibility, these resources form the basis of most of the region's small-scale fisheries.
- Offshore resources include tunas, billfish and allied species. They are characterized by an open-water pelagic habitat, potentially extensive individual movements, and wide larval dispersal. These resources form the basis of the region's industrial fisheries. Although oceanic in habit, some of the important species in this category are also found and harvested in coastal waters where, in some cases, they are thought to form essentially resident populations.

1.5 COASTAL FISHERY RESOURCES

Sources of information on coastal fishery resources

Information on the coastal fishery resources of the Pacific Islands is available from a variety of sources, on both national and regional levels. The regional overview documents that have proven to be most useful are:

- "Nearshore marine resources of the South Pacific: Information for fisheries development and management" (Wright and Hill, 1993), which is somewhat dated but nevertheless extremely useful. The publication contains chapters on the 17 most important groups of coastal marine resources: shallow-water finfish, trochus, marine aquarium fish, etc. Each chapter covers biology, resource assessment, fisheries description, management concerns and references;
- fishery resource profiles that were produced by FFA for most of the Pacific Island countries in the early 1990s. Each national profile has a section on the important fishery resources containing a summary of the resource, the fishery, stock status, management and references. The profiles for some countries have been updated

- recently. As an example, “Fiji fishery resource profiles” (Lee *et al.*, 2018) covers 44 groups of fishery resources (e.g. emperors, mullets, giant clams) in 300 pages;
- “FAO species identification guide for fishery purposes: The living marine resources of the Western Central Pacific” (Carpenter and Niem, 1998). This six-volume series (4 218 pages) covers virtually all the marine resources of economic value, including such groups as seaweed, coral and holothurians. In addition to taxonomic information on each species, the guide gives information on habitat, biology, fisheries and distribution;
 - fishery information bulletins produced by SPC, including several focused on coastal resources of special interest. These include the SPC Fisheries Newsletter (153 newsletters since 1971), and bulletins on beche-de-mer (37 bulletins issued since January 1990), live reef fish (21 since 1996) and women in fisheries (27 since February 1997);
 - regional studies of specific fishery resources undertaken by various development partners, including the Asian Development Bank (fish of the live reef food fish trade), World Bank (trochus), FAO (humphead wrasse) and WorldFish Center (giant clams).

Many studies on specific coastal fishery resources have been carried out at the national level over the years in all the countries of the region. Examples are studies on mullet in Tonga, tuna baitfish in Kiribati, trochus in the Marshall Islands, coconut crabs in Niue, shrimps in Papua New Guinea, aquarium fish in Palau and coral in Fiji. The reports of these surveys, especially the older ones, are frequently not readily available. Often there is not even an awareness that the studies took place, sometimes leading to duplicate research.

The Pacific Islands Marine Resources Information System (PIMRIS) is a formal cooperative network of libraries and information centres in Pacific Island regional organizations and government agencies concerned with the development of fisheries and marine resources. Its aim is to improve access to information on marine resources in the region by collecting, cataloguing, preserving and disseminating relevant documents in print and electronic formats, especially “grey literature”. The PIMRIS coordination unit, located at the University of the South Pacific, and the cooperating Information Section at SPC, are important sources of documents on coastal fishery resources of the Pacific Islands. Those agencies often hold reports of the studies mentioned in the previous paragraph – even those not available at the national level.

SPC has a wealth of information on the coastal fishery resources of the Pacific Islands from projects it has carried out (e.g. beche-de-mer, lobster, deep-water bottomfish, aquarium fish), documentation accumulated over 50 years, staff expertise, and data generated by the recently completed Pacific Regional Oceanic and Coastal Fisheries Project. The coastal component of the latter (PROCFish-C) is aimed at providing Pacific Island governments and communities with accurate, unbiased scientific information about the status and prospects of reef fisheries, with an emphasis on the identification of specific indicators that can be used for long-term monitoring of the status of reef fisheries.

Important coastal resources

The important coastal fishery resources of the region can be categorized in a number of ways. On a broad level, some schemes classify by type of fisher (subsistence, commercial), others by the fate of the catch (local use, export), or taxonomic group (finfish, invertebrates, and others). The most appropriate scheme depends on the objective of the classification, i.e. whether for economic or biological reasons.

Data from extensive fieldwork by SPC across the region shows that the coastal fisheries catch is made up of 55.6 percent demersal finfish, 27.8 percent nearshore pelagic fish and 16.7 percent invertebrates (SPC, 2013a).

Finfish

Dalzell and Schug (2002) reviewed finfish that are important in Pacific Island coastal fisheries. They stated that a typical, small-scale, commercial reef fishery in the western and central areas of the region could harvest between 200 and 300 finfish species, although it is likely that only a few species would dominate landings. SPC field work (SPC, 2013a) indicates that the average standing biomass of reef finfish across the Pacific Islands region is about 100 tonnes/km², with a range of 20 to 360 tonnes/km². Govan (2017a) used several sources to compile the common finfish species in the coastal fisheries in 15 locations (Table 1.4).

Invertebrates

The invertebrates of fisheries importance in the region can be divided into two groups, those for local food and those for export:

- SPC (2008b) gives the 14 most-landed, invertebrate food species groups in the region (wet weight, from questionnaire surveys). Giant clams made up about 40 percent of the total and beche-de-mer about 5 percent, followed by much smaller amounts of crabs, lobsters, strombus, Turbo, ark shell, other bivalves/gastropods, trochus, urchin, octopus, shoreline gastropods, beach bivalves and land crabs.
- Export invertebrates have historically been beche-de-mer, trochus and pearl oysters. In recent years, there has been considerable export of live molluscs, crustaceans and corals for the aquarium industry. The export of penaeid shrimp is significant, but only from Papua New Guinea.

Other important coastal fishery resources

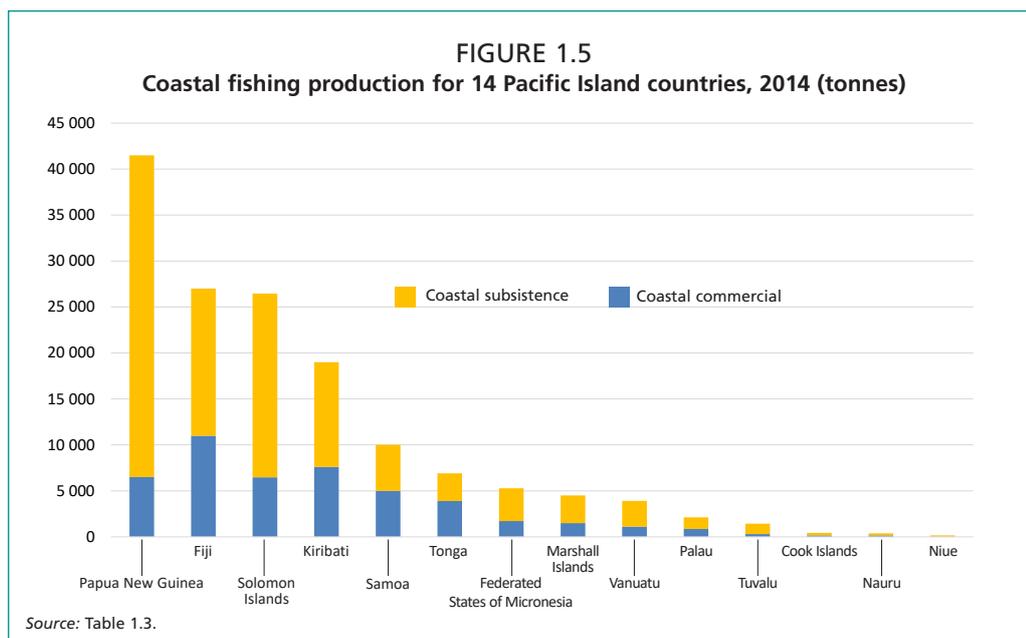
Seaweeds are considered a “fishery” resource in most Pacific Island countries. They are mainly used for local food, but are exported from a few countries (e.g. Tonga). In “Fiji fisheries resources profiles” (Richards *et al.*, 1994a), mangroves are included as a coastal fishery resource. “Live rock”, which is portions of reef rock covered with attached organisms, particularly coralline algae, is considered a fishery resource in several Pacific Island countries.

TABLE 1.4
Common types of finfish from 15 locations in the Pacific Islands region

Scientific name	Common name	Percent of catch
Lethrinidae	Emperors	13.32
Acanthuridae	Surgeonfish	10.91
Lutjanidae	Snappers	9.19
Carangidae	Jacks/scads	7.19
Serranidae	Groupers	6.96
Mugilidae	Mulletts	6.90
Scaridae	Parrotfish	6.58
Scombridae	Tuna/mackerels	5.53
Mullidae	Goatfish	3.25
Siganidae	Rabbitfish	2.92
Holocentridae	Soldierfish/ squirrelfish	2.69
Sphyraenidae	Barracudas	1.53
Albulidae	Bonefish	1.36
Haemulidae	Grunts	0.89
Belonidae	Needlefish	0.81
Balistidae	Triggerfish	0.74
Labridae	Wrasses	0.52
Gerridae	Mojarras	0.49
Hemiramphidae	Garfish	0.17
Chanidae	Milkfish	0.15
Theraponidae	Surf perches	0.03
Others		17.87

1.6 IMPORTANT TYPES OF COASTAL FISHING

Table 1.3 gives estimates of fisheries production for each Pacific Island country for 2014. Figure 1.5 below takes the coastal fishing data from that table and shows graphically the annual production by country. The figure shows that in most countries of the region, the volume of production from coastal subsistence fisheries is much greater than that from coastal commercial fishing, with Tonga and Samoa being notable exceptions.



Subsistence fishing

As can be seen in Table 1.3, about 70 percent of the overall fisheries production from coastal areas of the Pacific Islands is produced by subsistence fishing. In several countries (Tuvalu, Solomon Islands, Vanuatu, Papua New Guinea and Niue), over 80 percent of the coastal catch is from the subsistence sector.

In a recent review of the benefits from Pacific Island fisheries, Gillett (2016) estimated that the contribution of subsistence fishing to gross domestic product (GDP) was actually quite large in a number of Pacific Island countries. Overall, about 22 percent of the GDP contribution from the fishing sector in the region comes from subsistence fishing.

Subsistence fisheries generally involve a large variety of species, including fish, molluscs, crustaceans, algae and other groups. For example, Zann (1992) reported that in Samoa, the subsistence fisheries made use of 500 species. In a study of coastal resources management in the Pacific Islands (World Bank, 1999a), residents in coastal villages in five countries identified what they considered were their major coastal resources in descending order (Table 1.5).

Subsistence fishing tends to be most important in rural areas, but as rural economies become increasingly monetized, the amount of fish being traded for cash grows and there is a gradual move away from fishing for home consumption or to meet social obligations, and towards fishing as a means of generating cash income.

Much of the subsistence fishing in the region does not involve a vessel. Common methods include gleaning from shore, or swimming or use of a non-powered canoe. Typical characteristics of subsistence fisheries in the Pacific Island are: specialized

TABLE 1.5
Resources that support subsistence fishing

Country	Groups of fishery resources (in descending order of importance)
Fiji	Finfish, beche-de-mer, octopus, seaweed, lobster, mud crab, and various bivalve molluscs.
Tonga	Finfish, octopus, lobster, beche-de-mer, Turbo, giant clams, seaweed, and Anadara.
Samoa	Finfish (especially surgeonfish, grouper, mullet, carangids, rabbitfish), octopus, giant clams, beche-de-mer, Turbo, and crab.
Solomon Islands	Finfish, beche-de-mer, trochus, giant clam, lobster, Turbo, and mangroves
Palau	Finfish, giant clams, mangrove crab, lobster, turtle, and beche-de-mer.

Source: World Bank (1999a).

knowledge often passed down through generations, labour-intensive operations sometimes involving an entire community, sharing of the catch amongst the community, social restrictions/prohibitions, and specialization of activity by gender.

Characteristically, women are involved in inshore fishing activities, such as reef gleaning and invertebrate collection, and the preparation of food from the products of fishing activities. Men are usually involved in the more strenuous work of fishing further offshore for large species of fish, and in diving activities. There are, however, important exceptions to this generalization. Several observers of the situation of Pacific Island subsistence fisheries estimate that fishing activity by women actually results in a greater amount of family food than is produced by men through their fishing activity.

Although there have been many development projects attempting to commercialize aspects of fishing in subsistence communities, they have usually met with limited success. Thirty-five years ago, on the basis of studying the fish marketing situation in many Pacific Island countries, an FAO study concluded: “The basic structure of the subsistence sector is not conducive to the regular supply of fish to urban communities in sufficient quantities to satisfy demand” (Carleton, 1983). This is still true today.

Coastal commercial fishing

Compared to the subsistence fisheries of the region, the coastal commercial fisheries take a more restricted range of species, although it may still be substantial. For example, over 100 species of finfish and 50 species of invertebrates are included in Fiji’s fish market statistics. Total commercial fishery products from the region include reef and deep-slope fish (about 43 percent of total weight), coastal pelagic fish (18 percent), shell products including trochus, green snail and pearl shell (9 percent), crustaceans (8 percent), beche-de-mer (7 percent) and estuarine fish (6 percent).

It may not be appropriate to place the various types of coastal commercial fishing into discrete “fisheries”, especially for smaller-scale fishing. A single fishing trip often involves the use of several types of gear to make a range of catches. For example, Gillett and Moy (2006) state that during a multi-day fishing trip, spearfishers in Fiji characteristically collect beche-de-mer, trochus and lobster, and do some handlining in addition to the main effort of spearing finfish. It is often more accurate to discuss the various types of coastal commercial fishing in the region by primary target.

Shallow-water reef fish

In most of the Pacific Islands, finfish found in relatively shallow water (< 50 m) are the basis of much commercial fishing. About 300 species representing 30 to 50 fish families comprise the majority of the catch. Handlines, spears, and gillnets are the main gear used. Dalzell and Schug (2002) give the yields for the common types of gear used in the region for shallow-water reef fish (Table 1.6). Commercial export of shallow-water reef fish is not a major activity; the vast majority of the catch is for the domestic urban market, with an exception being Chuuk in the Federated States of Micronesia. Cuetos-Bueno (2014) indicates about 450 tonnes of reef fish are caught for commercial purposes in Chuuk lagoon each year, with half being sold at urban markets and half being exported.

TABLE 1.6
Yields for shallow-water reef fishing

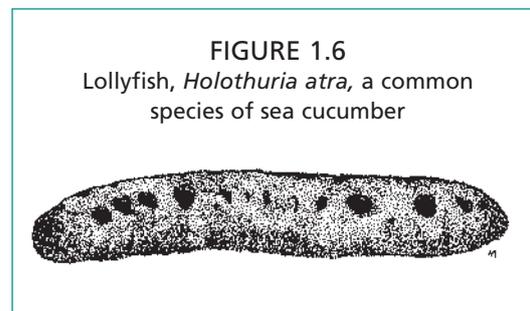
Fishing method	Catch rate units	Catch rate range	Catch rate mean
Handline	kg/line/hr	0.40–3.50	1.90
Spearfishing	kg/person/hr	0.41–8.5	2.97
Gillnet	kg/set	3.0–39.0	15.79
Drive-in-net	kg/set	14–350	80.90

Source: Dalzell and Schug (2002).

Sea cucumber

About 30 species are currently exploited in the region, with the highest value species being *Holothuria scabra*, *H. lessoni*, *H. fuscogilva*, *H. whitmaei* and *Thelenota ananas* (Purcell, 2014). Annual sea cucumber production from the region peaked in 1992 at 2 043 tonnes, with Melanesian countries exporting considerably more sea cucumbers than countries in Polynesia or Micronesia (Ericksson *et al.* 2017). Villagers can process sea cucumbers into a non-perishable product (beche-de-mer) that can be stored for extended periods awaiting opportunistic transport to markets. “Pulse fishing” is often used to describe the harvesting of sea cucumber – long cycles in which a period of intense exploitation is followed by a sharp fall in the abundance of the resource with associated difficulty in maintaining commercial exploitation. An example of a sea cucumber species is illustrated in Figure 1.6.

Sea cucumbers are characteristically overexploited in most Pacific Island countries. Box 1.4 summarizes the situation in Fiji.



BOX 1.4

Status of the sea cucumber fishery in Fiji

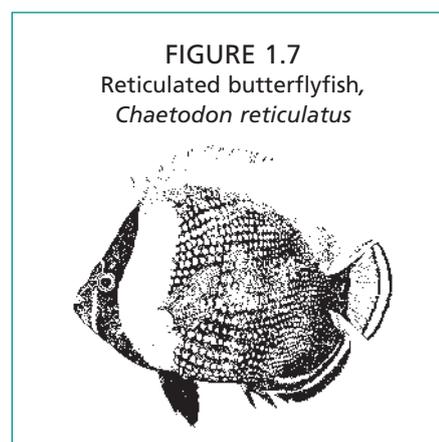
In the past 10 years, the sea cucumber fishery in Fiji has been evaluated in four major reports: a study conducted by the Pacific Community under the PROCFish project; a study by SPC on the status of sea cucumber resources and fisheries management; an SPC study on the economic evaluation of sea cucumbers in Fiji with other Melanesian countries, and Tonga; and a comprehensive report compiled by the Wildlife Conservation Society and the Ministry of Fisheries. All four reports concluded that Fiji’s sea cucumber fishery is extremely overexploited and urgently requires stricter management actions.

The underwater assessments all agreed that the sea cucumber species densities in Fiji were well below the regional reference densities. Despite an export ban on dairo (*Holothuria scabra*) since 1988, stocks have not recovered, with surveys recording densities below regional reference densities and comprising largely immature animals.

Source: Lalavanua (2017).

Aquarium fish and invertebrates

Aquarium fish collectors target a large number of species, with the major families being butterflyfish (Chaetodontidae), damselfish (Pomacentridae), surgeonfish (Acanthuridae) and angelfish (Pomacanthidae). Most aquarium species have the characteristics of relatively small size, bright coloration, and good survival in captivity. Many operations also harvest and export invertebrates and “live rock”. An appealing aspect is that aquarium fish are rarely taken for food in the Pacific Islands and therefore this fishery does not



interfere with subsistence fishing activities. According to SPC (2013a), the aquarium trade operates out of 12 Pacific Island countries. An example of a common butterflyfish species is illustrated in Figure 1.7.

*Trochus niloticus*¹

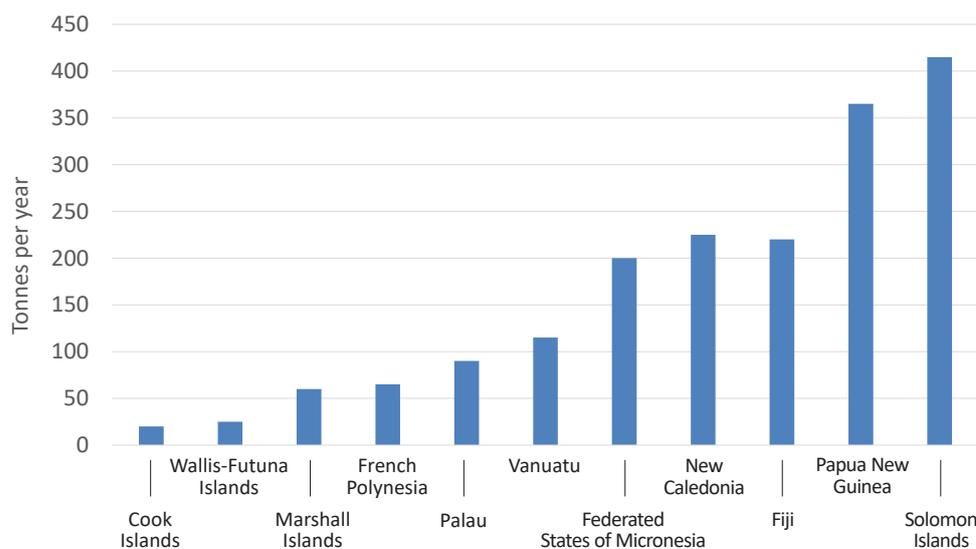
Trochus niloticus (Figure 1.8) is commercially one of the most important shellfish in the Pacific Islands. Although the natural range of trochus is limited to the western part of the region, the gastropod has been transplanted to almost all Pacific Island countries. It is valued for the inner nacreous layer of the shell, which, along with that of pearl oysters and some other shells, is used for the manufacture of "mother-of-pearl" buttons. The annual harvest of trochus in the Pacific Islands in recent years has been about 2 300 tonnes, with five Pacific Island countries providing most of the harvest (Figure 1.9). The region is a significant producer of trochus – producing about 60 percent of the trochus in the world.

Not a huge amount of trochus is captured in each country, but the benefits from these fisheries are substantial. Because little or no equipment is used in collecting trochus and because the shells can be stored for long periods prior to shipment to market, trochus (along with sea cucumbers) is one of the few commercial fisheries feasible for remote communities. In several Pacific Island countries, trochus provides an important source of cash income at the village level, especially since the demise of the copra industry.

FIGURE 1.8
Commercial top shell,
Trochus niloticus



FIGURE 1.9
Annual trochus harvests in the Pacific Island region



Source: Gillett (2008a).

¹ Also known as *Tectus niloticus*.

Live reef food fish

The live reef food fish fisheries typically harvest certain groups of fish in the tropical Indo-Pacific region and ship them by air or sea to Chinese communities in east Asia. Sadovy *et al.* (2003) indicate that in the main destination markets, the bulk of the trade consists of the groupers (Serranidae). Also taken are snappers (Lutjanidae), wrasses (Labridae), small numbers of emperors (Lethrinidae), sweetlips (Haemulidae), seabream (Sparidae) and members of a few other families. According to Yan (2016), one of the most valuable fish in the trade is the leopard coral trout (*Plectropomus leopardus*), which can fetch up to USD 200 per kilogram in Hong Kong's wholesale market. A variety of techniques/gear are used in live reef food fish fishing. The major exporter in the region is Papua New Guinea, with sporadic fishing operations in Palau, Solomon Islands, Fiji and Kiribati. Box 1.5 gives the main methods used in Papua New Guinea. It is difficult to determine the quantities of live reef food fish currently harvested and exported from the Pacific Islands region. Gillett (2008a) estimated 1 500 tonnes are harvested, based on the region having 5 percent of the Asia-Pacific trade of 30 000 tonnes, but a more recent publication (SPC, 2013a) indicates that the trade has dwindled considerably, with small-scale operations in just a few Pacific Island countries. This decrease is thought to be due to an increase in awareness of the public and fisheries departments of the negative consequences of the trade, such as targeting spawning aggregations or the use of destructive fishing techniques.

BOX 1.5

Live reef food fishing techniques in Papua New Guinea

Two methods are used legally to catch live reef food fish in Papua New Guinea: handlines and traps. For the latter, the choice of bait and fishing time depends on the species targeted. The traps are mainly rectangular or arrowhead in design, with a frame of steel or mangrove covered with chicken wire. The traps are commonly placed by divers using hookah gear. Although the use of cyanide for fishing is illegal, according to fishers associated with past live reef food fish operations in Papua New Guinea, the chemical is often used. A squirt bottle is used to deliver the cyanide solution as close as possible to the target fish. Most operations (legal and illegal) fish from a specially fitted skiff with a seawater compartment that allows free flow of water into the compartment. The target live fish are held in the compartment for the duration of the fishing. It is then used to transport the fish to a larger carrier vessel where they are kept or further transported to cages anchored off reefs. Fish held on the carrier vessels or in cages need food, which mainly comes from other fishing operations.

Source: SPC (2001).

Lobsters

The commercial lobster fishery in the region is based on three species in the genus *Panulirus*. The largest fishery occurs in the Torres Strait of Papua New Guinea and targets the ornate spiny lobster (*Panulirus ornatus*). These lobsters annually move off the reefs in the Torres Strait. Some of the migrating lobsters move north-east across the Gulf of Papua, while others move east to deep waters off the northern Great Barrier Reef. In recent years the catches of this species have ranged from 65 to 115 tonnes (National Fisheries Authority of Papua New Guinea (unpublished data)).

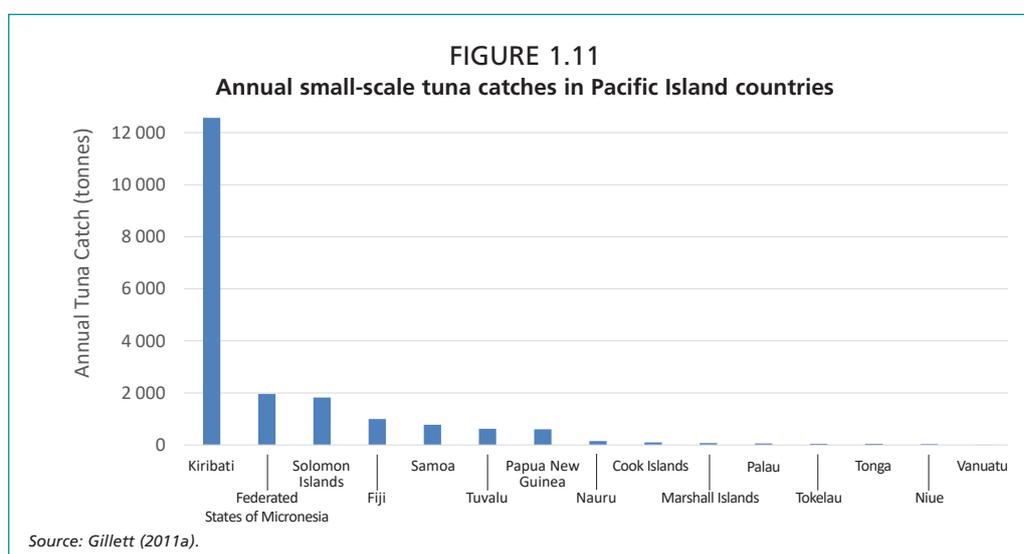
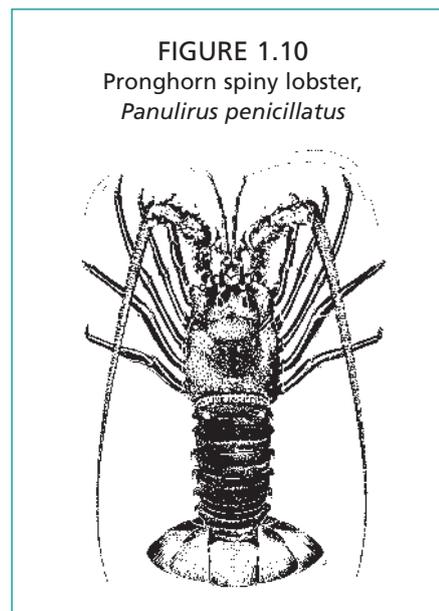
Smaller lobster fisheries, based mainly on the double-spined lobster (*Panulirus penicillatus*) (Figure 1.10), take place in many Pacific Island countries. The most common fishing method is walking on reef flats and catching by hand at night. Spearing

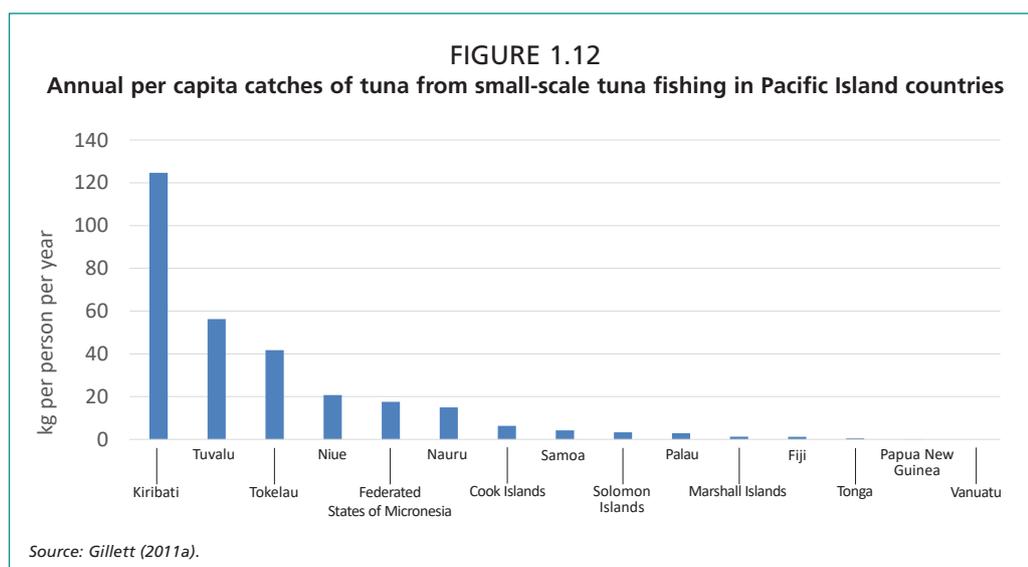
is also important. Some exports occur but they are rarely sustained. The biological characteristics of this species are such that it is generally unable to support an adequate throughput for an export market. Adams and Dalzell (1993) reviewed a large number of failed lobster export businesses, and posed the question: “Given the history of failed commercial enterprises, why do Australians and New Zealanders continue to throw themselves, lemming-like, into Pacific Island lobster ventures?”

Nearshore pelagics

Trolling for tuna and other large pelagics just outside the reef is practised in most Pacific Island countries. The use of fish aggregation devices (FADs) increases catches and reduces operating costs. Table 1.4 above shows that about 5.5 percent of the coastal catch in the region consists of tunas and mackerels. Alternatively, Gillett (2011a) estimated that total annual tuna production by small-scale fishing in all Pacific Island countries is about 20 000 tonnes. Figure 1.11 shows a breakdown of that amount by country, and Figure 1.12 shows estimates of the per capita catches of pelagics by country (thought to equate to per capita consumption expressed as whole weight equivalent). Current issues in the coastal fishery for tuna and other large pelagics include the following:

- There is increased interaction with industrial fisheries, especially at the local market level.
- There have been a large number of attempts to develop small-scale tuna fisheries but apart from FADs, few have been successful.
- Whether the safety record of small-scale tuna fisheries has changed is open to speculation, but it is clear that there has been an increase in the number of safety programmes applicable to small-scale tuna fishing.
- There has been an evolution in fishing craft from traditional canoes to fibreglass skiffs.
- A higher proportion of the small-scale tuna catch now comes from trolling, relative to the more complex traditional techniques, such as lasso fishing or the drop-stone method. Traditional tuna fishing knowledge appears to be declining.
- There has been a notable increase in the number of fishers who contend that there are now fewer surface schools of skipjack than in the past.





Sport game-fishing

This specialized form of small-scale commercial fishing is growing in importance in the region. The last regional overview of commercial sport-fishing vessels was done by SPC in 2004 (Table 1.7). The number of these vessels has probably increased considerably since that study. The target species range from large coastal pelagics to inshore bonefish. Sport fishers, especially tourists, spend money on vessel charters, accommodation, provisions and shoreside recreation. In addition, international tournaments are held annually in most countries of the region.

TABLE 1.7
Game-fishing charter boats in Pacific Island countries

Country/territory	Game fishing charter boats: number and location
Cook Islands	9 boats working from Rarotonga and 5 from Aitutaki.
Federated States of Micronesia	Several boats associated with tourist hotels.
Fiji Islands	Several charter boats, some associated with tourist hotels.
Kiribati	Nil at present.
Marshall Islands	Around 25 charter boats on Majuro plus 10 between Kwajalein and Arno.
Nauru	One private sector charter boat.
Niue	1 charter vessel with another to start in late 2003.
Palau	Around 7 charter fishing vessels in Koror.
Papua New Guinea	Several charter boats around the country, especially at main centres such as Port Moresby, Lae and Madang.
Samoa	4 charter boats, 2 owned by one company.
Solomon Islands	Several charter boats at Gizo.
Tonga	Around 8 charter vessels operating out of Vava'u.
Tuvalu	Nil at present.
Vanuatu	Around 9 charter boats, 7 at Port Vila and 2 at Santo.

Source: Chapman (2004).

Deep-water bottomfish

The target of deep-water bottomfishing in the Pacific Islands is actually a number of fish species that inhabit reef slopes and shallow seamounts at depths between 100 and 400 m. In simple terms, fishing for deep-water bottomfish involves locating a suitable deep slope or shallow seamount, positioning the vessel over the proper depth, and using lines with multiple baited hooks to catch the target fish. Boats used at present in various Pacific Island countries range from small, open skiffs to vessels of 16 m capable of making multi-day trips to offshore banks and seamounts. The major species involved in the deep-slope fisheries are given in Table 1.8. McCoy (2010) describes the development of the fishery:

During the 1970s SPC first became involved in what were termed “deep reef slope fisheries” to provide alternative avenues for fishing effort that had been concentrated on stocks of fish occurring on or within the shallow reef. A secondary enticement was that many of the deep reef slope species were free of ciguatera and thus held export potential. These efforts coincided with other activities sponsored by FAO and overseas donors in (Western) Samoa and elsewhere that encouraged expansion of fisheries beyond shallow reefs. Over time, commercial fisheries for deep reef slope species became established in Tonga, Fiji, Vanuatu, Papua New Guinea and American Samoa. Beginning in the early 1990s, locally based, small-scale longline fisheries were developed, and the focus of fishery development and management shifted to tuna and other offshore resources. Deep slope fisheries, including those for deep-water bottomfish in some countries of the region, either became dormant or activity was greatly reduced. More recently, changes to resource availability and the economic viability of the tuna longline fishery in some Pacific Island countries have raised the potential for renewing or increasing activity in deep-water bottomfish fisheries.

Penaeid shrimp

Although there is subsistence fishing for marine and freshwater shrimps in most Pacific Island countries, the only shrimp fishing in the Pacific Islands that produces significant exports are the four trawl fisheries located in Papua New Guinea. Characteristics of the Papua New Guinea fishery are given in Gillett (2007; 2008b). Fishing takes place primarily in the Gulf of Papua, with all vessels being based in Port Moresby and carrying out prolonged voyages (around a month), with on-board processing, freezing and packing of catch. Those vessels operating in the Gulf of Papua typically fish close to shore, up to depths of about 45 m. The fishing is based on the banana prawn (*Penaeus merguensis*) and to a lesser extent, the giant tiger prawn (*Penaeus monodon*)

TABLE 1.8
Common deep-water bottomfish caught in the region

Scientific name	Common name
Snappers	
<i>Etelis carbunculus</i>	Ruby snapper
<i>Etelis coruscans</i>	Long-tailed red snapper
<i>Aphareus rutilans</i>	Small-tooth jobfish
<i>Pristipomoides filamentosus</i>	Rosy jobfish
<i>Pristipomoides flavipinnis</i>	Yellow-finned jobfish
<i>Pristipomoides multidens</i>	Purple-cheeked jobfish
<i>Pristipomoides amoenus</i>	Flower snapper
<i>Pristipomoides auricilla</i>	Gold-tailed jobfish
<i>Pristipomoides zonatus</i>	Banded flower snapper
Groupers	
<i>Epinephelus septemfasciatus</i>	Giant grouper
<i>Epinephelus morrhua</i>	Curve-banded grouper
<i>Epinephelus cometae</i>	Snakeskin grouper
Others	
<i>Seriola rivoliana</i>	Amberjack
<i>Promethichthys prometheus</i>	Snake mackerel
<i>Ruvettus pretiosus</i>	Oilfish

Source: McCoy (2010).

FIGURE 1.13
Banana prawn,
Penaeus merguensis



(Figure 1.13). Production from the Papua New Guinea shrimp trawl industry has been variable over the past two decades. The maximum annual catch recorded from the fishery was 1 870 tonnes in 1979, but production typically varies between 400 and 1 300 tonnes.

Exports from coastal commercial fishing

Much commercial production from coastal areas in the Pacific Islands is exported. In general, the region exports high-value commodities, while importing mainly inexpensive food supplies, such as canned mackerel. Coastal fishery development efforts in the region have largely been oriented to export products. With the increased global demand for fishery products and subsequent price rise, the incentive to export will increase. As this trend continues, there is some cause for concern. Some of the export-oriented fisheries have interfered with traditional sources of food (e.g. giant clam exports) and have even been destructive (e.g. the live fish trade to Asia). In some cases, the benefits of export fisheries are enjoyed by a few individuals, while adverse side-effects may be experienced by many (e.g. the export of live fish). Information on the quantity of exported fishery products is often insufficient to gauge the benefits of the fishery or assess the sustainability.

Table 1.9 is an attempt to estimate the volume of exports from Pacific Island coastal fisheries. For many of the commodities listed, the quantities given could be considered as crude estimates. Although most countries of the region keep track of exports (including

TABLE 1.9
Exports from Pacific Island coastal fisheries

Commodity	Quantities	Country origin of exports	Source of information
Beche-de-mer	1 500 tonnes (dried equivalent to 15 000 tonnes live weight)	The major exporters are Papua New Guinea, Solomon Islands, Fiji and New Caledonia.	SPC data
Trochus	2 300 tonnes of shell annually during the last decade	The major exporters are Papua New Guinea, Solomon Islands, the Federated States of Micronesia, Fiji and New Caledonia.	Data from Gillett (2008a)
Deep-water bottomfish	350 tonnes annually in recent years	The major exporters are in Fiji and Tonga.	G. Southwick, D. Lucas, and B. Holden (personal communication)
Giant clam	20 tonnes of adductor muscle plus shells; quantities are declining due to resource exhaustion and export controls.	Some exports from most Pacific Island countries in the past; now many countries have export bans on meat; Solomon Islands is the major shell exporter.	SPC data; CITES data also available
Live reef food fish	Considerably less than 1 500 tonnes	The major exporter has been Papua New Guinea, with sporadic operations in Palau, Solomon Islands, Fiji and Kiribati.	Sea cucumber section of this report
Aquarium fish and invertebrates	The region annually exports a million ornamental fish and coral pieces, and 700 tonnes of live rock	Harvesting operations in most Pacific Island countries	SPC (2009)
Lobster	80 to 100 tonnes	Mainly from the Torres Strait between Papua New Guinea and Australia	National Fisheries Authority of Papua New Guinea (unpublished data) and K. Friedman (personal communication)
Prawns	600 tonnes	All from Papua New Guinea	Gillett (2008b) – using various primary sources.
Other	Considerably smaller quantities than the above commodities.	Minor exports from several countries: crabs, green snail, oysters, specimen shells, shells in handicrafts, barramundi, and shallow-water reef fish.	

fishery exports) through customs departments, it is often difficult to disaggregate the data to identify exports from coastal fisheries. For example, in the international harmonized system of tariff codes, HS0304 is “fish fillets and other fish meat (whether or not minced), fresh chilled or frozen” – so it is not possible to determine whether a particular HS0304 commodity is from coastal fisheries, offshore fisheries or aquaculture. The total value of fishery exports (coastal, offshore, aquaculture) from all independent countries was estimated to be about USD 300 million in 2014 (Gillett, 2016).

Status of coastal resources

In general, the coastal fishery resources are heavily fished and often show signs of over-exploitation, especially in areas close to population centres and for fishery products in demand by rapidly growing Asian economies. Coastal fisheries are also negatively affected by habitat degradation as a result of destructive fishing practices, urbanization, siltation from mining/logging, and competing uses of the coastal zone.

On a more detailed level, the degree of exploitation of coastal finfish is generally related to the distance to urban markets. The perishable nature of finfish has a limiting effect on fishing pressure in rural areas. By contrast, the products of commercial invertebrate fishing are mostly non-perishable. SPC (2008b) states that most sites surveyed in the Pacific Islands are “seriously depleted of commercial invertebrate resources”. Another aspect of the status of invertebrate fisheries in the region is variability. Dalzell and Schug (2002) state that commercial harvests of invertebrates are characterized by boom and bust cycles, and in some cases the bust part of the cycle has persisted with no indication of recovery.

In early 2009, SPC completed a project that was oriented towards identifying specific indicators that could be used for long-term monitoring of the status of reef fisheries (the PROCFish-C project). A huge amount of data was collected over six years in field surveys in 17 island groups of the region. In some respects, the status of that work is indicative of the general state of monitoring coastal fishery resources in the region. SPC (2008b) comments: “We are still a long way from being able to estimate fishing mortality in reef fisheries as we do in tuna fisheries, and because most governments and fishing communities do not collect information from fishers, we’re even a long way from being able to estimate fishing effort. However, by using various survey samples, particularly household consumption and fishing effort surveys, it is possible to develop a rough indicator of fishing pressure at different sites and islands, in terms of the number of active fishers per unit reef area”. SPC (2013a) contains a general analysis of the status of coastal finfish and invertebrate resources in the region. The report states that “human population density is strongly correlated with (and used as a proxy for) fishing intensity, and data suggest a strong reduction in the mean size of piscivorous fish (e.g. Serranidae and Lutjanidae) with increasing fishing pressure”.

1.7 MANAGEMENT OF COASTAL FISHERY RESOURCES

Historical background

In former times, most coastal communities in the Pacific Islands had some type of management of adjacent marine resources. This was often in the form of community leaders restricting access by outsiders, and various kinds of harvest bans for residents. The current thinking is that those mechanisms worked reasonably well in the context in which they were used, but there have been a multitude of other changes in management conditions, for example:

- the populations of the various island groups were considerably smaller than those of today;
- markets for coastal resources have developed and commercialization is now a major factor influencing fishing effort;

- the authority of community leaders, a basic element in local coastal resource management, has eroded through both changes in society and alteration to legal and regulatory regimes;
- external threats over which the community has little control (e.g. logging, pollution) are greater now than in the past.

The net result of these changes has been a marked decrease in the effectiveness of former systems of coastal resource management, especially near urban areas.

Although there is considerable variation among Pacific Island countries, the general pattern is that, during the colonial period, centralized forms of resource management were introduced to most Pacific Island countries by the mainly expatriate fishery administrators. The first 50 years of the 20th century were characterized by government indifference to marine issues (Adams, 1997). In the mid-1950s, most Pacific Island governments started using various forms of fisheries management measures, most typically through restrictions (gear, seasons, quotas, areas) stipulated as regulations under national fisheries laws. Although the new central regimes were often supported by legal systems, there was little technical backup or enforcement activity, especially in the areas away from urban centres.

Centralized management was also characterized by the fairly optimistic assumption that, through biological and economic studies of coastal resources, it would be possible to optimize the benefits from a fishery. In general, the sophistication of those studies did not come close to matching the government capability or desire to implement management.

Starting in the early 1970s, both fisheries managers and the environmental community placed increasing emphasis on using marine protected areas (MPAs) as fishery management tools. A decade later, the concept of community-based MPAs gained momentum. Research by Robert Johannes led to the book “Words of the lagoon” (Johannes, 1981) and to a much greater appreciation of the value of using indigenous knowledge in resource management.

Recognizing the difficulties associated with restriction-oriented coastal management, there have been many decades of efforts to encourage inshore fishers to diversify into deep-slope or offshore fisheries (bottomfish/tuna). There is also a long history of aquaculture promotion in the region, and one rationale for this is that the culture of marine organisms could lead to reduced pressure on coastal resources.

The current situation

Some management measures are ongoing, such as a minimum size for trochus or beche-de-mer, while others require a “trigger” – for example, when total catches of beche-de-mer fall to a low level, a complete ban on beche-de-mer fishing is triggered. Other triggers for management action are low abundance of the target species as noted by fishery-independent field surveys (e.g. giant clams in several countries), the discovery of illegal activity (the use of cyanide in live fish operations), complaints by villagers (scuba spearfishing at night), and falling catch per unit effort (Tonga deep-water bottomfishery).

Many current management measures support biological objectives – most often stock sustainability, i.e. prevention of resource collapses (rather than catch optimization). There is also management for purely economic objectives, such as encouraging in-country trochus processing. Cultural objectives, such as the closure of a reef to fishing after the death of a traditional leader to show respect, are also common. Preston (2008a) indicates that coastal fishery management measures (both centrally administered and community-driven) are characteristically non-quantitative and are intended to protect stocks in a generalized way. These measures include MPAs, size limits (both minimum and maximum), gear restrictions (minimum mesh sizes for nets, bans on torch fishing at night), prohibitions on the use of destructive fishing methods

(blast fishing, poisons), prohibitions on the taking of berried females, and seasonal or area closures.

In recent decades, the Pacific Islands have experienced a remarkable proliferation of MPAs and similar community management arrangements. Older models of larger, centrally planned reserves have failed in almost all cases. A newer approach, built on existing community strengths in traditional knowledge and governance, and using local awareness of the need for action, has been quite successful. An SPC survey of all 22 countries and territories in the Pacific Islands region showed that, of the 11 422 coastal communities and villages, 936 had some form of community-based fisheries management (Govan, 2015).

Recently there has been a sharp increase in recognition in the region of the need to improve the management of sea cucumbers. SPC commissioned a study of management of sea cucumber fisheries and the beche-de-mer trade in Melanesia (Carleton *et al.*, 2013), and made several recommendations to improve management, including that: (a) all beche-de-mer production be subject to a management levy collected at the point of export; (b) consideration be given to applying a per-piece levy on different species; (c) sea cucumber fisheries be managed to preclude the need for total closures; and (d) the use of underwater breathing apparatus in exploiting sea cucumber resources be banned. Another influential study (Purcell *et al.*, 2014) suggested that management agencies should consider a shift in resources from developing marine reserves, conducting underwater surveys and aquaculture-based restocking, to strengthening enforcement capacity, stakeholder involvement and communication with fishers. Since those studies, two ministerial-level regional meetings on sea cucumber management have been held.

Livelihood diversification has been promoted as a tool for marine resource management in the Pacific Islands for at least 30 years. The concept is that alternative or supplementary sources of income or food to those obtained from inshore fishing could be used to relieve fishing pressure on inshore marine resources. Because of the widespread past and present use of the technique as a fisheries management tool in the region, the WorldFish Center and SPC undertook a study in 2007 of its effectiveness. Box 1.6 summarizes the results.

BOX 1.6

Livelihood diversification as a marine resource management tool

Four main types of activities have been promoted in the region as alternatives to inshore fishing to reduce fishing pressure: aquaculture, FADs, deep-slope fishing, and alternatives outside the fishing sector (e.g. eco-tourism, livestock raising, surfing, handicrafts). The results of the study show that, in reviewing marine resource management in the Pacific Islands over the last three decades, it is difficult to identify cases where the use of livelihood diversification as an inshore management tool could be considered clearly successful. The most important result of the study is that the performance of livelihood diversification in the Pacific Islands has not been to the level where it can be considered an effective resource management tool. In many cases, livelihood diversification could even be a distraction that deters communities from gaining an awareness of the need for, and benefits of, more effective forms of marine resource management. Often there is the assumption by fishery managers that extra cash or food will remove fishing pressure, but the actual situation of what motivates and discourages individuals/communities from fishing is far more complex.

Source: Gillett et al. (2008).

There has been a considerable amount of recent activity associated with applying the ecosystem approach to fisheries management (EAFM) to coastal fisheries in the region. Essentially the ecosystem approach requires taking into consideration the effects of human actions on every element of an ecosystem, based on the recognition that they are all linked. Preston (2008b) states that few, if any, Pacific Island countries have enacted legislation or declared policies that commit them to implementation of EAFM. Despite this, however, many countries have implemented fisheries management measures that are consistent with EAFM, and that are assisting in its implementation in a de facto manner. Such measures include the promotion of community-based management or co-management arrangements, establishment of MPAs and marine managed areas, addressing specific non-fishery issues (such as waste disposal) that affect marine resources, and a range of technical measures intended to protect and conserve fish stocks. All the major regional organizations involved in fisheries, as well as several international agencies and a number of NGOs (non-government organizations), are encouraging adoption of EAFM and are able to provide support and assistance in its implementation.

The fisheries legislation of many countries in the region stipulates that management of significant commercial fisheries is to be done through fisheries management plans. Box 1.7 gives an example of a management plan.

BOX 1.7

Vanuatu Snapper Management Plan

The Vanuatu Fisheries Act No. 10 of 2014 states that upon designation of a fishery by the Minister responsible for Fisheries, the Director of the Vanuatu Fisheries Department will prepare, and review where necessary, a plan for the management and development of each designated fishery. The deep-bottom fish fishery is a designated fishery. The Plan sets out the formal policy guidelines in the form of strategies and measures for the sustainable development, management, and conservation of the deep-bottom fish fishery. The Plan comprises ten sections and includes an introduction, fishery overview, legal and policy framework, issues and challenges faced by the fishery, current and previous management measures applied to the fishery, broad policy directions needed for the fishery, management measures and strategies, policy priority areas, monitoring and evaluation methods, and review and amendment procedures. A key element in the development process of the Plan is consultation. The Plan is a result of a nationwide consultation process that started in 2013. Consultations were conducted on various levels, including national and provincial government, communities and fishers. The Plan has been structured in accordance with the requirement of the Fisheries Act but reflects the views received during the consultation process. During the consultation process, several issues and challenges were identified as needing urgent policy attention. These include adequate exercise of control over the fishery, data collection and monitoring mechanisms, market access, quality control and institutional capacity. The measures and policy strategies outlined in this Plan are designed to address these particularly important issues.

Source: VFD (2016).

Recent regional coastal fisheries policy evolution in the Pacific Islands

In the last 10 years there have been several regional policy statements relevant to coastal fisheries. Govan (2017b) describes the most significant ones:

Pacific Islands Regional Coastal Fisheries Management Policy and Strategic Actions 2008–2013

Known as the Apia Policy, this was based on SPC's 2003 Strategic Plan, interviews, questionnaires completed by fisheries agencies, results from regional workshops held in Noumea in October–November 2007, and recommendations from stock assessments and policy and planning workshops held in 2007 and 2008. It focused on the development and management of coastal fisheries in support of food security, sustainable livelihoods and economic growth for current and future generations of Pacific people. The Apia Policy was endorsed by the Heads of Fisheries in February 2008 and by the fourth Ministerial Meeting of the South Pacific Forum Fisheries Committee.

Melanesian Spearhead Group Roadmap for Inshore Fisheries Management 2015–2024

In 2012, the Prime Minister of Fiji along with other leaders of the Melanesian Spearhead Group (MSG) recognised the precarious state of coastal fisheries and the massive potential impacts on food security, and called for a roadmap for inshore fisheries management. This led to a review process, which was supported by SPC, and to the development of the draft policy in 2013. The MSG Coastal Fisheries Roadmap 2015–2024 was subsequently endorsed in 2015, and has been explicitly used to guide the development of the Solomon Islands and Papua New Guinea national coastal fisheries policies (currently awaiting endorsement), as well as Fiji's coastal fisheries policy (currently under development).

The Noumea Strategy: A New Song for Coastal Fisheries – Pathways to Change

Was endorsed by fisheries ministers to replace the region's existing coastal fisheries policy (Apia Policy 2008–2013). The New Song drew inspiration from and is entirely compatible with the MSG Roadmap, with proposals made for other subregions to carry out their own roadmap exercises given the different situations prevailing in each. The New Song represents a significant step forward in regional attention to, and management of coastal fisheries.

Regional Roadmap for Sustainable Fisheries, 2015

In 2015, the fisheries sector was identified as a regional priority under the policy process of the Framework for Pacific Regionalism, which led to the development of a Regional Roadmap for Sustainable Fisheries that included targets and goals for coastal fisheries. The Regional Roadmap for Sustainable Fisheries was subsequently endorsed by the Pacific Islands Forum leaders, and is already influencing technical and donor programming. Many elements of the Regional Roadmap are aligned with the FAO's recently produced "Voluntary guidelines for securing sustainable small-scale fisheries in the context of food security and poverty eradication".

Some important issues relating to coastal fishery resources and their management

It could be argued that the major issue of concern with respect to coastal fishery resources in the Pacific Islands region is rapidly expanding populations coupled with coastal fisheries production that is not increasing proportionately. Table 1.10 lists historical estimates of coastal fisheries production and population for independent countries and territories combined. The data for the various periods is not strictly comparable (i.e. different methodologies and rigour associated with the estimates) and there are complicating factors (the large inland population in Papua New Guinea; freshwater fisheries production), but the basic concept is valid: a slowly rising amount of food from coastal fishing is being spread among a rapidly growing number of people. Because the Pacific Island region is so highly dependent on coastal fisheries for food, this is a major concern.

TABLE 1.10
Annual production from coastal fisheries

Source	Period	Coastal fisheries production (t)	Population of region	Per capita fish supply from coastal fisheries (kg/person)
van Pel (1961)	1960	31 420	3 150 000	10.0
Crossland and Grandperrin (1979)	Late 1970s	55 130	4 410 000	12.5
Dalzell <i>et al.</i> (1996)	Early 1990s	108 242	6 068 000	17.8
Gillett (2009a)	2007	154 722	9 315 395	16.6
Gillett (2016)	2014	163 936	10 776 937	15.2

The above discussion supports an issue that is raised in an important publication by the Pacific Community. SPC (2008b) states: “Coastal fisheries are ‘mature’ in fishery development terms, and the main focus with reef fisheries is on consolidation and protection of current benefit. If anything, the main prospects for economic and livelihood development from reef resources, over and above maintaining current levels of production, lie not in fisheries but in tourism and other non-extractive uses.”

Another major issue of concern involves fisheries governance. Although the capability of government fisheries agencies is critically important in assuring sustainability of coastal resources, many of these agencies are deficient in various areas. These areas include technical capability, productivity incentives, structure of the agency and responsiveness. Another factor is that the attention of the agencies is being increasingly consumed by matters relating to the management of the region’s tuna resources, with less attention being paid to coastal resources. In addition, there are problems with the priorities of many government fisheries agencies: in several countries the fishery policies, fisheries department activities and staff experience appear to be “stuck in the 1960s”. There needs to be a transition from government-led development of what are often non-existent opportunities in coastal fisheries to the concept that fisheries departments, their officers, and communities are the guardians of marine resources.

Birkeland (1997) points out an important issue, namely that the rapid economic growth of Asian nations, especially mainland China, is putting a new type of pressure on marine resources. In normal circumstances, economics compels fishers to switch gear or locations before the resource population nears local extinction. However, the high dollar value placed on many coral reef resources by Asian economies can encourage effort even after the targeted species is too rare to sustain a viable reproductive population. The rapid increase in the dollar value of reef resources can override management policies, traditional practices and the law.

Ineffective coastal fisheries management is a real tragedy as it is these fisheries that currently provide Pacific Islanders with most of the nutrition and employment from the fisheries sector. Governments need to establish policies on the principle that the protection of fisheries resources to allow the continuing flow of marine foods to coastal communities is of paramount importance. In addition, there should be recognition by agencies involved in the management of coastal fisheries that the alternatives (e.g. reef re-seeding, promotion of alternate livelihoods) to the hard task of restricting fishing effort are often ineffective distractions to the real task of protecting resources and the associated flow of benefits to coastal communities.

Other types of action are also required to improve the management of coastal fisheries:

- Support should be given to community-based management of coastal fisheries resources, with the qualifications that (a) this should not consist of a government fisheries agency divesting all its responsibilities to an NGO or the communities themselves, and (b) there are limitations to community-based management.

- Incentives should be provided so that the best-qualified staff of government fisheries agencies are not enticed disproportionately to the tuna fisheries.
- Cost-effective mechanisms for periodically ascertaining major trends in coastal fisheries should be developed.
- Some priority should be given to preventing the massive dissipation of benefits presently occurring in the sea cucumber fisheries. The documentation on sea cucumber in the region makes many useful suggestions at the technical level, but considering the decades of fisheries officers unsuccessfully wrestling with ways to improve the situation, efforts should be made to capture attention at the political level – as was done for the tuna fisheries in the 1980s.
- The international export of fisheries resources from the relatively fragile inshore areas is often not sustainable – and the pressure to export will grow in the future to the detriment of local fish food supplies. In many cases, exports of inshore food fish benefit few, while the negative effects are felt by many, including those in the tourism industry. The bold measure (which can be relatively easily enforced at the point of export) of banning the international export of food fish from inshore areas should at least be considered.
- Climate change will cause rising sea surface temperatures and more acidic oceans. These are projected to have increasingly severe impacts on the growth of hard corals, including mass “coral bleaching” (Box 1.8). According to SPC (2014), continued greenhouse gas (GHG) emissions at current rates are expected to cause rises in sea surface temperature, alterations in major ocean currents, reductions in the availability of nutrients underpinning the ocean’s ecosystems and expansion of subsurface waters poor in oxygen. Carbon dioxide emissions, which make up 70 percent of GHGs, are acidifying the ocean. Preliminary modelling indicates that the projected changes to the tropical Pacific Ocean are likely to redistribute the abundant skipjack tuna to the central-eastern Pacific.

BOX 1.8

What is coral bleaching?

Coral bleaching is a descriptive term applied to the influence of higher sea temperatures on a variety of coral reef organisms, which include sea anemones and giant clams as well as corals. What they all have in common is the internal presence of symbiotic algae, the zooxanthellae. Prolonged, unusually high sea temperatures cause physiological problems and the algae are expelled from the host organisms. The resulting appearance of coral or other organisms is a lightening or whiteness, though the inherent coloration of the animal host may dominate, commonly as purple, blue or yellow. During late February through to early March 2000, mass bleaching occurred in Fiji after a prolonged period of temperatures in excess of 30°C. This coincided with similar coral bleaching being reported across the South Pacific from Papua New Guinea to Easter Island. Other Pacific Island countries such as Kiribati, Tuvalu and Samoa experienced no coral bleaching during that year. A major bleaching occurred subsequently in Fiji in 2002 and mainly affected the north sides of the two main islands, which had escaped the 2000 bleaching; 2003–2005 were years where the incidence of bleaching was low in Fiji. Kiribati has suffered severe bleaching, in 2003 in the Phoenix Islands and in 2005 in the Gilbert Group. Limited bleaching occurred in Fiji in 2006 and in 2009.

Source: Lovell (2009).

The quality of coral reefs as fish habitats will be degraded by ocean acidification and more frequent coral bleaching due to increased sea surface temperature. Even under good management, coral cover is expected to decline from 40 percent to 15–30 percent by 2035 and 10–20 percent by 2050, leading to greater seaweed cover on reefs. The changes to the ocean and to coral reefs are expected to reduce catches of reef fish by 20 percent by 2050. Regional policies seem clear that the first appropriate response to building climate resilience is the establishment of sustainable resource management systems that will provide the basis for adaptation (Govan, 2017a).

The number of NGOs involved in aspects of managing coastal marine resources in the region has grown substantially in recent years. In addition to local organizations, a number of international NGOs have commenced programmes that involve coastal marine resources, including the World Wide Fund for Nature, Greenpeace, the Nature Conservancy, the Wildlife Conservation Society, Conservation International, Foundation of the Peoples of the South Pacific, and several smaller groups. The increased attention, awareness, and education activities that these organizations bring are certainly positive. In some situations there is, however, an issue over how the roles of these NGOs relate to the functions of the government fisheries agency. NGOs are known to have taken over some of the roles of fishery departments. One view is that an important niche for NGO involvement in fisheries in the Pacific is to alert national governments to developments that represent new or growing threats to coastal resources, and take some initial action that may catalyze more comprehensive action on the part of government fisheries agencies. In any case, there is a real need for better coordination of the activities of NGOs and government fisheries agencies.

1.8 OFFSHORE FISHERY RESOURCES

Sources of information on offshore fishery resources

A substantial amount of information is readily available on the offshore fishery resources of the Pacific Islands, on both regional and national levels. The most important source is, without doubt, SPC's Oceanic Fisheries Programme (OFP). A knowledge of the role of OFP is essential for understanding the offshore resources of the region and the associated research (Box 1.9).

The main documents of OFP that have proved especially useful for understanding the offshore resources are:

- **tuna fisheries assessment reports** – These reports provide the most recent information on the tuna fisheries of the western and central Pacific Ocean and the fish stocks (mainly tuna) that are impacted by them. The information provides a summary, but a list of references (mostly accessible online) is included for those seeking further details. The reports in this series focus on the main tuna stocks targeted by the fisheries: skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), bigeye tuna (*T. obesus*) and South Pacific albacore tuna (*T. alalunga*). The first section of the report provides an overview of the fishery, with emphasis on developments over the past few years; the second summarizes the most recent information on the status of the stocks; and the third summarizes information concerning the interaction between the tuna fisheries and other associated and dependent species. The latest report (Tuna fisheries assessment report No. 16) was released in December 2016 (available at: <http://www.spc.int/oceanfish/en/ofpsection/sam/462-tuna-fisheries-assessment-report-no-16>).
- **WCPFC Tuna fishery yearbook** – This series is prepared by OFP for the Western and Central Pacific Fisheries Commission (WCPFC). The documents present annual catch estimates in the WCPFC statistical area starting from 1950. The

BOX 1.9

SPC's Oceanic Fisheries Programme (OFP)

The Oceanic Fisheries Programme is part of the Fisheries, Aquaculture and Marine Ecosystems (FAME) Division of SPC. OFP, formerly known as the Tuna and Billfish Assessment Programme, was established in 1980 by SPC's governing body, the South Pacific Conference, to continue the work initiated by its predecessor project, the Skipjack Survey and Assessment Programme. OFP provides scientific services relating to oceanic (primarily tuna) fisheries management to its membership. The most important programme outputs are information (e.g. reports on the status of fisheries, stocks and ecosystems), infrastructure (e.g. databases, monitoring programmes), advice (e.g. regarding appropriate levels of fishing), and national capacity building in SPC members. OFP has three main objectives as outlined in the FAME Strategic Plan:

- High-quality scientific information and advice for regional and national fisheries management authorities on the status of, and fishery impacts on, stocks targeted or otherwise impacted by regional oceanic fisheries.
- Accurate and comprehensive scientific data for regional and national fisheries management authorities on fisheries targeting the region's resources of tuna, billfish and other oceanic species.
- Improved understanding of pelagic ecosystems in the western and central Pacific Ocean.

These objectives are pursued through a diverse work programme across four sections: stock assessment and modelling, oceanic fisheries data management, oceanic fisheries monitoring, and ecosystem monitoring and assessment.

Source: <http://www.spc.int/OceanFish/en/about-ofp/the-oceanic-fisheries-programme>

tables of catch statistics cover the main commercial tuna and billfish species caught in the region.

- **series of OFP research publications** – These cover a wide variety of topics related to the tuna resources of the region, including impacts of tuna fishing, predicting tuna distribution, effects of environment on tuna distribution, impacts of El Niño, tuna mortality, population modelling, exploitation/movement of tuna, and the pelagic ecosystem of the region.
- **papers prepared by OFP for the WCPFC Scientific Committee** – Examples from the 2017 meeting are: Overview of tuna fisheries in the western and central Pacific Ocean (Williams *et al.*, 2017), and Stock assessment of bigeye tuna in the western and central Pacific Ocean (McKechnie *et al.*, 2017).

A very large amount of documentation on the tuna resources of the region is presented by various agencies to meetings of the WCPFC, especially to the Scientific Committee. For the August 2017 Scientific Committee meeting, over 100 technical documents on national and regional aspects of tuna resources and their management were given, with categories including summary information; general papers; science-related documents from the previous commission meeting; papers on the themes of data and statistics, stock assessment, management issues, ecosystems and bycatch mitigation; national annual reports; research projects; and NGO papers (all available at: www.wcpfc.int/meeting-folders/scientific-committee).

FFA produces several, publicly available publications related to the offshore fisheries of the region. These include Trade and Industry News, Economic and Development Indicators and Statistics, and the Tuna Fishery Report Card (all available at: <http://www.ffa.int>).

Other agencies that have provided a substantial amount of useful information on the offshore resources of the region are the Western and Central Pacific Fisheries Commission, the Pelagic Fisheries Research Program of the University of Hawaii, the Pacific Islands Regional Office of the National Marine Fisheries Service, the Food and Agriculture Organization of the United Nations, the Asian Development Bank, Japan's National Research Institute of Far Seas Fisheries, and several NGOs.

IMPORTANT OFFSHORE RESOURCES

Although several species of scombrids are found in the Pacific Island area, four species of tuna are of major commercial importance: skipjack tuna, yellowfin tuna, bigeye tuna and albacore tuna. Table 1.11 gives information on these fish in the western and central Pacific Ocean (WCPO).

Another important target of offshore fishing is swordfish (*Xiphias gladius*), which is caught by relatively shallow longline gear, mainly in the subtropical parts of the WCPO.

TABLE 1.11
Tuna species of major commercial importance in the region

Tuna species	Typical size captured	Important aspects
Skipjack 	40 to 70 cm	Skipjack are caught mainly on the surface by purse-seine and pole/line gear and used for producing canned tuna. Most fish caught are from 1 to 3 years old. In the WCPO, the skipjack biomass is greater than that of the other three main tuna species combined.
Yellowfin 	40 to 70 cm and 90 to 160 cm	Small yellowfin are caught on the surface by purse-seine and pole/line gear, while larger/older fish are caught in deeper water using longline gear. Small fish are used mainly for canning, while high quality larger fish are often shipped fresh to overseas markets. Most fish caught are from 1 to 6 years old.
Bigeye 	40 to 70 cm and 90 to 160 cm	Small bigeye are caught on the surface by purse-seine and pole/line gear, while larger/older fish are caught in deeper water using longline gear. Small fish are used mainly for canning, while high-quality larger fish are especially valuable as fresh fish in the Japanese market. Most fish caught are from 1 to 10 years old. Bigeye tuna account for a relatively small proportion of the total tuna catch in the region, but these tuna are extremely valuable.
Albacore 	60 to 110 cm	Small albacore are caught by trolling at the surface in cool water outside the tropics, while larger fish are caught in deeper water and mainly at lower latitudes using longline gear. Most of the catch is used for producing "white meat" canned tuna. Fish caught are typically from 1.5 to 10 years old.

Source: Modified from Gillett and Bromhead (2008).

A few billfish species and some sharks are targeted by specific fisheries, but the usual situation is that they are bycatch in tuna longlining and, to a lesser extent, tuna purse seining. The common billfish are: black marlin (*Makaira indica*), blue marlin (*M. mazara*), sailfish (*Istiophorus*), shortbill spearfish (*Tetrapturus angustirostris*), and striped marlin (*T. audax*). The most common shark caught is the blue shark (*Prionace glauca*), but the ones that are occasionally subjected to targeting (or are valuable enough to retain) are the oceanic white tip (*Carcharhinus longimanus*), silky shark (*C. falciformis*), short-finned mako (*Isurus oxyrinchus*), and three species of thresher shark (*Alopias* spp.).

1.9 IMPORTANT TYPES OF OFFSHORE FISHING

Historical perspective

Fishing for tuna has been important in Pacific Island countries for centuries. Tuna fishing lore forms a significant part of the cultural heritage of the region. The classic "Notes on the offshore fishing of the Society Islands" (Nordoff, 1930) describes several of the traditional tuna fishing techniques and states: "An accomplished fly-fisherman in Europe or America does not carry in his head one-half the store of practical knowledge a traditional skipjack fisherman uses every day". Today most tuna caught by small-scale fishing in the region are taken by trolling from small outboard-powered craft.

The history of industrial tuna fishing in the region is closely related to Japan's economic development activities in the area. After World War I, Japan was awarded control of much of Micronesia by a League of Nations mandate. Japan subsequently directed substantial effort to developing the fishing industry of its newly acquired territories. Three commercial tuna pole-and-line fishing operations were established in the late 1920s. By the mid-1930s, Japanese tuna fishing was well-developed in the area with 45 pole-and-line vessels based in Palau, 52 in the Federated States of Micronesia, and 19 in the Northern Mariana Islands. Tuna catches in Micronesia reached their highest level of 33 000 tonnes in 1937. All commercial tuna fishing in the area came to a halt during World War II.

Tuna fishing activity in Micronesia was remarkably different post World War II. Much of the fishery infrastructure and tuna vessels were destroyed by war activity. As part of the terms of war surrender, geographic restrictions, known as MacArthur Lines, were placed on the movements of Japanese vessels, which effectively prevented their tuna fishing in Micronesia. These lines were relaxed four times and finally the last line was lifted in April 1952. The Japanese then became active in establishing tuna facilities in the Pacific Island area. Between the early 1950s and early 1960s, tuna longline bases were established in Pago Pago (American Samoa), Espiritu Santo Island (Vanuatu), Noumea (New Caledonia), Papeete (French Polynesia) and Levuka (Fiji). At the same time, the Japan-based pole-and-line vessels continued to expand their range, with fishing operations eventually reaching even the southern parts of the Pacific Island area, with 300 pole-and-line vessels participating seasonally in the fishery.

A remarkable change occurred when purse-seine tuna gear was adapted for use in the region. Box 1.10 gives an account of that process.

BOX 1.10

Development of tuna purse seining in the Pacific Islands

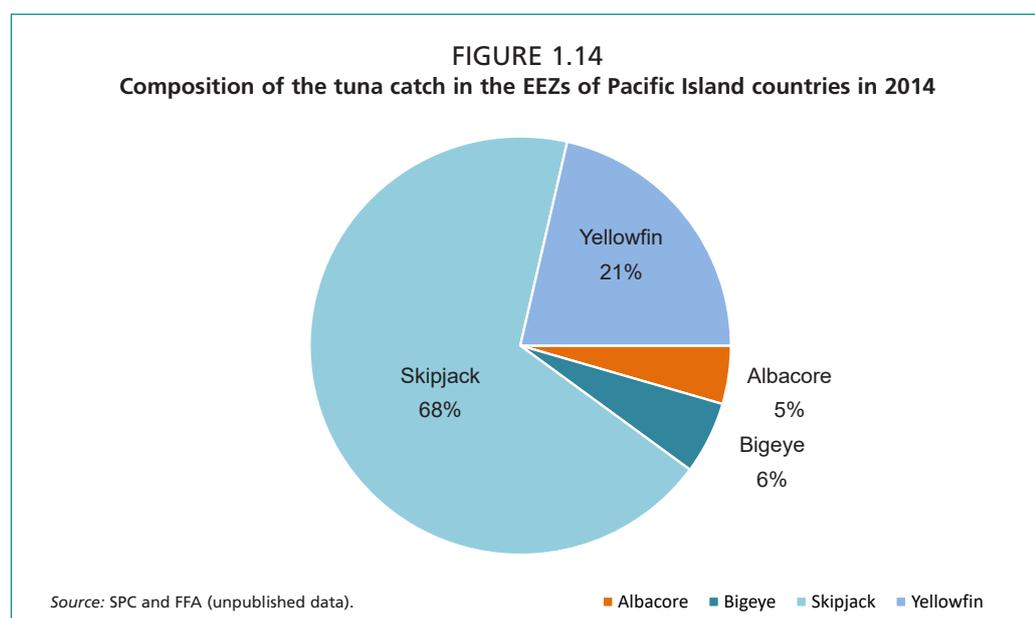
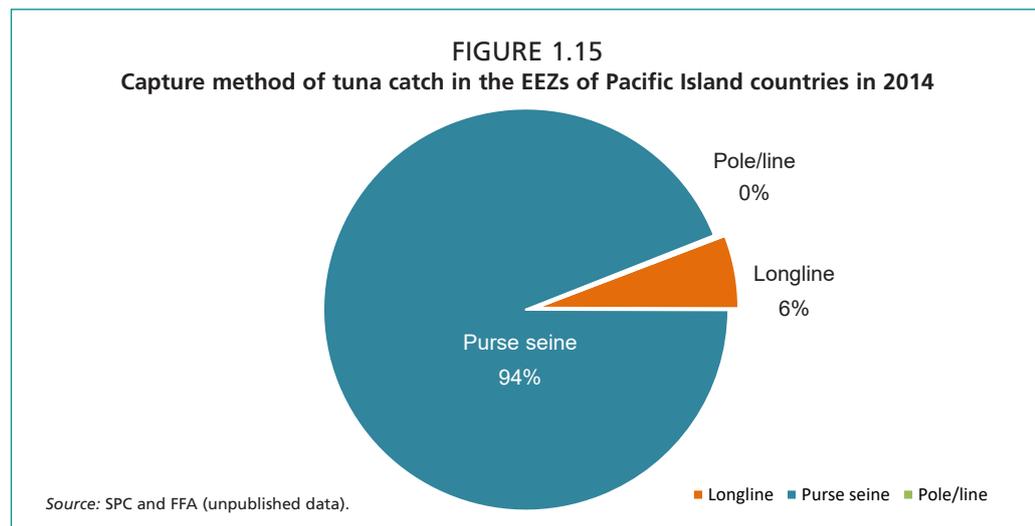
Primarily due to expanding Japanese tuna catches in the 1950s, the California-based pole-and-line fishery (almost 300 vessels) experienced severe financial difficulties. The fleet survived largely through technical innovations that led to the feasibility of using purse-seine gear for capturing tuna in relatively cool water. In the subsequent years, nearly 100 California bait boats were converted to purse seiners and new tuna purse seiners were constructed. The technique later was taken up by Japanese tuna fishermen for use in temperate waters off Japan. By the late 1960s, between 60 and 70 small Japanese tuna purse-seine vessels were fishing seasonally. Tuna purse seining in tropical waters was another matter. The characteristically clear water and deep thermocline in the equatorial Pacific create conditions unfavorable for purse seining – the tuna schools tended to be smaller, faster-moving, and dive deeper than in the eastern Pacific or off Japan. The Governments of Japan and subsequently of the United States sponsored many experimental purse-seining expeditions to the equatorial Pacific area.

The Japanese persisted and were the first to have success. The main innovation was the pre-dawn setting of deep nets around logs in the area between Micronesia and Papua New Guinea. By the late 1970s there were several fully commercial Japanese and American purse-seine operations in the western equatorial area of the Pacific Islands. The number of purse-seine vessels operating in the Pacific Islands increased rapidly in the early 1980s. The purse-seine fleet flagged to the United States of America moved in quickly from the eastern Pacific due to the very strong El Niño event of 1982–1983 and pressure to reduce dolphin mortality in their traditional fishing grounds. In mid-2016 about 250 tuna purse seiners flagged in 19 countries operated in the Pacific Islands region.

Source: Gillett (2007) and FFA website.

Current situation in the Pacific Island area

In 2014, about 1.8 million tonnes of tuna were caught in the EEZs of the 14 independent Pacific Island countries. Figure 1.14 gives the breakdown by species, and Figure 1.15 by capture method.

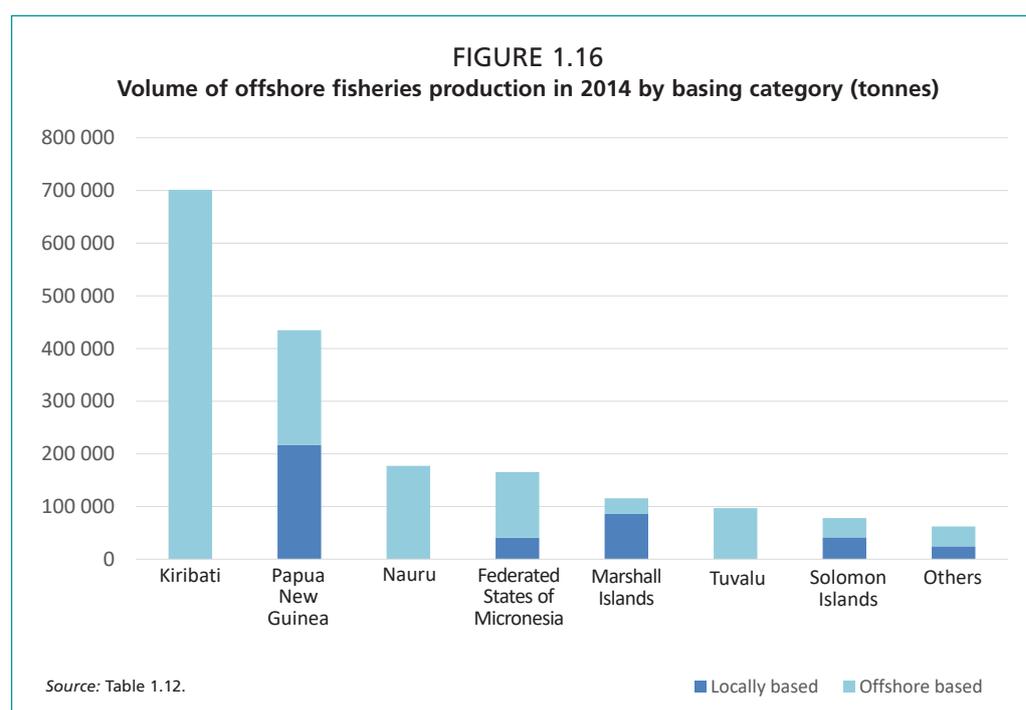


The above catches are made by both tuna vessels based in Pacific Island countries and those based outside the region. Table 1.12 partitions the offshore catch by country and by basing category. This is shown graphically in Figure 1.16. It can be seen that almost 78 percent of the offshore catch in the EEZs of Pacific Island countries is made by vessels based outside the region. Vessels in Papua New Guinea are responsible for about half of the catch made by locally based vessels.

TABLE 1.12
Volume of offshore fisheries production, 2014 (tonnes)

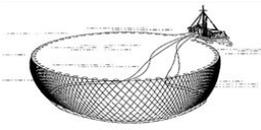
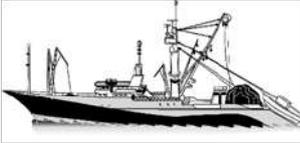
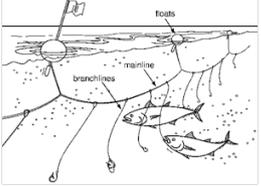
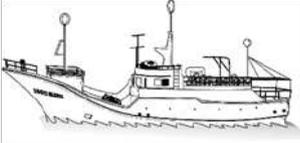
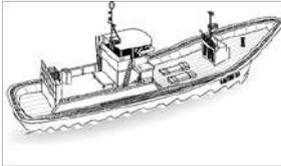
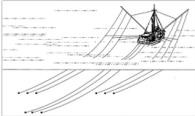
	Offshore locally based	Offshore foreign-based	Total
Kiribati	510	701 067	701 577
Papua New Guinea	216 896	217 871	434 767
Nauru	0	177 315	177 315
The Federated States of Micronesia	40 838	124 481	165 319
The Marshall Islands	85 918	29 754	115 672
Solomon Islands	41 523	36 573	78 096
Tuvalu	0	96 898	96 898
Fiji	17 079	0	17 079
Cook Islands	194	20 342	20 536
Vanuatu	568	10 942	11 510
Samoa	1 254	0	1 254
Tonga	1 363	1 891	3 254
Palau	3 987	4 017	8 004
Niue	0	547	547
Total	410 130	1 421 698	1 831 828

Source: Table 1.3.



Tuna production in 2014 was somewhat atypical. It was affected by the El Niño, which tends to displace the purse seine fishery to the east – hence the relatively large offshore catches in Kiribati that year. Figure 1.17 gives the attributes of the main types of offshore fishing in the region.

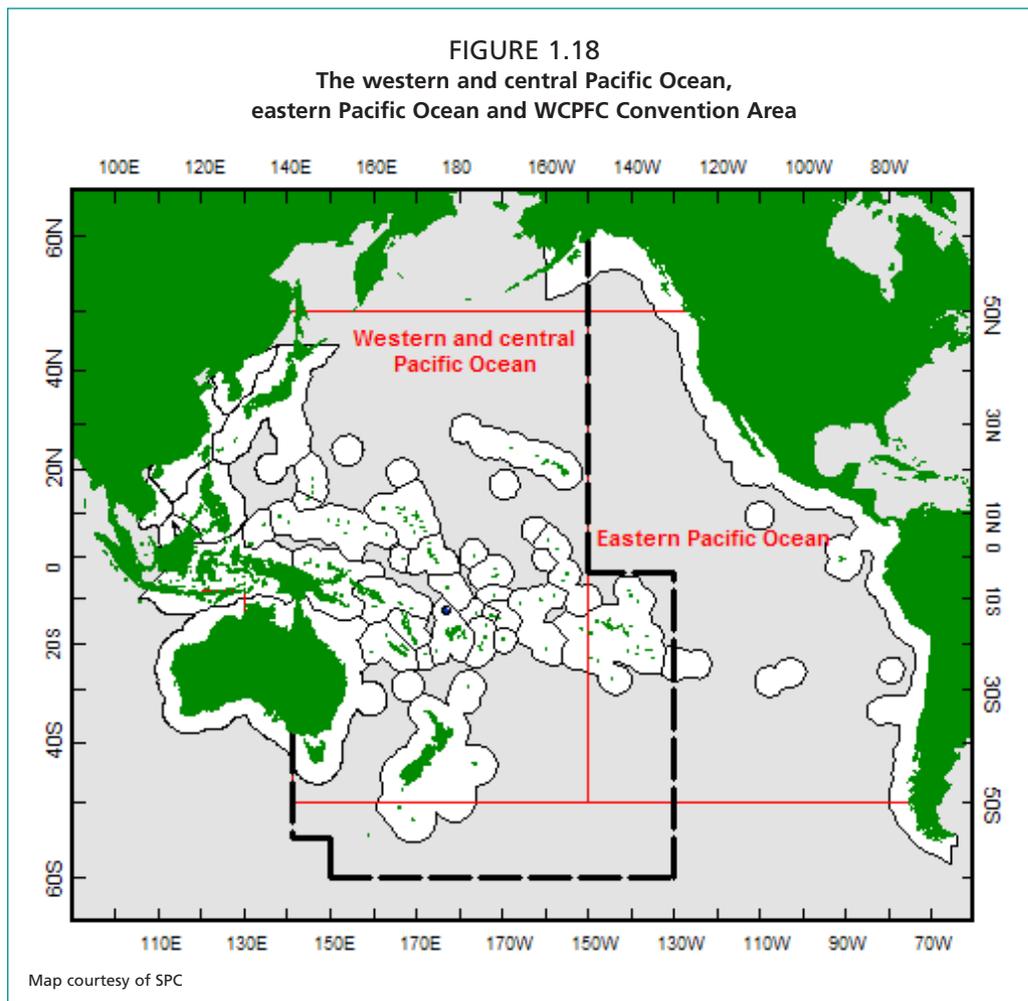
FIGURE 1.17
Major types of fishing gear

Gear type	Catch	Typical vessel	Notes
<p>Purse seine</p> 	<p>Mainly skipjack and small yellowfin are caught by purse-seine gear. Most catch is for canning.</p>		<p>About 94% of the tuna catch in the WCPo region was made by purse-seine gear in 2014. Most of the purse-seine catch is taken within 5° of the equator.</p>
<p>Longline</p> 	<p>Most tuna caught are large size yellowfin, bigeye, and albacore. The prime yellowfin and bigeye often are exported fresh to overseas markets. Most of the albacore is for canning.</p>		<p>About 6% of the tuna catch in the region is by longline gear. There are two major types of longliners: (1) relatively large vessels with mechanical freezing equipment (often based outside the Pacific Islands), and (2) smaller vessels that mostly use ice to preserve fish and are typically based at a port in the Pacific Islands.</p>
<p>Pole-and-line</p> 	<p>Mainly skipjack and small yellowfin are caught by pole-and-line gear. Most catch is for canning or producing a dried product.</p>		<p>Less than 1% of the tuna catch in the region is by pole-and-line gear. In the 1980s, several Pacific Island countries had fleets of these vessels, but most no longer operate because of competition with the more productive purse-seine gear.</p>
<p>Trolling</p> 	<p>Large-scale trolling targets albacore for canning.</p>		<p>Large-scale trolling is carried out in the cool water to the south and north of the Pacific Island region.</p>

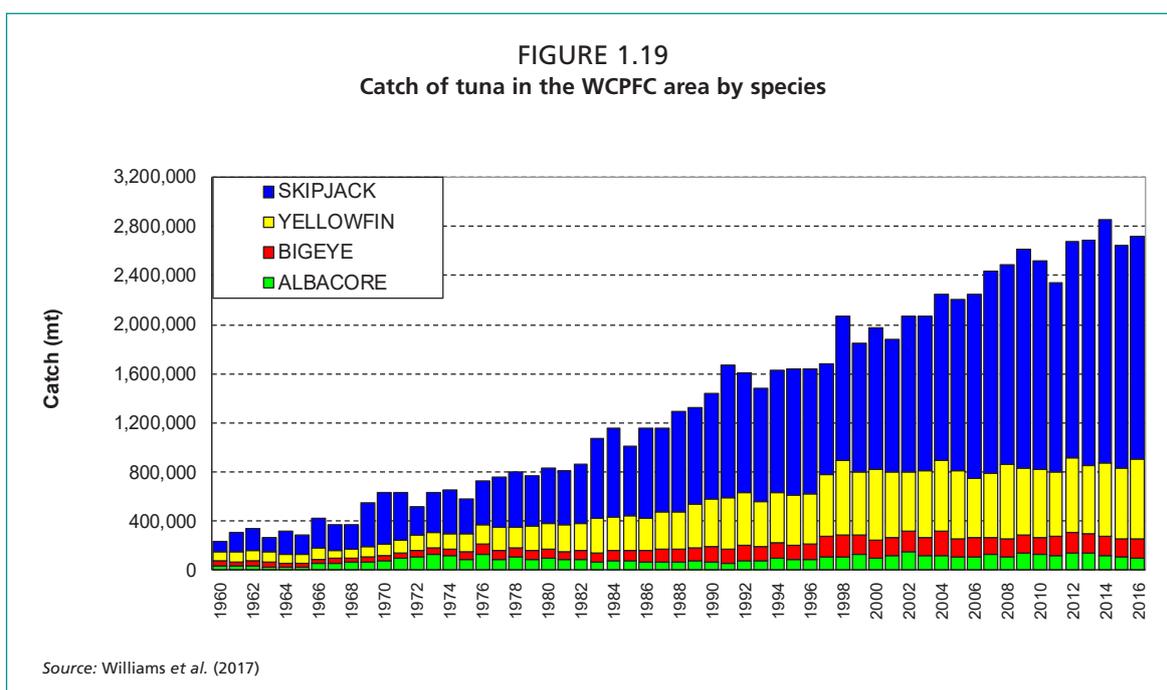
Source: Gillett and Bromhead (2008).

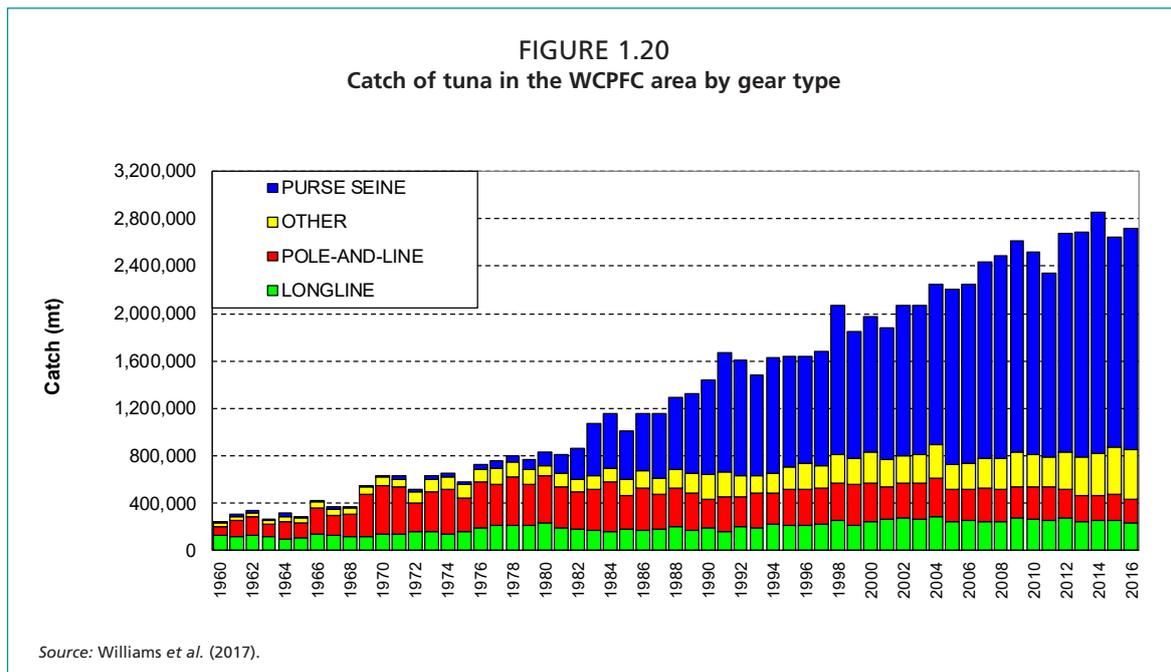
WCPFC area catches

The above catch information is for the independent Pacific Island countries and their EEZs, which are a subset of the area covered by the WCPFC (Figure 1.18). The WCPFC area includes temperate waters to the north and south of Pacific Island countries as well as parts of the waters of some Asian countries. The tuna resources and tuna fishing of the Pacific Islands (the subject of this paper) are somewhat different from those of the entire WCPFC area. For example, there is a huge tuna catch by small-scale gear in Indonesia, the catch of small tuna in the Philippines is substantial, and a very large number of small longliners operate from Taiwan Province of China. Nevertheless, the available regional tuna catch statistics (i.e. data aggregated at a level higher than that of an individual country) are now compiled/presented for the entire WCPFC area.



Information in Williams *et al.* (2017) can be graphed to show trends over the past three decades in catch by species (Figure 1.19) and by gear type (Figure 1.20).





From the above figures it can be seen that much of the expansion of the tuna catch in the WCPFC area is due to increased harvesting by purse-seine gear and increased harvesting of skipjack. Although bigeye catches have expanded much less than skipjack catches, they are a source of more concern due to the relatively small size of the bigeye resource in the region.

Williams *et al.* (2017) comment on the 2016 tuna catches in the WCPFC area:

- The 2016 catch of skipjack (1 816 650 tonnes; 67 percent of the total catch) was the fourth highest recorded, nearly 160 000 tonnes less than the record in 2014 (1 977 019 tonnes).
- The yellowfin catch for 2016 (650 491 tonnes; 24 percent) was the highest recorded (more than 40 000 tonnes higher than the previous record catch of 2008; 609 458 tonnes); the increase in yellowfin tuna catch from 2015 levels was mainly due to increased catches in the purse-seine fishery and the Indonesia and Philippines domestic fisheries.
- The bigeye catch for 2016 (152 806 tonnes; 6 percent) was an increase on the 2015 catch and around average for the past 10 years.
- The 2016 WCP-CA albacore catch (97 822 tonnes; 4 percent) was the lowest since 1996 and around 50 000 tonnes lower than the record catch in 2002 at 147 793 tonnes.

Some benefits from offshore fishing in the Pacific Islands area

In the Pacific Islands, the coastal fisheries resources produce a significant amount of food and employment for the residents of the region. The offshore resources produce somewhat different types of benefits.

All Pacific Island countries received fees for foreign tuna fishing activity in their waters in 2014. An SPC study (Gillett, 2016) estimated that the total access fee payments for the independent countries of the region for 2014 were about USD 340 285 572. Table 1.13 shows these fees by country and makes some comparisons to other national attributes.

One of the columns in the table above – “2014 access fees as a percentage of the value of foreign-based offshore fishing” – requires further explanation. The column is a crude attempt to learn what fraction of the value of fish harvest by foreign fishers is received by countries through access fees. A difficulty occurs because in some countries there are fee-paying, foreign, locally based fleets that inflate the percentages in the column

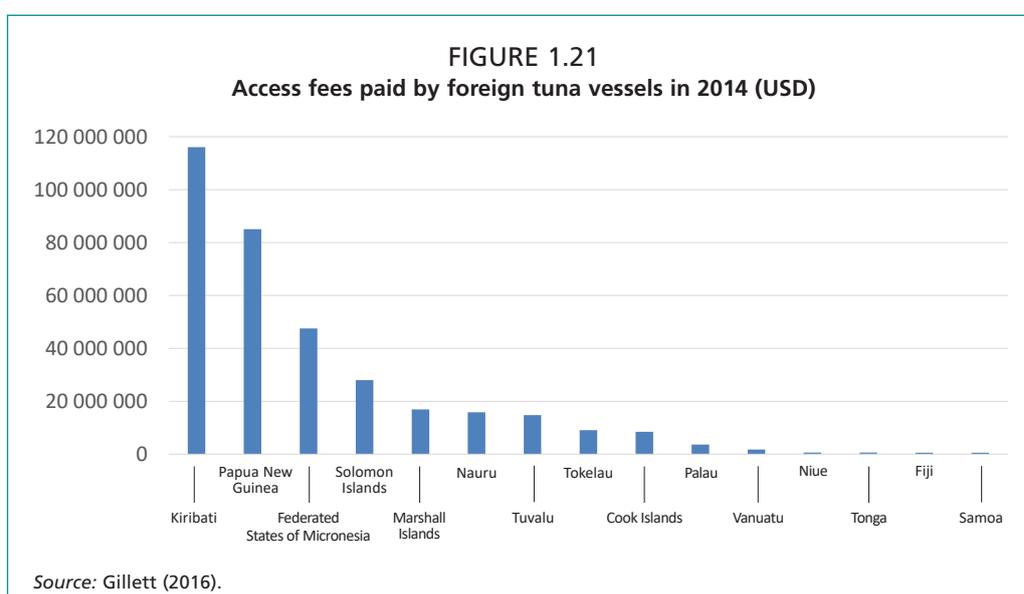
TABLE 1.13
Access fees for 2014 and some comparisons with country settings

	2014 access fees (USD)	2014 access fees as % of value of foreign-based offshore fishing	2014 access fees per resident (USD)	2014 access fees per km ² of 200-mile zone (USD)	Other information
Cook Islands	8 437 500	14.8%	554	4.61	
The Federated States of Micronesia	47 518 000	20.8%	462	15.96	
Fiji	555 815	Large	1	0.43	No foreign fishing in zone, but payments under the US tuna treaty.*
Kiribati	116 040 984	10.4%	1 044	32.69	
The Marshall Islands	16 920 802	43.7%	310	7.94	Access fees as a % of foreign-based offshore fishing distorted by fee-paying locally based foreign fleet
Nauru	15 852 459	6.9%	1 487	49.54	
Niue	635 815	41.8%	424	1.63	Access fees as a % of foreign-based offshore fishing distorted by US treaty payments for no fishing.
Palau	3 620 586	19.5%	203	5.76	
Papua New Guinea	85 019 455	27.3%	11	27.25	
Samoa	555 814	Large	3	4.63	No foreign fishing in zone
Solomon Islands	27 963 558	35.3%	45	20.87	
Tonga	627 858	12.4%	6	0.90	
Tuvalu	14 777 814	11.2%	1 331	16.42	
Vanuatu	1 759 112	6.7%	6	2.59	
TOTAL	340 285 572	15.4%	32	11.43	

* Multilateral Treaty on Fisheries between Certain Governments of the Pacific Island States and the Government of the United States of America (commonly referred to as the US Treaty)
Source: Gillett (2016).

(e.g. for the Marshall Islands). Another difficulty is that when there are payments for fishing that does not take place (e.g. under the US tuna treaty), a very large percentage is created. This feature dominates the results for Fiji and Samoa and has a large effect for Niue. The information in that column should therefore be used cautiously.

The information on access fees in the above table is graphed in Figure 1.21.



Access fee information was collected in a similar way by an Asian Development Bank study covering the year 2007. Converting the 2007 access fee payments of that study to 2014 dollars allows a comparison in real terms over the seven-year period (Table 1.14).

TABLE 1.14
Changes in access fees 2007–2014

	2007 access fees (in 2007 USD)	2007 access fees (in 2014 USD)	2014 access fees (in 2014 USD)	Percent change 2007–2014
Access fee payments for all independent countries of the region	78 528 093	92 113 452	340 285 572	270%

Source: Gillett (2016).

It may seem that there was a large change in access fees between 2007 and 2014. It is no coincidence that the implementation of the PNA Vessel Day Scheme (VDS) described below (Box 1.13) began and was completed between those two dates. Officially, the VDS took effect from December 2007, but it was not fully implemented until 2012.

Offshore fishing vessels employ substantial numbers of Pacific Islanders, with onshore tuna processing employing even more. Studies by FFA (Terawasi and Reid, 2017a; 2017b) estimated that in 2015, about 800 citizens of Pacific Island countries were employed on the 269 longliners, 56 purse seiners, and 2 pole-and-line vessels based in the region. Total employment related to tuna fisheries in FFA member countries for 2015 was estimated at 23 000, a slight increase on 2014. Growth in local crew numbers and the onshore processing sector has driven a trend of increasing employment levels. Between 70 and 90 percent of the tuna processing workforce are female workers. Tuna processing accounts for more than 50 percent of total tuna-related employment. Of the 10 500 employed in the processing sector in the region, Papua New Guinea accounts for 60 percent, Fiji 18 percent and the Solomon Islands 13 percent.

Status of the exploited offshore resources

SPC's Oceanic Fisheries Programme (OFP) periodically assesses the condition of the four main species of tuna in the region. These assessments utilize all available information from the fishery, including catch effort and size composition data for the main fisheries, as well as tagging data where available. The results of the SPC stock assessments are presented in various documents and discussed/debated at the annual meeting of the Scientific Committee of the WCPFC where conclusions are reached. WCPFC (2017) summarizes the conclusions on the assessments and gives the management advice of the 2017 Scientific Committee (in italics below):

Bigeye

A 2017 stock assessment indicated that the WCPO bigeye spawning biomass is likely above the biomass limit reference point (LRP) and fishing mortality is less than the level corresponding to the maximum sustainable yield (MSY). Considering the level of uncertainties in the current assessment, it appears that the stock is not experiencing overfishing (77 percent probability) and it appears that the stock is not in an overfished condition (84 percent probability). This is a remarkable change from the previous bigeye assessments.² The positive changes for bigeye tuna stock status in the 2017 assessment are primarily due to three factors: the inclusion of the new growth curve information, the inclusion of the new regional assessment structure, and the estimated

² An article in the SPC Fisheries Newsletter (No. 153) gives additional details of the new bigeye assessment, which is much more optimistic than in the past (available at: <http://www.spc.int/coastfish/en/component/content/article/479-spc-fisheries-newsletter-153.html>).

increases in recruitment in recent years. *The Scientific Committee recommended as a precautionary approach that the fishing mortality on bigeye tuna stock should not be increased from the current level to maintain current or increased spawning biomass until the WCPFC can agree on an appropriate target reference point.*

Yellowfin

A 2017 assessment indicated that the spawning biomass is highly likely above the biomass limit reference point and recent fishing mortality is highly likely below the mortality at maximum sustainable yield. Considering the level of uncertainties in the current assessment, it appears that the stock is not experiencing overfishing (96 percent probability) and it appears that the stock is not in an overfished condition (92 percent probability). *The Scientific Committee reiterates its previous advice from 2010 that WCPFC could consider measures to reduce fishing mortality from fisheries that take juveniles, with the goal to increase to maximum fishery yields and reduce any further impacts on the spawning potential for this stock in the tropical regions.*

Skipjack

The 2017 Scientific Committee noted that no stock assessment was conducted for WCPO skipjack tuna in 2017 and therefore the stock status description from the 2016 Scientific Committee is still current and the management advice remains unchanged. In that year, the Committee stated that the fishing mortality still remains below the level that would result in the MSY and that the skipjack assessment continues to show that the stock is currently moderately exploited and the fishing mortality level is sustainable. *2016 Scientific Committee noted that skipjack spawning biomass is now around the adopted target reference point (TRP). The Committee recommends that the WCPFC take action to keep the spawning biomass near the TRP and also advocates for the adoption of harvest control rules based on the information provided.*

South Pacific albacore

The most recent assessment of albacore was in 2015. In that assessment, based on the range of MSY estimates (range: 62 260–129 814 tonnes), the catch then was likely at or slightly less than the MSY. Although fishing mortality has generally been increasing through time, it is now estimated to be 0.39 times the fishing mortality that will support the MSY, indicating that overfishing is not occurring. *While overfishing is not occurring, further increases in effort will yield little or no increase in long-term catches and result in further reduced catch rates. Despite the fact that the stock is not overfished and overfishing is not occurring, the 2015 Scientific Committee reiterates the advice of the Committee from the previous year and recommends that longline fishing mortality and longline catch be reduced to avoid further decline in the vulnerable biomass so that economically viable catch rates can be maintained.*

1.10 MANAGEMENT OF OFFSHORE FISHERY RESOURCES

The management of the offshore fishery resources in the Pacific Island area is complex and involves political, resource and historical considerations. Current management occurs on national, regional and international levels.

National-level management

A general feature of national-level tuna management in the region is the use of tuna management plans (TMPs). In 1998, the Canada-South Pacific Oceans Development Programme cooperated with FFA to produce a detailed TMP for the Solomon Islands. FFA/Canada have subsequently prepared plans, on country request, for Palau, Vanuatu, Fiji and Kiribati. The Asian Development Bank and Australia have also assisted in the formulation of TMPs for the Federated States of Micronesia and Samoa

respectively. FFA has continued with this process using its own staff, and has prepared or updated TMPs for Tonga, Marshall Islands, Niue, Tokelau and the Federated States of Micronesia. Recently New Zealand has provided fisheries assistance that includes support for TMPs in the Cook Islands and Solomon Islands. Currently, all Pacific Island countries have prepared national TMPs, and most have been formally adopted.

Characteristically, TMPs give a description of the current national tuna fisheries, the status of the tuna resources (mostly from the work of SPC's OFP), overall government goals in the fisheries sector, specific objectives for the management of the fishery, and the interventions used to obtain the objectives. Tuna resource sustainability is often given as the priority objective in TMPs. Other objectives are related to increasing employment, increasing access fees, and creating and/or enhancing domestic tuna fisheries.

As an example of a TMP, Box 1.11 gives the key elements of the "Plan for the Management of Tuna in the Federated States of Micronesia".

BOX 1.11

The Federated States of Micronesia Tuna Management Plan

The Federated States of Micronesia Tuna Management Plan indicates that the guiding principles for management interventions are:

- The tuna resource is shared with other countries in the region and is finite.
- The precautionary approach to fisheries management is most appropriate.
- Management measures will promote the objective of optimum utilization.
- Effective management requires participation in, and compliance with, regional and international measures.
- Surveillance and enforcement are important tools of management.
- Surveillance of state waters is important to resource management and should be supported.
- Tuna stock assessment is not exact and there may be differing scientific opinions on the status of resources.
- Special attention should be given to bigeye resources.
- Principles guiding tuna fisheries management are generally applicable to non-target species affected by tuna fishing.

The Federated States of Micronesia's National Oceanic Resource Management Authority (NORMA) is to address several common themes *using these interventions*:

Determine allowable level of fishing and impose access fees: *Ensuring that the tuna catch does not exceed sustainable levels (catch limits) and that fishing effort (effort and capacity limits) are strictly controlled and managed; Developing/ adopting catch and effort controls by fishing gear and target species (incl. dependent spp.) under rights-based management regime for purse-seine and longline fisheries; Obtaining national revenue from foreign vessel access agreements and related partnership arrangements equitable to catch values in the Federated States of Micronesia EEZ;*

Promote economic benefits from fisheries development: *Supporting development of the Federated States of Micronesia-owned and/or foreign the Federated States of Micronesia-based fishing enterprises; Encouraging foreign and national investment in tuna fisheries related enterprises; Developing and implementing an investment strategy thereby creating an attractive environment for potential investors; Promoting and expanding employment opportunities in tuna fisheries;*

Obtain economic benefits deriving from outside the fishery: *Enhancing fisheries relationships that are beneficial to the Federated States of Micronesia; Fostering support for robust and coherent policies that underpin fisheries; Establishing linkages, transformational changes and networking with other key sectors including due consideration of climate change threats in tuna fisheries.*

Source: NORMA & FFA (2015).

Experience gained in studying the formulation and implementation of tuna management plans in the region indicates that TMPs have had their successes and disappointments (Gillett, 2009b). Although the process has not always been smooth, there have been substantial benefits. The first experience of some countries in formally establishing fisheries policies and articulating management goals has been during the process of formulating these plans. The plans have brought a degree of transparency to the fisheries management process, which was somewhat nebulous in several countries. The stable/reliable set of policy measures promoted by the plans are crucially important for attracting domestic and foreign investors into the fisheries sector. In some countries, the first government/industry consultative mechanisms in the fisheries sector are those established by the plans. The tuna planning process has resulted in a movement in some countries to develop management plans for inshore fisheries.

Regional-level management

There are a number of regional tuna fishery management arrangements in the Pacific Islands. They are promoted and coordinated by FFA and/or PNA. The first measures, introduced in the 1980s and early 1990s, were as follows:

- In licensing foreign fishing vessels, countries agreed to insist on the Harmonized Minimum Terms and Conditions for Foreign Fishing Vessel Access (described in Box 1.12). These have been progressively added to over the years and now encompass several types of measures, such as the use of vessel monitoring systems.

BOX 1.12

Minimum terms and conditions for foreign fishing vessel access

Pacific Island countries developed and implemented a set of Harmonized Minimum Terms and Conditions for Foreign Fishing Vessel Access (MTCs) that apply to all foreign tuna fishing vessels seeking access to the EEZs of Pacific Island countries. Currently, the application of these MTCs is both widespread and comprehensive by Pacific Island countries in areas under their respective national jurisdictions. The MTCs provide the following guidance to PICs in licensing foreign fishing vessels:

- Use of a common regional licence form
- Vessels are required to be in “good standing” on the Regional Register of Foreign Fishing Vessels and Vessel Monitoring System (VMS) Register of Foreign Fishing Vessels as a condition of licensing
- Monitoring and control of transshipment
- Maintenance and submission of prescribed forms reporting all catch and by-catch taken in EEZs and on the high seas
- Vessel reporting requirements
- Observers and observer coverage
- Appointment of an agent in the relevant Pacific Island licensing country
- Requirements for foreign fishing vessels to stow gear when transiting fisheries zones
- Application of MTC in port and exercise of port State authority
- Enforcement cooperation
- Flag State or Fishermen’s Associations responsibility
- Requirement to implement regional Vessel Monitoring System
- Identification of fish aggregating devices
- Pre-fishing inspections

Source: FFA (unpublished document).

- Reciprocal fisheries law enforcement, as per the Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region.
- Incentives for local basing for industrial tuna vessels, as per the Federated States of Micronesia Arrangement for Regional Fisheries Access.

In a general sense, the original thrust of regional tuna fishery management in the 1980s and 1990s was to increase foreign fishing access fees. This has been broadened in recent years to include domestic tuna industry development and resource sustainability. The latter objective overlaps somewhat with international fishery management efforts in the western and central Pacific Ocean.

The region's first conservation-oriented management move in the tuna fisheries was the Palau Agreement for the Management of the Western Pacific Purse-Seine Fishery, which entered into force in November 1995. The arrangement places a ceiling on the number of purse-seine licences that can be issued by the seven Pacific Island countries that are party to the agreement. The limit was originally set at 164 vessels and has been progressively increased. For several years, there has been discussion of modifying the Palau arrangement so that purse-seine vessel fishing days (rather than vessel numbers) are used as the basis for management. This scheme and its implementation is described in Box 1.13.

BOX 1.13
PNA Vessel Day Scheme

In 2000, an FFA study suggested that the purse-seine management scheme that was then based on vessel numbers be replaced by a scheme based on purse-seine fishing days. The transition was actually made seven years later. In 2007, the Parties to the Nauru Agreement began implementing the Vessel Day Scheme (VDS), transitioning from permitting a total number of purse-seine vessels in the region (205) to permitting a total allowable number of purse-seine fishing days (44 703 for 2012). Given the volume, value and multi-jurisdictional nature of the fishery, it is arguably the most complex fishery management arrangement ever put in place.

Due to the complicated nature of the new VDS system and the various constraints of the government fisheries agencies of the region (e.g. under-funded, under-staffed), it could be expected there would be problems in the introduction of the scheme. This is not to say that the VDS has not produced substantial benefits for PNA countries. The system is creating competition for a limited number of days, thereby increasing the value of each day. In practice, the value of a fishing day before the VDS was roughly USD 1 350, but it increased to about USD 5 000 in July 2011 and was about USD 6 000 in 2013 (Havice, 2013). The PNA Office has indicated that the VDS has already increased revenue to the Pacific Islands from the purse-seine fishery more than three-fold (PNA website).

On a different and less tangible level, another benefit is that the VDS moves fisheries management in the region to a desirable rights-based system. That is, fishing rights (such as vessel days) can be defined, allocated and traded. By limiting the rights (e.g. a cap on vessel days) scarcity is created and value increased. Consistent with this transition to a rights-based approach, a VDS-style arrangement for management of the tropical longline fishery is being implemented.

Source: Campling (2013).

International-level management

In the mid-1990s, there was growing awareness of the need for a tuna management agency that would cover an area larger than that encompassed by Pacific Island countries and that would include countries with vessels fishing in the area, such as Japan and United States of America. After years of discussions between the coastal states of the western and central Pacific and the states fishing in the region, a management convention came into force in June 2004. Box 1.14 provides some details of the Commission established by the convention.

BOX 1.14

Western and Central Pacific Fisheries Commission

Complex negotiations between the coastal states of the western and central Pacific and distant-water fishing nations led to the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. The objective of the Convention is to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean in accordance with the 1982 United Nations Convention on the Law of the Sea and the 1995 UN Fish Stocks Agreement. For this purpose, the Convention establishes a Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. The Contracting Parties to the Convention are members of the Commission. The Convention applies to all species of highly migratory fish stocks, except saurians. Conservation and management measures under the Convention are to be applied throughout the range of the stocks, or to specific areas within the Convention Area, as determined by the Commission. As of late 2017, participation in the Commission consisted of:

- Members: Australia, China, Canada, Cook Islands, European Union, Federated States of Micronesia, Fiji, France, Indonesia, Japan, Kiribati, Republic of Korea, the Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Philippines, Samoa, Solomon Islands, Taiwan Province of China, Tonga, Tuvalu, United States of America, Vanuatu.
- Participating territories: American Samoa, Commonwealth of the Northern Mariana Islands, French Polynesia, Guam, New Caledonia, Tokelau, Wallis and Futuna Islands.
- Cooperating non-members: Ecuador, El Salvador, Mexico, Panama, Liberia, Thailand, Viet Nam.

Source: WCPFC website.

The Commission, which has its secretariat headquarters in Pohnpei, has been operational for about 14 years and has held 14 annual meetings. Subsidiary bodies of WCPFC, including the Scientific Committee and Technical and Compliance Committee, also have annual meetings.

The Commission adopts “resolutions”, which are non-binding statements, and “conservation and management measures” (CCMs), which are binding. As of late, a total of 42 CCMs have come into force.³ The following measures were adopted in December 2016:

- CMM 2016-01 Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean
- CMM 2016-02 Conservation and Management Measure for Eastern High Seas Pocket Special Management Area
- CMM 2016-03 Conservation and Management Measure for the Protection of WCPFC Regional Observer Programme Observers
- CMM 2016-04 Conservation and Management Measure to Establish a Multi-annual Rebuilding Plan for Pacific Bluefin Tuna
- CMM 2016-05 Conservation and Management Measure on Charter Notification Scheme

Pacific Island countries form the largest block of members in the WCPFC, and they most often agree on common positions on issues before a WCPFC meeting – but this does not equate to those countries getting what they want in Commission meetings. The convention that established the Commission states that as a general rule, decision-making in the Commission shall be by consensus. The convention indicates that “consensus” means the absence of any formal objection made at the time the decision

³ Several of the older CCMs have been replaced by more recent CCMs

is taken. Given the diversity of interests of WCPFC member countries, this provision has created problems for the WCPFC (and all the other regional tuna commissions in the world) as it often means that a small number of countries can block measures that are perceived by other countries to be important.

Much of the hope for the sustainability of the tuna resources of the WCPO is focused on the Commission. Some Pacific Island countries are growing uncomfortable at what they perceive as non-cooperation by a few of the larger fishing nations in agreeing to management initiatives. There continue to be considerable difficulties with agreeing on how to achieve compatibility between management arrangements applied by coastal states in national waters and those for the high seas agreed through the Commission. This is less so for the purse-seine fisheries, where the PNA group have effectively exerted control through the VDS applied in their waters. The longline fisheries, however, continue to be less well managed, and efforts to agree to southern albacore catch limits have repeatedly failed. While there are plans to develop harvest strategies for the four key tuna species, progress has been slow.

The relationship between management of the offshore resource at the regional and international levels is complex. To some degree, the international management encompasses objectives that are common to its members, which are largely those measures that relate to resource sustainability. For some other objectives, such as maximizing government revenue from foreign fishing or encouraging the basing of vessels in the region, the interests of Pacific Island countries may be very different from those of distant water fishing nations. Those are the types of objectives where regional management coordinated by FFA and PNA has an important role.

Some important issues relating to offshore fishery resources and their management

Regional solidarity

For several decades, a major feature of the Pacific Islands region was the solidarity among countries on fisheries issues. In the late 1970s and early 1980s, many distant water fishing nations wishing to fish in the Pacific Islands area had a “divide and conquer” strategy, which often involved cutting a deal with a country viewed as being in a weak position – and then playing countries off against each other. Through strong leadership (most notably by Philip Muller of FFA), the countries banded together to achieve an effective block, which was possible because the tuna resources of the western and central Pacific Ocean are (unlike other regions of the world) largely within the 200-mile zones of Pacific Island countries.

One of the first effective manifestations of regional solidarity was the agreement by all countries of the region on the Harmonized Minimum Terms and Conditions for Foreign Fishing Vessel Access (Box 1.12), which specify consistent conditions across the region with respect to several features, including requirements for being in good standing on the regional register of fishing vessels, transshipment, catch logbooks, vessel reporting and observers. The application of this non-negotiable, “take it or leave it” policy by all Pacific Island countries in their dealing with foreign fishing entities has resulted in significant benefits over the years.

Many examples of the positive impact of regional solidarity over the decades can be cited. To some degree, other regions of the world are aspiring to achieve the solidarity that Pacific Island countries have attained. Currently, FFA’s motto is: “Strengthening national capacity and regional solidarity for sustainable tuna fisheries”. In the SPC/FFA report on the long-term future of fisheries in the region it is stated: “For the offshore fisheries, regional solidarity amongst Pacific Island countries will be central to mitigating most of the challenges listed, as well as for taking advantage of most of

the opportunities” (Gillett and Cartwright, 2010). In the Vava’u Declaration on Pacific Fisheries Resources (2007), Pacific Island leaders committed themselves to maintaining regional solidarity among Forum member countries in managing the region’s tuna stocks.

In recent years, there has been some breakdown of regional fisheries solidarity. In some countries’ dealings with foreign fishing entities, some aspects of the regionally agreed MTCs have not featured. Foreign interests have successfully applied pressure on some countries to ignore purse-seine effort limits and high seas closures. Currently, countries are having difficulty resolving their differences and taking collective control of the southern albacore longline fishery – as was done two decades earlier for the purse-seine fishery.

Opinions differ on why regional fisheries solidarity is crumbling. One view is that “there are no longer any Ratu Maras or Philip Mullers who can bring the countries together”. Another is that regional fisheries solidarity was at its height when there was not much value in the fisheries, “but now they are worth billions”. There is some degree of consensus, however, that improvements in solidarity must come from a higher level than that of fisheries officials.

IUU fishing

Illegal, unreported and unregulated (IUU) fishing is sometimes discussed in the context of the difficulties of the fisheries of the region. It is occasionally implied that this is the worst problem facing the offshore fishing in the region. Greenpeace (2006) stated: “Pirate fishing – illegal, unreported and unregulated fishing – is rife in the Pacific. Pirates leave communities without much needed food and income and the marine environment smashed and empty”. Several of the recent high-level fishery policy papers mention the severity of the IUU problem in the region. As part of the European Union’s (EU) effort to mitigate the large amount of IUU fishing in the region, the EU has introduced (and selectively enforced) a scheme whereby a country must fulfill a number of requirements in order to export fishery products to the EU. FFA (2013) states that more resources are being dedicated by donors to addressing IUU related issues.

Interestingly, none of the 26 regional fisheries specialists consulted for an ESCAP (Economic and Social Commission for Asia and the Pacific) regional fisheries study (Gillett, 2014a) thought that IUU⁴ was among the major fisheries issues of the region. There was a consensus, however, by those individuals familiar with IUU that:

- it is extremely difficult to accurately estimate the level of IUU in the region;
- IUU on the high seas is a problem;
- IUU in the region has tended to decrease and change in character over the years, from fishing in a 200-mile zone without a licence in the past, to misreporting of catches at present.

The last point is supported by a recent report commissioned by FFA, which indicates that unlicensed fishing accounts for only 4 percent of the volume of catch by IUU fishing (MRAG, 2016).

The above is not to imply that IUU fishing is insignificant in the region. Proper reporting of catches is essential for Pacific Island countries to maximize benefits from their tuna resources, including benefits from foreign fishing access fees. The stock assessments that are critical for proper management are dependent on accurate data

⁴ To some degree, the term IUU creates an unclear idea of the situation. IUU (an abbreviation popularized by FAO to encompass a large array of conditions around the world) covers many different types of illegal activities – when it would be clearer to simply state poaching or misreporting, or in the case of offshore fishing in the Pacific Islands, a transition from poaching to misreporting. The recent trend to apply the term IUU to coastal fisheries in the region is also awkward because most coastal fishing in the region (including that which is entirely legal) is unreported.

from vessels. Vessels that misreport and are not apprehended encourage other vessels to misreport.

Purse seiners operating in the region are now required to have 100 percent observer coverage, a feature that minimizes misreporting. It is therefore likely that most misreporting problems involve longlining. With several thousand longliners operating in the region, the misreporting difficulties are not small, and will not soon be resolved.

It is important to keep the IUU issue in perspective. Although serious, IUU fishing should not become the vague “foreign bogeyman” that can be blamed for all sorts of regional fisheries problems. Some senior regional fisheries officials caution that the externally driven publicity of IUU fishing can distract policy makers from some of the more important issues.

Access fees versus domestic industry development

All Pacific Island countries collect access fees for foreign fishing in their waters and all have aspirations to develop their own fishing and/or processing industries. The various considerations and trade-offs involved in balancing these two opportunities have been a major issue in the region for many years.

Access fees have been collected by Pacific Island countries since the late 1970s. In the 1980s, a general theme in the region was that greater benefits would accrue if countries could be directly involved in the tuna industry. Because of a scarcity of local private capital in most countries of the region, and suspicion about overseas investors, this involvement usually entailed governments jumping into the tuna industry. That era and the associated problems are well studied and documented. An ADB study concludes:

Pacific Island government investments have been planned and entered into with either government as sole owner and operator or in joint venture with foreign companies in pole-and-line tuna fishing vessels (Fiji, Kiribati, Solomon Islands) longline (Federated States of Micronesia, Tonga), and purse seiners (Federated States of Micronesia, Kiribati, Marshall Islands, Solomon Islands), transshipment bases (Federated States of Micronesia), canneries (Fiji, Papua New Guinea, Solomon Islands) and other tuna processing plants. Unfortunately, with very few exceptions, government tuna ventures that have operated for more than two years have been unprofitable and have required additional heavy injections of public funds to maintain operations (Pollard, 1995).

From the above experience, some countries re-focused on obtaining benefits from their tuna resources through access fees, others sought overseas investment to build industries, while some pursued both. Currently access fees are at an all-time high, assisted by the introduction of the PNA Vessel Day Scheme. Domestic tuna industry development is also advancing, judging by employment creation related to the tuna industry – with jobs increasing from about 8 000 in 2002 to about 23 000 in 2015 (Terawasi and Reid, 2017a; 2017b). Much of this industry development came about by using access to tuna resources to leverage fishing and processing companies to base locally.

In the balancing of benefits from access fees and from domestic industry development, every country of the region is different in terms of resource endowment, past experience, political will and development aspirations. However, there are some common issues for countries:

- Comparing dissimilar benefits is difficult. For example, how can a million dollars of access fees (relatively easy to calculate) be compared to the creation of 100 tuna-related jobs (relatively complex) in terms of what is best for a country? Calculating and comparing opportunity costs is also difficult.
- In recent years, joint-venture fishing arrangements (i.e. local basing/flagging) are becoming popular, but there is growing concern about a lack of transparency

and whether real benefits flow to Pacific Island countries from these frequently complex arrangements.

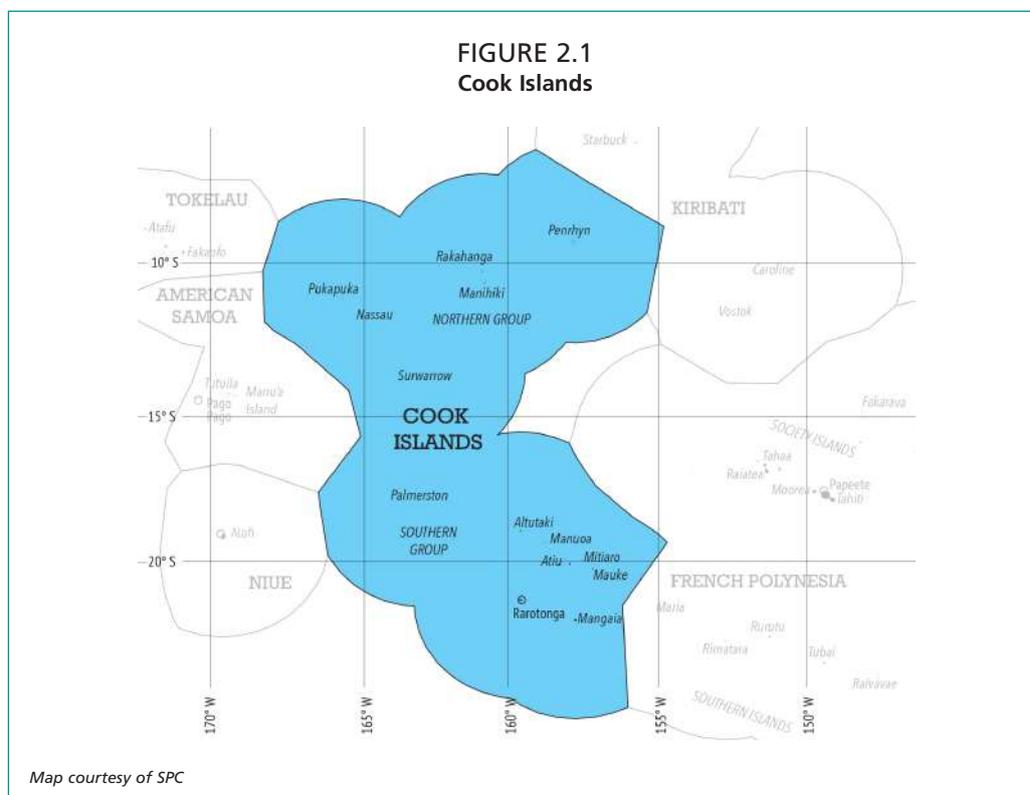
- In some countries, development aspirations are not well thought out and/or effectively translated into government policies.
- Some of the government fisheries agencies have historically been involved with the generation of revenue from access fees and have been institutionally oriented towards that goal, whereas the promotion of domestic tuna industry development requires different skills, and success can be more intangible and difficult to measure.
- As the tuna industry has changed over the years, some governments have not kept abreast of new developments and technology, and have tried to pursue developmental plans that are outdated and/or impractical.

Other important offshore fishing issues in the Pacific Island region are:

- **climate change:** Alterations in ocean temperatures and currents, and the food chains in the open ocean, are projected to affect the future location and abundance of tuna species in the Pacific Islands region. An SPC policy brief (SPC, 2014) indicates that the projected changes to the tropical Pacific Ocean are likely to redistribute the abundant skipjack tuna to the central-eastern Pacific. Abundance of bigeye tuna is also expected to decrease in the western Pacific and increase in the east, whereas albacore are likely to shift poleward to avoid a projected increase in oxygen-poor waters in their present-day distribution. The response of yellowfin tuna has yet to be modelled. However, experiments show that survival and growth of their larvae may be affected by intense ocean acidification;
- **stock assessment work:** This work indicates that tuna fishing in Indonesia and the Philippines is having a large impact on stocks in the WCPO region. SPC studies show that the Indonesian fishery is a large contributor to the depletion of the WCPO yellowfin stock. Much of the tuna captured in Indonesia and the Philippines is taken with very small-scale gear – it is difficult to place controls on that type of fishing. Even if Pacific Island countries put considerable effort into establishing national and regional tuna management, those regimes may be undermined by the unmanaged tuna fisheries in Indonesia and the Philippines;
- **domestic consumption:** From several perspectives, there is justification for the countries of the region to use more offshore fish for domestic consumption; for example, to compensate for declining food resources from coastal fisheries, support adaptation to climate change, and provide benefits to small-scale fishers. This will require countries of the region to push management measures in WCPFC that encourage industrial fishing vessels to offload at least some catch in Pacific Island ports and to support small-scale tuna fisheries. This offloading will come at some cost (i.e. reduction in some access fees) and small-scale tuna fishing will require well-managed national FAD programmes.

NATIONAL INFORMATION ON FISHERIES

2. Cook Islands



REPORTING YEAR

This profile was written in 2017, based on data mostly from 2014.

PART 1. OVERVIEW AND MAIN INDICATORS

2.1 GENERAL GEOGRAPHIC AND ECONOMIC INDICATORS

TABLE 2.1

General geographic and economic indicators - Cook Islands

Land area ¹	237 km ²
Water area ²	1 830 000 km ²
Population (2016) ³	17 459
GDP of Cook Islands (2014) ⁴	USD 299 063 000
Fisheries contribution to GDP (2014) ⁵	USD 17 813 000
Fisheries contribution as a % of GDP (2014) ⁶	6

2.2 FAO FISHERIES STATISTICS

TABLE 2.2

FAO Fisheries statistics on total production, employment and trade – Cook Islands

2014		
Production (tonnes)	Aquaculture	8
	Capture	3 843
	Total	3 851
Employment (thousands)	Aquaculture	0.007
	Capture	0.008
	Total	0.015
Value of trade (USD 1000)	Fisheries exports	2 931
	Fisheries imports	1 599
	Total	4 530

Source: FAO Statistics and Information Branch of the Fisheries and Aquaculture Department.

PART 2. NARRATIVE

2.3 PRODUCTION SECTOR

2.3.1 Introduction

Cook Islands is an archipelagic state comprising 15 widely scattered islands with a total land area of 237 km², distributed in an exclusive economic zone (EEZ) of about 1.8 million km². The EEZ of the Cook Islands adjoins the zones of Niue, American Samoa, Tokelau, Kiribati and French Polynesia. The islands form two groups: the Northern Cooks, all of which are atolls, and the Southern Cooks, which are mostly high islands.

¹ Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia.

² Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia.

³ Ministry of Finance & Economic Management (MFEM) www.mfem.gov.ck/census (provisional figure).

⁴ Reported in Gillett (2016) from the Statistics Office of MFEM unpublished data (provisional figure).

⁵ Reported in Gillett (2016) from the Statistics Office of MFEM unpublished data (provisional figure). Fisheries sector defined by the Statistics Office as “fishing and pearl”

⁶ Reported in Gillett (2016) from the Statistics Office of MFEM unpublished data (provisional figure).

The population dynamics of the Cook Islands have a large effect on fishing activities. From the turn of the century until 1971, the population of the Cook Islands showed steady growth. From 1971 to 1976, it dropped with the steady exodus of Cook Islanders to New Zealand in search of employment opportunities. This decline continues today and is most marked in the outer islands, with people moving to Rarotonga or overseas (Pinca *et al.*, 2009a). The availability of willing labour is a major constraint on fishing industry development in the Cook Islands.

The land area and coastline of the country are quite small, and consequently inshore fishery resources are limited in comparison to those of other Pacific Island countries. This is, however, balanced by a relatively large EEZ – the fifth largest in the Pacific Islands region.

Fisheries statistics can be presented in different forms to cater for different purposes. In the statistics published by FAO (Part 1), the presentation follows the international conventions and standards used by FAO and its Member States for reporting catches, which are given by the flag of the catching vessel. Accordingly, the fishery and aquaculture production of the Cook Islands in 2014 published by FAO (as given in Part 1) was 3 851 tonnes.

In Table 2.3 below, the Cook Islands fishery production statistics include the catch by Cook Islands-flagged vessels (as reported to FAO), the catch by small boats and skiffs (which do not carry a flag) and the catch from fishing activities that do not involve a vessel (e.g. reef gleaning). The offshore category in the table is defined as the

TABLE 2.3
Cook Islands fisheries production (as per FAO reporting standards)

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Cook Islands-flagged offshore
Volume (tonnes)	12 tonnes and 52000 pieces ⁷	5	150	276	2 106
Value (USD)	855 469	29 297	1 328 125	1 562 500	n/a

catch from Cook Islands-flagged, industrial-scale fishing operations that are carried out anywhere in the Pacific Ocean (i.e. inside or outside the Cook Islands zone).

The amounts of production in the above table differ slightly from those shown in Part 1. The table gives production estimated from a variety of sources (see SPC study below), whereas the quantities given in Part 1 are generally those reported to FAO by the Cook Islands Ministry of Marine Resources.

A recent study by the Pacific Community (SPC) presents the fishery statistics of the Cook Islands in a different way to that of FAO. The SPC study reports on the amount of catch in the Cook Islands' EEZ, regardless of vessel flag, and places catches in different categories, which is useful for other purposes, such as administration of the foreign fishing that occurs in Cook Islands waters. A summary of fisheries production from the SPC study is given in Table 2.4.

Some comment is required to explain the difference between the information in this table and that in Part 1 of this profile:

- Catches can be given by the flag of the catching vessel (as in the FAO statistics given in Part 1), or by the zone where the catch is made (the “offshore foreign-based” and “offshore locally based” columns in the table above). These two different ways of allocating catch each have their purposes. Attribution by flag

⁷ The production of several important aquaculture products (e.g. pearls, giant clams) is measured in pieces rather than in weight.

TABLE 2.4
Fisheries production in Cook Islands waters

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Offshore locally based ⁸	Offshore foreign-based ⁹
					Both Cook Islands- and foreign-flagged vessels	
Volume (tonnes)	12 tonnes and 52000 pieces ¹⁰	5	150	276	194	20 342
Value (USD)	855 469	29 297	1 328 125	1 562 500	2 265 625	57 153 854

Source: Gillett (2016).

is important for consistency with international conventions, while attribution by zone is important for determining fishing contributions to GDP, and managing revenue from licence fees for foreign fishing in a country's zone.

- There are two Cook Islands-flagged mid-water trawl vessels that target orange roughy and alfonsino. These vessels fish in the southern Indian Ocean and offload their catches in Port Louis, Mauritius, and Cape Town, South Africa. These catches are not included in the SPC study as they are made outside the Pacific Ocean.
- There is no fisheries statistical system covering the categories of freshwater fishing, aquaculture and most coastal fishing. The estimates above were made in a 2015 study by SPC that examined a large number of fishery and economic studies covering the last two decades. It is likely that the basis of the information in the FAO statistics in Part 1 above was a more informal conjecture by a nominated person in the Cook Islands Fisheries Department.
- Aquaculture production in Table 2.3 includes non-food items, such as giant clams for the aquarium trade, and pearls.

2.3.2 Marine sub-sector

2.3.2.1 Catch profile

The marine sub-sector has two distinct components: offshore¹¹ and coastal. The offshore catches in the Cook Islands zone are currently made by longline and purse-seine vessels.

The longline vessels are both local and foreign based. The SPC study (Gillett, 2016) gives the catches of the three components of offshore fishing:

- In recent years, a domestic commercial fishing company has carried out offshore longlining using one or two Rarotonga-based longline vessels. In 2013, the one vessel offloaded 105 tonnes of fresh catch. In 2014, two longliners offloaded 194 tonnes of fresh catch.
- Foreign-based longline vessels caught 7 949 tonnes in 2013 and 7 577 tonnes in 2014.
- Purse-seine vessels (all foreign-based) caught 8 338 tonnes in 2013 and 12 765 tonnes in 2014.

⁸ In the SPC study, "offshore locally based" is the catch in Cook Islands waters from industrial-scale tuna fishing operations that (a) are based at a port in the Cook Islands, and (b) generally harvested more than 12 nautical miles offshore.

⁹ "Offshore foreign-based" is the catch in the Cook Islands zone from catch from industrial-scale tuna fishing operations that are based at ports outside Cook Islands. Under the internationally agreed standards of the System of National Accounts (SNA, 2009), those catches do not contribute to the Cook Islands' GDP.

¹⁰ As noted above, production of some aquaculture products is measured in pieces rather than weight.

¹¹ In this profile, "offshore" is defined as the area outside the zone normally frequented by small, usually undecked, coastal fishing vessels and is generally greater than 12 nautical miles from the nearest land.

The Cook Islands Offshore Fisheries Annual Report 2014 (OFD, 2015a) contains some information on trends in the offshore fisheries. The total longline fishery catch in the Cook Islands zone in 2014 was the third highest catch on record for the Cook Islands. Fifty-five percent of this catch was albacore, the target species of the longline fishery. The majority of the longline fishing activity was in the northern part of the zone. The total purse-seine fishery was the second highest purse-seine catch on record. Approximately 87 percent of the purse-seine catch is skipjack tuna.

Longline catch rates of albacore, measured in kilograms per 100 hooks, have steadily declined since 2007 but have stabilized to some degree since 2012 at around 25 kg per 100 hooks. Catch rates for both bigeye and yellowfin tuna have fluctuated around 4 kg per 100 hooks. However, in 2014, yellowfin catch per unit effort (CPUE) increased rapidly. There is typically a strong seasonal trend evident throughout the calendar fishing year. In general, the first and fourth quarter catch rates and total longline catch are the lowest for the year, with this period referred to as the off-season. The second and third quarter catches are the peak of the fishing season, with catch rates of albacore ranging between 30 and 35 kg per 100 hooks.

The purse-seine fishery targets surface-schooling tuna. In 2014, only vessels under the United States Multilateral Treaty were licensed to operate in the Cook Islands. Those vessels had 550 days available for fishing during the year, of which 368 days were actually used.

The oceanographic features of the Cook Islands have important implications for tuna fishing. Bigelow (1997) reviewed the oceanography of the Cook Islands EEZ, with the major points given in Box 2.1:

BOX 2.1

Oceanography of Cook Islands EEZ

- Currents in the vicinity of the Cook Islands are highly variable in direction and rate, but are generally weak (~25 cm/sec or 0.5 knots).
- The Cook Islands extend over a considerable north/south distance and the sub-surface thermal structure indicates that longline catchability may vary across the area. In the northern area (5°–15°S) the 15°C isotherm is within 220 m of the surface and the thermocline gradient is strong. In the southern area (15°–25°S), the 15°C isotherm is ~325 m deep and the thermocline is diffuse.
- Dissolved oxygen concentrations are generally high in the southern Cook Islands and should not limit the distribution of tuna. Yellowfin and bigeye catchability will be greater in northern areas compared to southern areas, due mainly to a shallower and steeper thermocline and low oxygen concentrations at depth.
- Subsurface isotherms were ~50–100 m shallower after the strong El Niño – Southern oscillation (ENSO) event in 1982. However, recent ENSO or La Niña events did not alter the sub-surface thermal structure (or the data were possibly inadequate for the detection of such changes).
- The primary and secondary productivity within oceanic waters near the Cook Islands is relatively low compared to that of high islands within the south Pacific.

Coastal fishing is primarily carried out for subsistence purposes and for sales in local markets. In addition, there are some coastal fisheries that are export oriented: aquarium fish and trochus. With respect to coastal fisheries statistics, currently the Ministry of Marine Resources publishes only estimates for the artisanal troll fishery. The SPC-supported artisanal tuna database shows that, in 2014, there were 302 active artisanal vessels and the total pelagic fish catch by those vessels was estimated to be 219 tonnes, 53 percent of which was yellowfin (OFD, 2015a).

Estimating the catches of the other components of the coastal fisheries in the Cook Islands requires more speculation, mainly due to the lack of fishery statistics. Table 2.5 gives the coastal catches estimated by the Asian Development Bank and SPC. Those studies made use of a wide variety of information sources, including the opinions of fishery specialists, export records, household income and expenditure studies (HIES), the documentation of the Ministry of Marine Resources, and information on population changes in the country.

The nominal drop in coastal subsistence production between 1999 and 2007 in the table above is likely to be due to better information becoming available rather than to any major change in the fishery. Between those years, the Ministry of Marine Resources produced a situation and outlook report and the Statistics Office carried out a HIES.

Factors that influence coastal fishery production in the Cook Islands include the presence of fish aggregation devices (FADs), the movement of people between islands, overseas emigration, the availability of formal employment, outbreaks of ciguatera fish poisoning, and the cost of food alternatives. There are indications that production from small-scale fisheries in the Cook Islands has probably fallen in recent years. The population in the predominantly fish-eating outer islands has decreased, while fish consumption in the expanding Rarotonga population is tempered by occasional outbreaks of ciguatera.

2.3.2.2 Landing sites

In the Cook Islands, the only developed port is a small harbour at Avatiu on Rarotonga. The facilities at that port are limited and easily become congested with shipping, visiting yachts and local fishing vessels. Penrhyn Island in the north has a rudimentary port with few facilities.

All landing of catch by the Cook Islands' tuna longliners occurs either at Avatiu Harbour or (for the longliners fishing in the north of the zone) at Pago Pago in neighbouring American Samoa. The purse-seine tuna catch is all landed at locations outside the country, mainly Pago Pago, or transhipped to an Asian port.

Many small-scale commercial vessels also offload at Avatiu Harbour as well as at other locations in the Southern Group where there are small passages through the reef or blasted channels. Outside of Rarotonga, subsistence fishery landings occur at villages throughout the country, roughly in proportion to the distribution of the population.

In general terms, almost all the value of the offshore catch (estimated to be worth about USD 59.4 million) is landed outside the Cook Islands. All of the coastal catch (about USD 2.9 million) is landed in the country.

2.3.2.3 Fishing practices/systems

In 2014, the Cook Islands' longline fleet consisted of 14 vessels, of which 12 vessels were authorized to fish within both the Cook Islands EEZ and the high seas. The majority of these longline vessels were between 51 and 200 gross registered tonnes (MMR, 2015).

A total of 34 non-Cook Islands-flagged longline vessels were licensed to operate within the Cook Islands EEZ during 2014; only 24 of these vessels actually fished in the zone. The foreign-flagged fishing in 2014 was undertaken by two Chinese

TABLE 2.5
Estimates of Cook Islands' coastal fishery production

Harvest sector	Estimate year	Volume (tonnes)
Coastal commercial	1999	80
	2007	133
	2014	150
Coastal subsistence	1999	795
	2007	267
	2014	276

Source: Gillett (2016); Gillett (2009a); and Gillett and Lightfoot (2001).

companies comprising both Chinese- and Federated States of Micronesia-flagged vessels that operated out of Pago Pago, American Samoa (MMR, 2015).

All of the purse seiners licensed to fish in the Cook Islands zone in 2014 were associated with the United States Multilateral Treaty. Those vessels were mainly based in Pago Pago, American Samoa. In 2015, the Cook Islands entered into purse-seine bilateral agreements with the Republic of Korea and New Zealand and that was the first year that purse-seine fishing occurred outside the scope of the United States Treaty (OFD, 2016a).

Coastal fishing is often carried out by modern methods such as trolling off the reef, and closer inshore by gillnetting, castnetting and underwater spearfishing. Reef gleaning is very important.

An older document produced by the Ministry of Marine Resources, “Basic information on the marine resources of the Cook Islands” (MMR, 2000), remains a valid source of information on some of the important traditional small-scale fishing techniques of the Cook Islands:

- **Hook-and-line fishing** is one of the oldest methods for catching fish. In the Pacific, traditional hook-and-line gear was made from natural materials: vines, coconut fibre or strong bark from trees were woven into thin fishing lines; hooks were made from strong wood (e.g. the roots of trees), bone, or shell; and stones were used for weights. Over time, hook-and-line gear has changed to take advantage of modern materials. Examples include the use of monofilament for fishing line, stainless steel for hooks, and wood or plastic spools or mechanized fishing reels for storing the line.
- **Titomo** is carried out while diving. The fisher has a small baited hook attached to a short length of line (15–30 cm) on a rod of about 1 m. Fishers using this method target koperu (mackerel scad) at dawn or dusk, or small patuki (groupers). To catch mackerel scad, a piece of coconut flesh is attached to a barbless hook. The fisher uses chum (ground coconut flesh) to attract the fish and then offers the bait to the fish. Once the fish is hooked, it is quickly flicked into a canoe.
- **Matira** fishing uses a 2–5 m rod and is done either from boats or from the shore. Fishers cast the line and keep the baited hook stationary or move it about. The lure is made of shell, feather, metal or plastic. Matira is carried out at any time of the day to catch small groupers, paoa and titiara (trevally) or at night to catch ku (squirrel fish).
- **Tiritiri** targets predatory fish such as titiara, urua (trevally), angamea (snapper), mu (emperors) and groupers. The method uses only a handline and a baited hook.
- **Matau tamoe** is generally used for catching large trevallies. Fishers tie a thick line to a tree, then walk the line out over the reef. A hook is baited with live eel to prevent other fish (such as small groupers and triggerfish) from eating the bait. The hook is placed somewhere soft (such as in a patch of soft coral) to stop it shifting about with the swell and currents. The fisher either waits or leaves the baited hook overnight and checks it in the morning.
- **Drop-stone** fishing uses a baited hook, which is dropped to great depths to target deep-sea fish species such as groupers and snappers, and pelagic fish such as tuna, wahoo and marlin. Bait is usually mackerel scad, bigeye scad or flyingfish. Ground-up bait and a weight (usually a rock) are wrapped inside a leaf with a baited hook and tied with a slip-knot. The package is dropped over the side of the boat and lowered to the required depth and then the line is jerked upwards. The movement slips the knot, freeing the packet of leaves and ground bait.
- **Tavere** is done on dark nights, generally when the seas are very calm. Fishers go out in canoes and troll (10–15 m in length) rigged with three to five hooks attached directly to the main line. Uru tavake (bird feathers) or shiny white-strand rope (preferably nylon) are attached to the hooks. This type of fishing is

similar to modern-day trolling but is done from canoes. The boat is paddled along the reef areas or as close to the reef as possible to catch squirrel fish.

Much of the small-scale tuna fishing around Rarotonga, and to a lesser extent the other islands, occurs in conjunction with FADs. Fishers rely on the FADs to hold tuna schools in set locations, allowing them to troll around the FADs to maximise their catch. In addition, mid-water fishing techniques are used to further increase the catch of larger tunas from around the FADs. Cook Islands fishers have become very reliant on the FADs as part of their regular fishing practice. Box 2.2 gives further information on the coastal FADs.

BOX 2.2

Coastal FADs in the Cook Islands

Since 2005 there have been numerous FADs deployed in various locations around the islands of the Cook Islands. Over the years there have been many FADs that were lost, with most for Rarotonga and Aitutaki having been replaced. Off Rarotonga there are currently three shallow-water FADs (250 m from the shoreline) and five deep water (2 miles from the shoreline). Aitutaki has a total of three deep-water FADs (all of which were replaced this year) and Atiu has one deep-water FAD. The FADs are funded by Government and regional donors enabling opportunities for further cooperation. These include the formation of good working partnerships between beneficiaries, funding agencies and the Ministry of Marine Resources. The objectives of a FAD programme include: relieving pressure on the reef and lagoon, increasing catch thus reducing operation costs, improving safety at sea, assisting charter operation, sports fishing and tourism, and increasing food security. The Ministry of Marine Resources' aim is to continue to provide and maintain a FAD deployment and maintenance programme, inform beneficiaries regularly of issues related to FADs, and provide funding.

Source: modified from Hunter *et al.* (2013).

Flyingfish fishing is important in the Cook Islands and an interesting technique is used. Gillett and Ianelli (1993) give an account of the fishery that is still accurate today (Box 2.3). Catches of up to 400 fish per boat per night are not uncommon. The short lifespan and fecundity characteristics of the fish make it tolerant to harvest pressure (MMR, 2010).

BOX 2.3

Flyingfish fishing in the Cook Islands

The catching of flyingfish at night is significant in the Cook Islands, especially Rarotonga. This commercial fishery developed from a traditional Polynesian technique in which palm frond torches and dipnets were used from outrigger canoes. Over the years the technique evolved, including the introduction of kerosene lanterns in the late 1940s to replace palm frond torches, the use of skiffs powered by outboard motors to replace paddled canoes, and the use of halogen lamps to replace kerosene lanterns.

Currently, small generators are used to power the fishing lights. A high-powered light is affixed to a helmet worn by the fisherman. This allows the fishermen to direct the light while still having use of both hands to manoeuvre the boat and manipulate the dipnet. The boats are specially designed so that the fisherman can stand in the bow section of the boat to facilitate scooping. Steering is accomplished by the use of an aviation-type "joystick"

which may have an integrated throttle. The shape of the hulls is such that they turn easily yet have enough “V” shape to be comfortable in moderate seas. An important characteristic of these boats is that they can easily be used for other types of fishing.

Conditions for catching are better during hours of maximum darkness. That is, the fisherman’s light is most effective at spotting and immobilizing fish if the moon is below the horizon and there is no twilight. Calm conditions are often better because it is easier to spot fish; if there is wind it is usually best to fish downwind or in the lee of an island. Scooping requires practice to become proficient and is done while the fish is in the water, usually not when fish take flight.

2.3.2.4 Main resources

Various tuna species make up the vast majority of the catch by offshore fishing in the Cook Islands. The Cook Islands Offshore Fisheries Annual Report (OFD, 2015a) gives the tuna species in the catch by gear type:

- Albacore dominated the longline fishery, accounting for about 55 percent of the total catch in 2014. Yellowfin tuna comprised 25 percent, followed by bigeye tuna at 9 percent.
- In 2014, 87 percent of the purse-seine catch was skipjack tuna. Yellowfin tuna comprised 6 percent, followed by bigeye tuna at 1 percent.
- Tuna catches by small artisanal vessels were reported to be about 53 percent yellowfin.

In terms of the status of offshore resources, the four major species of tuna in the Cook Islands mix freely with those of the neighboring countries in the western and central Pacific. Recent information from the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC, 2016) indicates that for:

- **skipjack** – the stock is currently only moderately exploited and fishing mortality levels are sustainable;
- **bigeye** – recent analysis indicates that overfishing is occurring for the bigeye tuna stock and that in order to reduce fishing mortality to that at the level of maximum sustainable yield, a large reduction in fishing mortality is required;
- **yellowfin** – the current total biomass and spawning biomass are higher than at levels associated with maximum sustainable yields. Therefore, yellowfin tuna is not considered to be in an overfished state;
- **South Pacific albacore** – there is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries. It should be noted that longline catch rates are declining and that catches over the last 10 years have been at historically high levels and are increasing.

With respect to coastal resources, many species of finfish and invertebrates are found in the inshore marine areas of the Cook Islands. According to Passfield (1999), there are an estimated 200 species of algae, 600 species of fish, 390 species of molluscs, 200 species of crustaceans, 70 species of echinoderms and 120 species of corals. The most commonly exploited fish species in Rarotonga are surgeonfish, parrotfish, goatfish, squirrel fish, bulls-eyes and small groupers.

FFA (1993) indicates that about 20 species of fish are important in the aquarium fish fishery. The flame angel (*Centropyge loriculus*) and red hawkfish (*Neocirrhites armatus*) are especially important due to their high value. These have been replaced in recent years by other schooling species caught at depth, e.g. fairy basslets (*Pseudanthias ventralis*), as fish such as the flame angel are increasingly available at lower cost from other countries.

The trochus fishery is based on a single species, *Trochus niloticus*.¹² This gastropod is not native to the Cook Islands but was transplanted from Fiji in 1957.

In general, those fish and invertebrate species that are sought after and are located in areas readily accessible to many fishers tend to be heavily exploited or overexploited.

2.3.2.5 Management applied to main fisheries

Tuna fisheries in the Cook Islands are managed on regional and national levels.

- On the regional level, the Cook Islands is a member of the Western and Central Pacific Fisheries Commission (WCPFC) that was established by the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. The Cook Islands and the other 26 members of the commission enact tuna management measures at the annual WCPFC meeting. From the Cook Islands' perspective, the two most important recent measures are: (1) the Conservation and Management Measure for South Pacific Albacore, and (2) the Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in The Western and Central Pacific Ocean.
- On the national level, the longline fishery is managed by the Large Pelagic Longline Fishery Plan (2014) and the Marine Resources (Large Pelagic Longline Fishery and Quota Management System) Regulations 2016, in which the total allowable catch for albacore has been set at 9 750 tonnes and for bigeye tuna at 3 500 tonnes. There is also a maximum limit of 50 longline vessels licensed to fish within the Cook Islands EEZ at any one time.
- Also on the national level, the purse-seine fishery is managed by the Purse Seine Fishery Plan (2013). The major features of the plan are: (1) establishment of licensing arrangements that encourage fishing operations to provide greater benefits to the Cook Islands, particularly through the landing, value-adding and processing of fish in the Cook Islands; (2) a limit on the size of the purse-seine fleet in the fishery waters to avoid local depletion, particularly of skipjack tuna and yellowfin tuna; and (3) a requirement to use fishing gear and methods that reduce the impacts of fishing on non-target species.

Management of the coastal marine environment has been practised in the Cook Islands since the ancestors of the present Polynesian population inhabited these islands. It has been important because of the small areas and limited resources available. Today, although the large majority of islands have plentiful supplies of most of their marine resources, there are some species that need to be managed to prevent population declines. Management is becoming even more important because of the economic, technological and environmental changes occurring as well as changes in the traditional use of marine resources. Income from fisheries is becoming increasingly important as people have come to rely on cash for purchasing imported food and goods. More efficient fishing gear (such as gillnets) means that more fish can be caught in less time, and storage facilities such as freezers allow a surplus of fish to be accumulated.

Traditional pre-contact societies of the Cook Islands had a complex system of marine and land tenure that allowed delineated and enforceable control over the use of land and sea. The customary prohibition known as ra'ui was one example of such control. The elimination of customary ownership of the lagoon and sea under the Cook Islands Act 1915 took away the right of landowning units to impose enforceable controls, weakening management regimes in these areas, particularly on Rarotonga. Although in the past few decades there have been efforts to revive the ra'ui system predicated on respect for traditional authority rather than on the legal system (Tiraa, 2006), the current success is limited – perhaps only at locations close to some resort hotels is there effective surveillance (K. Passfield, personal communication, September 2015).

¹² Also known as *Tectus niloticus*.

In accordance with the Marine Resources Act 2005, a fishery can be declared a designated fishery if it is important to the national interest and requires management measures to ensure sustainable use of the fishery resource. In practice, the island councils manage the fisheries inside 12 nautical miles, with the Ministry of Marine Resources assisting the councils in formulating and implementing fisheries management plans. Formal management plans have been prepared for important coastal fisheries, including those for parrotfish on Palmerston and trochus on Aitutaki.

With respect to trochus, there is general recognition among fishery specialists in the Pacific Islands region that the Aitutaki trochus fishery in the Cook Islands is one of the best, if not the very best, managed of any coastal fishery in the region. In fact, a detailed case study to document the success of that fishery was undertaken by SPC in the 1990s. Friedman and Pakoa (2007) provide some details of the management system:

On Aitutaki, trochus are harvested only when there are sufficient numbers on reefs to ensure the quota can be reached sustainably, and harvests are valuable enough to warrant fishing. To ensure that harvesting is sustainable, the quota is set at 30 percent of the estimated number of trochus in the size range 80–110 mm. This ensures that trochus are able to reproduce before they reach harvestable sizes, and very large trochus (with lower quality shell) remain as broodstock. Harvests began in 1981 and typically harvests have occurred once every one to two years.

On a different level, the Cook Islands Marine Park represents a type of management of the country's marine resources. Announced at the Pacific Islands Forum meeting in 2012, the park will cover an area twice the size of France and will include buffer zones around islands and possibly other areas of significance, such as seamounts, and special zones where tourism and carefully monitored fishing will be allowed. It is anticipated that in early 2017, the *Marae Moana Bill 2018*, the legislation underpinning the Cook Islands Marine Park, will be discussed in parliament. The bill states that its primary purpose is to protect and conserve the ecological, biodiversity, and heritage values of the Cook Islands marine environment. Additional purposes are to:

- provide an integrated decision-making and management framework to coordinate the work of relevant agencies so as to effectively balance marine conservation with ecologically sustainable use of the marine environment and resources;
- allow ecologically sustainable use of the marine environment for purposes, including
 - public enjoyment and appreciation;
 - public education about, and understanding of, the *Marae Moana*;
 - economic, recreational and cultural activities;
 - research relating to its natural, social, economic, and cultural systems and values;
- encourage engagement in the protection and management of the marine environment by interested persons and groups, including the national and island governments, communities, *Aronga Mana*, business and industry;
- assist in meeting the Cook Islands' international responsibilities, in particular its responsibilities under the Convention Concerning the Protection of the World Cultural and Natural Heritage, the Convention on the Conservation of Biological Diversity, and the United Nations Convention on the Law of the Sea.

Management objectives

In general, all fisheries management objectives in the Cook Islands must conform to the Marine Resources Act 2005. The act states: "The principal objective of this Act and the Ministry of Marine Resources is to provide for the sustainable use of the living and non-living marine resources for the benefit of the people of the Cook Islands."

The "primary management objectives" of the Large Pelagic Longline Fishery Plan (2014) and the Purse Seine Fishery Plan (2013) are essentially the same:

- a) To provide for the sustainable use of large pelagic fish resources for the benefit of the people of the Cook Islands.
- b) To ensure the long-term sustainability of the fishery.
- c) To mitigate the impact of fishing on non-target species.
- d) To develop and maintain the economic viability of the fishery and associated fishing industry, including the development of the Cook Islands' domestic fleet and onshore processing in the Cook Islands.
- e) To ensure that the revenue and domestic benefits derived from the fishery are aligned with the value of the catch of albacore and bigeye tuna in the Cook Islands EEZ.
- f) To ensure that Cook Islands meets its international environmental and fisheries obligations.
- g) To strengthen the exercise of Cook Islands' sovereign rights and ensure that its special requirements as a Small Island Developing State are appropriately taken into account in regional tuna management and position Cook Islands for equitable participation in the regional tuna fisheries.
- h) To protect traditional and small-scale commercial inshore fishers.
- i) To protect the integrity of government revenue.
- j) To fulfil the purposes and principles in the Marine Resources Act 2005.

The objectives of coastal fisheries management in the country vary considerably between the various fisheries. In general, most fisheries are managed for the sustainability of the target resources and the viability of the fishery for food and income. The management objectives of some fisheries include the equitable distribution of benefits to the community (e.g. the Aitutaki trochus fishery).

Institutional arrangements

The main institution involved with fisheries management in the Cook Islands is the Ministry of Marine Resources. The Marine Resources Act 2005 states that the Ministry has the principal function of, and authority for, the conservation, management and development of the living and non-living resources in the fishery waters. It is described more fully in section 2.7 below.

2.3.2.6 Fishing communities

The concept of "fishing communities" has limited applicability to the Cook Islands. Nearly all households, especially those away from Rarotonga, are involved in fishing activities. It could therefore be stated that most villages in the Cook Islands are "fishing communities".

2.3.3 Inland sub-sector

The lack of large freshwater bodies in the Cook Islands results in freshwater catches being extremely small. Catches are limited to:

- eels on Mitiaro;
- six species of freshwater prawns where there are streams;
- tilapia on a few islands.

Annual freshwater fishery production in 2014 was estimated to be 5 tonnes, worth USD 37 500 (Gillett, 2016).

There is no specific management of the small inland fishery sub-sector.

2.3.4 Aquaculture sub-sector

A recent SPC study discusses aquaculture in the Cook Islands (Gillett, 2016). Currently the most significant type of aquaculture is pearl farming. Pearl production reached maximum production about 17 years ago. At its peak, there were 81 farms with 2 million shells in the water, accounting for more than 90 percent of national exports

and 20 percent of gross domestic product (MMR, 2012). Production has since declined due to bacterial infection and a decline in prices in the global pearl market (Hambrey Consulting, 2011). In 2014, there were about 10 active pearl farms, with a further 14 farms operating at a minimal level (Brown, 2015).

According to the Cook Islands Pearl Authority (CIPA), the annual benchmark surveys for pearl production were discontinued in 2010. Consequently, there is a wide range in current estimates of the number of saleable pearls produced annually and the associated value. For 2014, estimates ranged from 37 169 pearls (Brown, 2015) to 56 000 pearls (MMR staff and a large pearl retailer, personal communication, September 2015). In 2014, prices cited to pearl farmers ranged from USD 12.97 (CIPA) to USD 16.63 (MMR staff). The official export statistics of the Cook Islands show USD 284 000 worth of pearl exports, but as pointed out by several individuals associated with the pearl trade, only about half of the pearls are formally exported. The actual pearl export situation appears to be that most “non-exported” pearls are informally exported (i.e. hand carried and undeclared) or sold to tourists, who subsequently take them overseas. If 50 000 pearls worth USD 15.63 per pearl to the farmers were produced in 2014, that would equate to USD 781 500.

There were other types of aquaculture production in 2014. According to MMR staff this consisted of:

- Tridacna clams – about 30 000 were produced during the year, of which 2 000 were exported (at a farm-gate value of USD 3.90/clam), with non-exported clams being used for reef restocking.
- Milkfish – production is for both food and bait (USD 1.95/kg), with 2014 production estimated to be 10 tonnes worth USD 54 688.
- Tilapia – a small amount of tilapia is reportedly being produced at one farm, though details of production are not readily available. Production was deemed to be 2 tonnes in 2014, worth USD 11 719 to the farmer.

From the above information, the SPC study (Gillett, 2016) estimated that in 2014, Cook Islands aquaculture production was about 12 tonnes plus 52 000 pieces, worth USD 855 469.

The management of aquaculture in the Cook Islands is stipulated in the Marine Resources Act 2005. The management provisions are covered in Part II, Section 7, which states:

1. The Queen’s Representative may by Order in Executive Council designate an aquaculture management area.
2. The Secretary, or where appropriate, a local authority, shall prepare an aquaculture management plan for such aquaculture management area.
3. Each aquaculture management plan shall:
 - a) identify the area to which the plan shall apply;
 - b) describe the status of aquaculture activities in the area;
 - c) specify management measures to be applied to ensure sustainable aquaculture;
 - d) specify the process for allocating and authorizing participation in the area; and
 - e) address any other matter necessary for sustainable aquaculture.
4. The Secretary shall approve any aquaculture management plan prepared by a local authority in accordance with Subsection (2), and may not do so if it is inconsistent with the objectives, functions or authority in Section 3 or the principles and measures in Section 4 of this Act.

According to the Cook Islands Aquaculture Development Plan 2012–2016 (MMR and SPC, 2012), the goals of aquaculture development in the Cook Islands are to promote aquaculture best practices to responsibly and sustainably:

- enhance populations of selected aquatic resources;
- maintain food security;

- diversify income-generating opportunities, particularly in the Outer Islands;
- supplement capture fisheries in Cook Islands.

In terms of marketing aquaculture production, most of the pearls are exported, either formally or informally (i.e. hand-carried by producers or by tourists). In 2014, about 7 percent of the giant clams were exported to the United States for the aquarium trade, with the remainder used for local re-stocking purposes. Milkfish is used for domestic food and bait, and tilapia for domestic food.

2.3.5 Recreational sub-sector

The recreational sub-sector consists of local residents fishing for pleasure, and overseas tourists fishing from chartered commercial vessels, often referred to as game fishing. According to a study of game fishing in the Cook Islands (Wichman, 2012):

- game fishing is distinguished from other artisanal and small-scale fishing by the fact that game-fishing operators hire their fishing vessel out to visitors keen to score a billfish (swordfish, marlin, sailfish), or large tuna (yellowfin, bigeye) or smaller game fish (dolphinfish, wahoo, albacore or skipjack tuna, barracuda, sharks);
- 19 percent of all fishers in the country are either recreational fishers or part-time subsistence fishers;
- in 2012, there were 12 commercial “game-fishing and fishing charter operations” on Rarotonga and 5 on Aitutaki;
- the Cook Islands Game Fishing Club holds annual fishing competitions.

A study on further developing commercial game fishing was carried out by SPC (Piquel and Blanc, 2009). The study concluded that there was potential to diversify sport fishing opportunities on Rarotonga and to further develop it on Aitutaki. In particular, the report suggested that for Rarotonga, where current activities focus on big game fishing around FADs, activities could be diversified to include other fishing opportunities such as ultralight casting in Muri lagoon and medium and heavy casting and jigging close to reef passages, on the outer reef slope and around FADs.

Apart from the bonefish fishery in Aitutaki, where there is a management plan for bonefish, there is no specific management of recreational fishing in the Cook Islands. However, activities in this sub-sector must conform to the provisions of the fisheries and other legislation of the country.

2.4. POST-HARVEST SECTOR

2.4.1 Fish utilization

The marketing and processing of the production of small-scale fisheries in the Cook Islands are not well-developed. Although some of the production from small-scale fishers on Rarotonga, especially tuna and flyingfish, is sold through commercial channels, the majority of fish are consumed fresh or frozen by fishers and immediate families. Selling fish on the roadside is common, but an increasing amount is sold through trade stores. There is very little export of the fish and other seafoods taken in small-scale fisheries.

A number of attempts have been made to provide access to the Rarotonga market for outer island fishers. Fish collection and transportation schemes have been sponsored by both government and private entrepreneurs but have met with very limited success. These projects have generally been constrained by unsuitable or erratic shipping services, and by inadequate catch-handling facilities and procedures at the fishing sites. Nevertheless, refrigeration facilities exist on all the populated outer islands and frozen fish is sporadically sent to Rarotonga as gifts for family members, or for sale. Palmerston atoll, in particular, supplies substantial quantities of fish to the Rarotonga market on an opportunistic basis.

The above is applicable to edible fishery products. In contrast, pearl culture and trochus collecting are associated with elaborate marketing arrangements. The black pearls are sold both in Rarotonga and overseas, and trochus shells are sold unprocessed to factories in Asia and Europe for the manufacture of mother-of-pearl buttons.

There are three types of marketing arrangements for tuna caught in the Cook Islands:

- The longliners fishing in the north of the country deliver their albacore and other tuna directly (all frozen) to the canneries in Pago Pago, American Samoa, for canning. Most of the production is for the market in the United States of America.
- The Rarotonga-based longliners offload in Avatiu Harbour. Current production is mainly for the domestic market, with most consumed by the booming tourism industry. In the past there were significant exports.
- The purse-seine tuna catch is all landed at locations outside the country, mainly Pago Pago in American Samoa, or transshipped to an Asian port.

2.4.2 Fish markets

On Rarotonga, where the cash economy is well developed, there are sales of fish both on the roadside and in sections of supermarkets and trade stores where local fish is sold. The one locally based longline company sometimes sells tuna and bycatch directly to restaurants and hotels, as do the smaller-scale troll fishers.

In the outer islands where subsistence fishing prevails, there are no formal markets for fish, but informal sales often occur.

2.5. SOCIO-ECONOMIC CONTRIBUTION OF THE FISHERY SECTOR

A recent study by SPC (Gillett, 2016) attempted to quantify the fishery-related benefits received by the Cook Islands and other Pacific Island countries. The study gave available information on the contribution of fishing to GDP, exports, government revenue and employment. Unless otherwise noted, the information in this section is from that study.

2.5.1 Role of fisheries in the national economy

The Statistics Office of the Ministry of Finance and Economic Management makes the official estimate of the contribution of fishing to the GDP of the Cook Islands. The SPC study examined the official methodology and, using its independent estimate of the value of fisheries production, re-estimated the fishing contribution as follows:

- The official contribution showed a 2014 fishing contribution to GDP of USD 17.8 million, or 6 percent of GDP.
- The contribution of fishing to GDP was re-estimated by the SPC study for the year 2014. It showed a contribution of USD 3.0 million, or 1.0 percent of GDP.

In 2014, the Cook Islands received USD 8.4 million as access fees for foreign fishing. According to the Cook Islands Government Quarterly Financial Report (MFEM, 2015a), in fiscal year 2014/2015, the government's "operating revenue" was USD 74.1 million. Therefore, the access fees for foreign fishing represented 11.4 percent of the operating revenue for fiscal year 2014/2015.

2.5.2 Trade

The official overseas trade statistics of the Cook Islands (MFEM, 2015b) give the value of the exports of the country, including fishery exports (Table 2.6).

The data in the table is different from the FAO data for fishery exports given in Part 1 of this profile: USD 2 931 000 for 2014. In scrutinizing the above table for possible sources of the difference, the value given for "Fish fresh or chilled" is curious. The value on the table does not correspond to what was offloaded and exported from Rarotonga-based longliners (Brown, 2015), nor to catches in Cook Islands waters (section 2.3.1 of this profile), nor to catches by Cook Islands-flagged vessels (MMR, 2015). The cited

values for “Fish fresh or chilled” in the table are likely to include some (but not all) of the catch that is being transshipped by Cook Islands-flagged vessels in ports outside the Cook Islands.

For 2014, the FAO data indicates USD 1 599 000 of fishery imports, as reported in Part 1 of this profile.

2.5.3 Food security

Some earlier studies on fish consumption in the Cook Islands gave the following information:

- Preston (2000), using 1995 FAO data on production, imports and exports, estimated the annual per capita fish consumption to be 63.2 kg.
- MMR (2000) stated that Cook Islanders consumed, on average, 47.0 kg of seafood per person per year.
- Passfield (1997) gave the annual per capita consumption of fish on Tongareva Island as 219.0 kg.

Bell *et al.* (2009b) used information from household income and expenditure surveys (HIES) conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES were designed to enumerate consumption based on both subsistence and cash acquisitions. For the whole of the Cook Islands, the annual per capita fish consumption (whole weight equivalent) was 34.9 kg, of which 81 percent was fresh fish. For rural areas the figure for per capita consumption of fish was 60.9 kg, and for urban areas, 24.8 kg. According to the study, overall, Cook Islanders obtained about 35 percent of their animal protein from fish.

In the Cook Islands, there has been a significant amount of work on fishery resource consumption on Rarotonga. The most recent work appears to be an investigation undertaken in September 2006 into the consumption of seafood and meat in Rarotonga (Moore, 2006). Ninety households in Rarotonga were surveyed (with a questionnaire) using a random sampling method. The results showed a continual decline in average daily per capita fish consumption since 1989, from 318 g in 1989 to 271 g in 2001 and 176 g in 2006¹³ (or on an annual basis, from 115.9 kg to 98.8 kg to 64.2 kg). The decrease in finfish consumption was attributed to many factors, such as ciguatera, marine protected areas, changes in the lifestyle of residents, and the high cost of finfish as opposed to meat products.

Two factors affecting fish consumption on Rarotonga have emerged in recent years – ciguatera, and tuna from longliners:

- Several documents (e.g. Moore, 2006; MMR, 2008; MMR, 2010) point to a decrease in fish consumption on Rarotonga. A study by Rongo and van Woesik (2011) proposes that an increase in the occurrence of ciguatera fish poisoning over the past two decades has discouraged local fish consumption. They estimate that 52 percent of Rarotongans have experienced ciguatera at least once in their lives.
- A major change in fish consumption in Rarotonga since the early 2000s relates to the availability of fish from longliners. MMR (2008) states that the domestic market is estimated to absorb around 40 to 50 percent of the total catch from the longline vessels based in Rarotonga. In 2007, about 120 to 150 tonnes of whole

TABLE 2.6
Cook Islands' fishery exports for 2013 and 2014 (USD 000)

	2013	2014
Live fish	16	71
Fish fresh or chilled	212	82
Pearls	116	284
Pearl shells	40	0
All fishery exports	384	438
All exports	10 643	16 622
Fishery exports as a percentage of all exports	3.6%	2.6%

Source: (MFEM, 2015b).

¹³ In the text of the report it is not clear whether the per capita consumption is whole fish weight equivalent or food weight.

fish equivalent were sold domestically to the hospitality industry and the local population on Rarotonga. Brown (2015) states that the domestic longliners put 90 tonnes and 171 tonnes of fish on the Rarotonga market in 2013 and 2014, respectively.

2.5.4 Employment

The Cook Islands 2011 Census of Population and Dwellings (Statistics Office, 2011) contains a considerable amount of information on fisheries-related employment in the country. Overall, 42.4 percent of households in the Cook Islands participate in fishing or pearl farming. However, involvement in fishing appears to be declining. In 2011, 57.6 percent of households had not engaged in any level of fishing activity, whereas the previous census in 2006 showed 50.6 percent with no such activity.

Employment related to subsistence fishing differs considerably between Rarotonga and the outer islands:

- An SPC survey on Mangaia indicated that almost all households (92 percent) were engaged in fisheries with an average of one to two fishers each. In total, there were 309 fishers on Mangaia, including 148 women and 161 men. One third (111) of all fishers were men who targeted finfish exclusively and about another third (101) were women who exclusively targeted invertebrates. The remaining fishers basically did both (Kronen and Solomon, 2008a).
- A similar SPC survey on Rarotonga showed that less than half of all households (44 percent) were engaged in fisheries, with an average of one fisher per every second household only. These figures also included sport fishers and households using a motorized boat for weekend trolling outside the outer reef. About half (155) of all fishers were predominantly men targeting finfish, with very few women specializing in finfish fishing only. About a quarter of the fishers (69) were women who exclusively targeted invertebrates. The remaining fishers basically did both (Kronen and Solomon, 2008b).

The Forum Fisheries Agency (FFA) has some unpublished data on employment in the Cook Islands related to the tuna industry. It indicates that in 2014, there were no local crew members working on tuna vessels, but seven people were employed in “processing and ancillary”. In addition, five observers worked on tuna vessels under national and regional programmes.

2.5.5 Rural development

According to recent reports of the Ministry of Marine Resources, the government believes that marine resources offer the best opportunity to increase employment and income in the outer islands. The ministry’s efforts are focused on:

- assisting island councils in formulating and implementing fisheries management plans;
- sponsoring a national network of FADs to enhance food security and income by (a) maintaining FADs on a monthly basis, (b) maintaining FADs on islands without fisheries offices on a six-monthly basis, and (c) completing catch statistics and making catch reports available to the general public;
- providing support to pearl farming in the northern islands;
- carrying out resource assessments in support of commercial harvests and ra’ui areas;
- developing new commercial fisheries, such as that for deep-water snappers.

In addition to staff based in relatively developed Rarotonga and Aitutaki, the Ministry of Marine Resources has staff in more isolated locations: Atiu, Mangaia, Manihiki, Mauke, Mitiaro, Nassau, Palmerston, Penrhyn, Pukapuka and Rakahanga.

2.6. TRENDS, ISSUES AND DEVELOPMENT

2.6.1 Constraints and opportunities

Some of the major constraints of the fisheries sector include the following:

- There is a high incidence of ciguatera fish poisoning on Rarotonga.
- Rarotonga is a high-cost location for operating longline tuna vessels.
- Labour for industrial-scale tuna fishing is scarce. Considering population trends in the country, the domestic labour pool is not likely to grow in the foreseeable future.
- Over-exploitation of marine resources close to areas of population concentration is a growing problem.
- The benefits of purse seining in the Cook Islands EEZ are constrained by concern over the status of the bigeye resource due to the high incidence of setting on FADs in the Cook Islands zone.

Opportunities in the fisheries sector include:

- taking advantage of the booming tourism industry for sales of marine products/ services at favourable prices (e.g. pearls, tuna, game fishing);
- legislating for the use of traditional protected areas (ra'ui) as a fisheries management tool;
- increasing tourism by clever marketing of the huge Cook Islands Marine Park;
- taking advantage of the relatively high level of fisheries development and management skills in the Ministry of Marine Resources;
- using the positive example of the benefits of fisheries management in Aitutaki to promote fisheries management in other areas of the country.

2.6.2 Government and non-government sector policies and development strategies

The major policies and strategies¹⁴ of the Government of the Cook Islands' Ministry of Marine Resources in the various fisheries sub-sectors include:

- **offshore fisheries development** – expanded income earning opportunities from sustainably managed offshore fisheries through capacity building, and infrastructure and market development;
- **pearl industry rejuvenation** – a profitable and sustainable pearl industry through improved productivity and environmental management;
- **inshore fisheries and aquaculture development** – improving income-generating opportunities for the private sector, particularly in the outer islands, through increased provision of technical and scientific assistance;
- **food security and subsistence fisheries** – ensuring sustainable fishing and conservation practices, resulting in long-term food security and traditional subsistence practices;
- **marine conservation, biodiversity and eco-tourism** – supporting the protection and conservation of natural marine biodiversity and its affiliated customary practices and knowledge, and potential commercialisation, such as marine eco-tourism.

The policies/strategies of the major NGO working in the fisheries sector, Te Ipukarea Society, are given in section 2.7 below.

2.6.3 Research

Historical fisheries research is detailed in the “Cook Islands fisheries bibliography” (Gillett and Tearii, 1989) and in the “Cook Islands fisheries resources profiles” (FFA, 1993).

The Ministry of Marine Resources undertakes fisheries and aquaculture research in the Cook Islands. According to the Ministry's website, current research deals with:

¹⁴ Source: <http://www.mmr.gov.ck>

- pearl culture
- the effectiveness of ra'ui protected areas
- analysis of tuna catch and effort data
- outbreaks of crown of thorns starfish, ciguatera and coral bleaching
- monitoring of key inshore fishery resources
- the water quality of lagoons.

The Ministry of Marine Resources currently has three Fisheries Officers stationed at the Araura (Aitutaki) Marine Research Centre.

Conceptually, tuna research in Cook Islands can be thought of as occurring on three levels:

- The collection of data by the Ministry of Marine Resources, mainly through the requirement that all licensed vessels maintain and submit logbooks.
- Relatively simple compiling, processing, analyzing, interpreting and presenting of Cook Islands tuna data by the Ministry of Marine Resources.
- More complex, sophisticated data analysis by SPC's Oceanic Fisheries Programme (OFP). This category is further divided into two sub-components: (a) analysis of Cook Islands data for presentation to the Ministry of Marine Resources for national use, and (b) combining of Cook Islands data with that of other Pacific Island countries to enable regional assessments by OFP. An example of the end products of this process is the report on the overview and status of tuna stocks in the Pacific Islands region produced annually by OFP staff.

2.6.4 Education and training

Education related to fisheries in the Cook Islands is provided by a variety of institutions:

- Academic training in biological, economic and other aspects of fisheries is available at the University of the South Pacific in Suva, and to a lesser extent at universities in New Zealand, Australia and the United Kingdom.
- Training courses, workshops and attachments are frequently arranged by regional organizations – SPC in New Caledonia and FFA in the Solomon Islands. The subject matter has included such diverse topics as fish-quality grading, stock assessment, seaweed culture, fisheries surveillance and on-vessel observing.
- Courses and workshops are also held by NGOs and bilateral donors.

2.6.5 Foreign aid

New Zealand is by far the largest donor of development assistance to the Cook Islands, the amount being reviewed annually by the New Zealand Government. Direct assistance for development of the fisheries sector has historically flowed from a range of sources, including ACIAR, AusAID, China, EU, FFA, FAO, JICA, NZODA, SPC, UNCDF, UNDP and USAID. Projects have variously been concerned with the provision of shore-based plant and equipment (buildings, ice plants, aquaculture and mariculture research and training centres, and fisheries stations), fishing vessel construction, research, fishery harbours, marketing, training, FADs and pearl farming equipment. In recent years, much fisheries aid has been directed to supporting the development of the pearl culture industry.

The largest donor-supported fisheries project in recent years was the Cook Islands Marine Resources Institutional Strengthening Project (CIMRIS). The main aim of this New Zealand-funded project was to build capacity to achieve sustainable management of marine resources. The project operated from 2006 until 2010. Six sets of activities were pursued, including building management capability in the Ministry of Marine Resources and strengthening existing institutions to take action to improve lagoon water quality.

2.7. INSTITUTIONAL FRAMEWORK

Successive Cook Islands Governments have long considered the country's marine resources to be a priority for development. This was demonstrated by the formation of the Ministry of Marine Resources in 1984. It was the first government ministry in the Pacific Islands region dedicated to the fisheries sector, with fisheries in most other countries coming under the control of the ministry responsible for agriculture. The Ministry of Marine Resources was formed, in part, as a response to the United Nations Convention on the Law of the Sea (1982) from which the Cook Islands anticipated substantial development opportunities (Passfield, 1999).

The current Ministry of Marine Resources is responsible for the conservation, management and development of marine resources, both living and non-living, for the benefit of the people of the Cook Islands.

According to its website (<http://www.mmr.gov.ck>), the ministry is managed by a Secretary. It is headquartered at Rarotonga but also maintains fisheries officers on the islands of Aitutaki, Atiu, Mangaia, Manihiki, Mauke, Mitiaro, Nassau, Palmerston, Penrhyn, Pukapuka and Rakahanga. It employs observers based in Apia, Samoa, and New Zealand, and two staff at a field office in Pago Pago, American Samoa. The ministry operates a pearl oyster hatchery at Penrhyn, a giant clam and trochus hatchery at Aitutaki, a marine laboratory at Manihiki and a chemistry and microbiology laboratory at Rarotonga. As at 30 June 2016, the ministry employed 61 staff in total, made up of 49 full-time and 5 part-time staff and 7 service providers, and had an annual appropriation of USD 1.1 million.

The Ministry has several divisions, described below together with their areas of responsibility:

Offshore Fisheries

- Expand income earning opportunities from sustainable offshore fisheries, through effective management, capacity building, and infrastructure and market development.
- Enhance current monitoring control and surveillance capabilities, ensuring compliance with licence and access agreement conditions.

Pearl Industry Support and Environmental Management

- Improve the quality and diversity of cultured black pearls and pearl products by better farm husbandry, improve access to financial support, mitigate environmental impacts, promote research and development and, wherever possible, strengthen local capacity.
- Develop capacity in cross-cutting areas within the marine sector concerning environmental management, public health safety and food safety programmes.

Inshore Fisheries and Aquaculture

- Improve income generating opportunities for the private sector, particularly in the outer islands, through increased provision of assistance to allow small-scale fisheries opportunities and to develop new, local commercial export fisheries.
- Ensure safe, sustainable fishing and conservation practices, the protection of culture and tradition and long-term food security.

Policy and Legal Services

- Ensure appropriate legal and policy frameworks governing the ministry and marine resources sector are in place.
- Ensure that all licensed vessels are properly registered and a licensing register system is in place.
- Ensure provision of sound legal advice on issues emanating from ministry-related activities.

Corporate Services

- Ensure all management and financial decisions are informed and fiscally responsible and compliant with government financial practices.
- Provide excellent ICT infrastructure that caters for current and future trends whilst maintaining robust user policies.

Te Ipukarea Society (TIS) is the major NGO working in the fisheries sector. According to the society's website (<http://tiscookislands.org/>), TIS is a proactive NGO formed to help look after the Cook Islands heritage. Its philosophy is "we do not own our land and marine resources but borrow them from our future generations, and need to leave them in good condition". TIS is a collection of individuals and groups who desire a sustainable, healthy and beautiful environment. Their main interactions with the fisheries sector include:

- the Year of the Coral Reef campaign;
- a longline and purse-seine fishing awareness campaign – "Te Ki o to Tatou Moana ei Angai rai ia Tatou" (Our ocean of fish is for the sustenance and nourishment of our people);
- supporting and working with Cook Islands Whale Research, the Cook Islands Whale and Wildlife Centre, and the Cook Islands Voyaging Society;
- Marine Park project management;
- campaigning against the use of drifting FADs in the purse-seine fishery because of the impact on bigeye tuna and other vulnerable bycatch species.

Other associations with involvement in the fisheries sector are the Cook Islands Fishing Association, Cook Islands Game Fishing Club and Manihiki Pearl Farmers Association.

Important internet links for external partners in fisheries in the Cook Islands include:

- Forum Fisheries Agency (FFA): www.ffa.int
- Pacific Community (SPC): www.spc.int
- Western and Central Pacific Fisheries Commission (WCPFC): www.wcpfc.int

2.7.1 Regional and international institutional framework

The major regional institutions involved in fisheries are the Forum Fisheries Agency (FFA), located in Honiara, and the Pacific Community (SPC), which has its headquarters in Noumea. Other players are the Parties to the Nauru Agreement (PNA) Office in Majuro, the Pacific Islands Forum Secretariat (PIFS) in Suva, the Secretariat of the Pacific Regional Environment Programme (SPREP) in Apia, and the University of the South Pacific (USP) in Suva. The characteristics of these institutions are given in Table 2.7.

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean entered into force in June 2004 and established the Western and Central Pacific Fisheries Commission (WCPFC). The Cook Islands is a member of the commission along with 26 other countries. The WCPFC has its headquarters in Pohnpei, Federated States of Micronesia, and has held 13 annual meetings to date.

2.8. LEGAL FRAMEWORK

The main fisheries law of the Cook Islands is the Marine Resources Act 2005. This 56-page document has 10 parts:

- Part 1: fisheries conservation, management and development
- Part 2: fishing and related activities
- Part 3: conservation measures
- Part 4: licensing
- Part 5: monitoring, control and surveillance

TABLE 2.7
Pacific Island regional organizations involved in fisheries

	FFA	SPC	Other regional organizations with fishery involvement
Main area of emphasis	Providing management advice on tuna fisheries and increasing benefits to Pacific Island countries from tuna fishing activities	Most aspects of coastal fisheries and scientific research on tuna. Fisheries are only one aspect of SPC's work programme, which also covers such issues as health, demography and agriculture.	PNA – subregional grouping of the countries where most of the purse seining occurs. SPREP – environmental aspects of fisheries. USP – School of Marine Studies (SMS) is involved in a wide range of training. PIFS – major political initiatives, some natural resource economics; leads trade negotiations with EU, which have a major fisheries component.
Inter-regional relationships	The FFA/SPC relationship has had ups/downs over the years. It has been most difficult in the early 1990s, with tremendous improvement in the mid/late 1990s. An annual colloquium has helped the relationship. Staff who have moved between the two organizations have made a noticeable improvement in understanding. Much of the success/benefits achieved by FFA/SPC cooperation depends on the personalities of FFA's Director/Deputy and SPC's Director of the Division of Fisheries, Aquaculture and Marine Ecosystems.		At least in theory, all regional organizations come under the umbrella of PIFS with their activities coordinated to some degree by the Council of Regional Organisations in the Pacific (CROP). CROP has a Marine Sector Working Group that meets at least once per year, but is limited by lack of resources for follow-up. FFA originally provided secretariat services to PNA, but PNA broke away from FFA in 2010. Currently, there are some sensitivities in the relationship, but it appears to be improving.
Main strengths	Direct contact with its governing body many times per year results in a high degree of accountability. Mandate of tight focus on tuna eliminates considerable dissipation of effort.	Noumea being a pleasant place to work, there is considerable staff continuity. The Oceanic Fisheries Programme often sets the standard for tuna research in the world. Documentation of work is very good.	Because PIFS is under the national leaders, it is considered the premier regional organization. PNA has achieved considerable success and credibility in such areas as raising access fees, 100% observer coverage, eco-certification, high seas closures, and controls on FADs. USP is centrally located in the region and the SMS has substantial infrastructure. SPREP has close ties to NGOs active in the marine sector.
Membership	Australia and New Zealand, plus Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu	Includes the major metropolitan countries, all Pacific Island countries, and the French/UK/US territories – the most inclusive membership of any regional organization.	PNA: the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. USP: Cook Islands, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. SPREP: 21 Pacific Island countries and territories, plus Australia, France, New Zealand and United States of America. PIFS: same as FFA

Source: Adapted from Gillett (2014a).

Part 6: jurisdiction and evidence

Part 7: sale, release and forfeiture of retained property

Part 8: miscellaneous

Part 9: regulations

Part 10: general

Among the important and distinguishing features of the Act are the following provisions:

Authority: The Ministry of Marine Resources has the principal function of, and authority for the conservation, management and development of the living and non-living resources.

Designated fisheries and management plans: The Executive Council can declare a fishery as a designated fishery where, having regard to scientific, social, economic, environmental and other relevant considerations, it is determined that the fishery: (a) is important to the national interest; and (b) requires management measures for ensuring sustainable use of the fishery resource. A fishery plan for the management of each designated fishery in the fishery waters is to be prepared by the Secretary, and kept under review. Each fishery plan shall:

- identify the fishery;
- describe the status of the fishery;
- specify management measures to be applied to the fishery;
- specify the process for the allocation of any fishing rights provided for in the fishery plan;
- make provision in relation to any other matter necessary for sustainable use of fishery resources.

The management measures in such plans have the full force and effect of regulations promulgated under the Act.

Aquaculture Management Areas: The Executive Council can designate an area as an aquaculture management area where, having regard to scientific, social, economic, environmental and other relevant considerations, it is determined that aquaculture activities in the area (a) are important to the national interest; and (b) require management measures for ensuring sustainability. The Secretary, or where appropriate a local authority, shall prepare an aquaculture management plan for such aquaculture management area. Each aquaculture management plan shall:

- identify the area to which the plan shall apply;
- describe the status of aquaculture activities in the area;
- specify management measures to be applied to ensure sustainable aquaculture in the area;
- specify the process for allocating and authorizing participation in aquaculture activity in the area;
- make provision in relation to any other matter necessary for sustainable aquaculture.

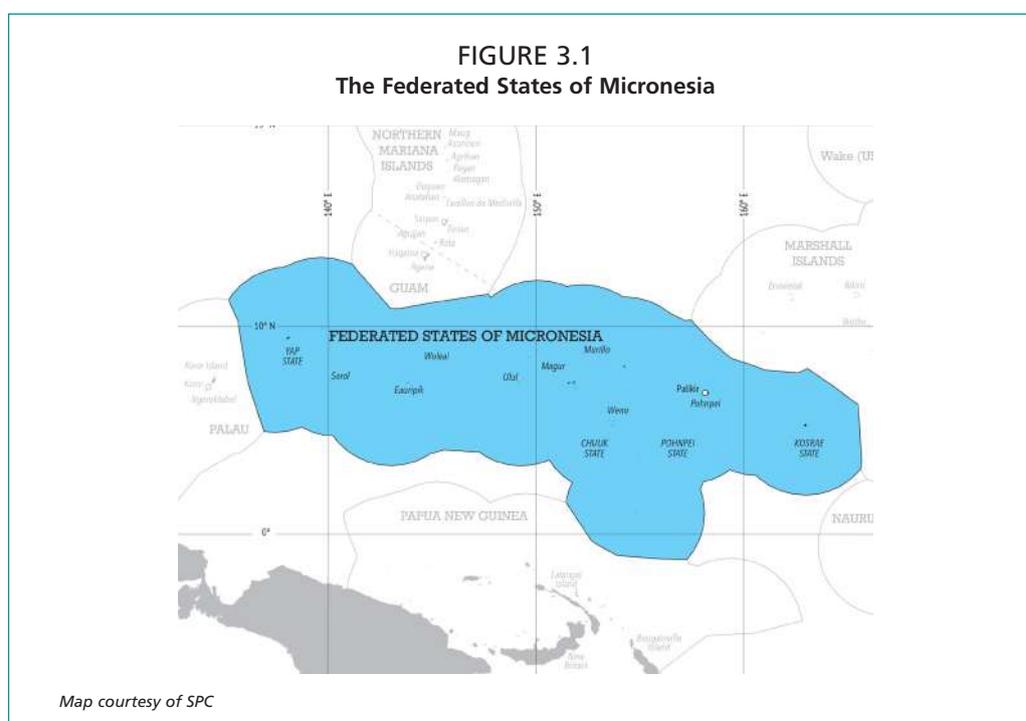
Conservation, management and development of fisheries of local interest by local authorities: A local authority may take measures for the conservation, management and development of any fishery of local interest or aquaculture within its area of authority in accordance with the principles and provisions of the Act, including preparation of (a) a fishery plan in cooperation with the ministry; and (b) where no fishery plan exists, by-laws for promulgation by the Queen's Representative.

Fishing rights: Any fishery plan may provide for the allocation by the Secretary of fishing rights within the following class of rights:

- A right to take a particular quantity of fish, or to take a particular quantity of fish of a particular species or type, or a proportion of fishing capacity, from, or from a particular area in, a designated fishery.
- A right to engage in fishing in a designated fishery at a particular time or times, on a particular number of days, during a particular number of weeks or months, or in accordance with any combination of the above, during a particular period or periods.
- A right to use a boat or particular type of vessel, or a particular size of vessel, or a boat having a particular engine power, in a designated fishery.
- A right to use a particular fishing method or equipment in a designated fishery.
- Any other right in respect of fishing in a designated fishery.

In January 2017, a draft fisheries bill to replace the Marine Resources Act was under discussion in parliament. Although many parts of the bill are similar to the 2005 Act, a major change is a move towards using a quota management system for management of the longline fishery.

3. The Federated States of Micronesia



REPORTING YEAR

This profile was written in 2017, based on data mostly from 2014.

PART 1. OVERVIEW AND MAIN INDICATORS

3.1 GENERAL GEOGRAPHIC AND ECONOMIC INDICATORS

TABLE 3.1
General geographic and economic indicators - Federated States of Micronesia

Land area ¹	701 km ²
Water area ²	2 978 000 km ²
Population (2010) ³	102 843
GDP of the Federated States of Micronesia (2014) ⁴	USD 318 100 000
Fisheries contribution to GDP (2014) ⁵	USD 31 800 000
Fisheries contribution as a % of GDP (2014) ⁶	10

¹ Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia.

² Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia.

³ 2010 Total Population Census from the Federated States of Micronesia Statistics website: www.fsmstats.fm

⁴ Reported in Gillett (2016) from the FY 2014 Statistical Compendium (Graduate School, 2015a).

⁵ Reported in Gillett (2016) from the FY 2014 Statistical Compendium (Graduate School, 2015a). GDP contribution excludes that of foreign-owned locally based fishing vessels, but includes all fish processing and the shore-based services of the vessel-operating companies.

⁶ Reported in Gillett (2016) from the FY 2014 Statistical Compendium (Graduate School, 2015a).

3.2 FAO FISHERIES STATISTICS

TABLE 3.2

FAO Fisheries statistics on total production, employment and trade – Federated States of Micronesia

2014		
Production (tonnes)	Aquaculture	0
	Capture	50 615
	Total	50 615
Employment (thousands)	Aquaculture	N/A
	Capture	N/A
	Total	N/A
Value of trade (USD 1000)	Fisheries exports	54 721
	Fisheries imports	9 185
	Total	63 906

Source: FAO Statistics and Information Branch of the Fisheries and Aquaculture Department. N/A: Data is not available.

PART 2. NARRATIVE

3.3 PRODUCTION SECTOR

3.3.1 Introduction

The Federated States of Micronesia comprises some 700 islands, ranging in size from large, fertile, high islands to tiny coral islands. These islands stretch about 2 500 km in an east-west direction just north of the equator. The urban centres of each state are all located on high islands where land and freshwater resources are more abundant. These features have major implications for the country's fisheries.

The fisheries sector is a major component of the economy. Subsistence fishing is important to most households in the country and is a critically important part of the food supply in the outer islands. The money received from licensing foreign fishing vessels represents about 20 percent of all government revenue and grants.

Fisheries statistics can be presented in different forms to cater for different purposes. In the Federated States of Micronesia statistics published by FAO (Part 1 of this profile) the presentation follows the international conventions and standards used by FAO and its Member States for reporting catches, which are given by the flag of the catching vessel. Accordingly, the fishery and aquaculture production of the Federated States of Micronesia in 2014 published by FAO (as given in Part 1) was 50 615 tonnes.

In Table 3.3 below, the Federated States of Micronesia fishery production statistics include the catch by Federated States of Micronesia-flagged vessels, the catch by small boats (which do not carry a flag) and the catch from fishing activities that do not involve a vessel (e.g. reef gleaning). The offshore category in the table is defined as the catch from Federated States of Micronesia-flagged, industrial-scale fishing operations that are carried out anywhere in the western and central Pacific Ocean (i.e. inside or outside the Federated States of Micronesia waters).

TABLE 3.3

Federated States of Micronesia fisheries production (as per FAO reporting standards)

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Federated States of Micronesia-flagged offshore
Volume (tonnes unless otherwise stated)	37 400 pieces plus 8 tonnes	1	1 725	3 555	40 838
Value (USD)	164 800	8 000	5 000 000	8 800 000	n/a

The production amounts given in the above table differ from those shown in Part 1. The table gives production estimated from a variety of sources (see SPC study below), whereas the quantities reported in Part 1 are generally those reported to FAO by the National Oceanic Resource Management Authority (NORMA). The major difference between the amounts in the above table and in Part 1 is in the category “locally-flagged offshore”. The amount listed in Table 3.3 for this category is from the Federated States of Micronesia’s official report to the Western and Central Pacific Fisheries Commission (Phillip *et al.*, 2015).

A recent study by the Pacific Community (SPC) presented the fishery statistics in a different way from that of FAO. The SPC study reports the amount of catch in the Federated States of Micronesia fishery waters, regardless of vessel flag. In the study, the catches are placed in different categories, which is useful for other purposes, such as administration of the foreign fishing that occurs in the fishery waters. A summary of fishery production from the SPC study is given in Table 3.4 below.

TABLE 3.4
Federated States of Micronesia fisheries production in 2014 (as per the SPC study)

	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Offshore locally based ⁷	Offshore foreign-based ⁸
					Both locally- and foreign-flagged vessels	
Volume (tonnes)	37 400 pieces plus 8 tonnes	1	1 725	3 555	40 838	124 481
Value (USD)	164 800	8 000	5 000 000	8 800 000	85 342 200	228 148 080

Source: Gillett (2016).

Some comment is required to explain the difference between the information in this table and that in Part 1 of this profile.

- Catches can be given by the flag of the catching vessel (as in the FAO statistics given in Part 1), or by the zone where the catch is made (the “offshore foreign-based” and “offshore locally based” columns in the table above). These two different ways of allocating catches each have their purposes. Attribution by flag is important for consistency with international conventions, while attribution by zone is important for determining fishing contributions to GDP, and managing revenue from licence fees for foreign fishing in a country’s zone.
- In the Federated States of Micronesia there is no fisheries statistical system covering the categories of aquaculture and coastal subsistence/commercial fishing. The estimates above were made in a study carried out by SPC in 2015 that examined a large number of fishery and economic studies covering the last two decades. It is likely that the basis of the information for the three categories in the FAO statistics in Part 1 above was a more informal conjecture by a nominated person NORMA.
- Aquaculture production includes non-food items, such as coral and giant clams for the aquarium trade, and sponges, which may not be included in the FAO statistics.

⁷ In the SPC study, “offshore locally based” is the catch in the Federated States of Micronesia waters from industrial-scale tuna fishing operations that are (a) based at a port in the Federated States of Micronesia, and (b) generally harvested more than 12 nautical miles offshore.

⁸ “Offshore foreign-based” is the catch in the Federated States of Micronesia zone from catch from industrial-scale tuna fishing operations that are based at ports outside the Federated States of Micronesia. Under the international standardized System of National Accounts (SNA, 2009), those catches do not contribute to the GDP of the Federated States of Micronesia.

3.3.2 Marine sub-sector

3.3.2.1 Catch profile

The marine fisheries of the Federated States of Micronesia have two very distinct components, offshore and coastal:

- Offshore fisheries consist almost exclusively of tuna fishing from vessels that are both locally and foreign based.
- Coastal fishing is carried out for subsistence purposes and for sale in local markets. Some production is sent to family and friends in Guam, Saipan and Hawaii.

The volumes and values of locally-based offshore fishing and foreign-based offshore fishing are given in Table 3.5.

TABLE 3.5
Locally-based offshore fishing and foreign-based offshore fishing

		2012	2013	2014
Locally-based	Total volume locally based purse seiners and longliners (tonnes)	37 810	26 118	40 838
	Total value locally based purse seiners and longliners (USD)	72 637 000	55 678 700	85 342 200
Foreign-based	Volume all foreign-based fishing in the Federated States of Micronesia zone (tonnes)	179 077	205 280	124 481
	Value all foreign-based fishing in the Federated States of Micronesia zone (USD)	309 552 781	346 415 036	228 148 080

Source: Gillett (2016)

The catch by both local and foreign-based offshore vessels is greatly affected by the climatic event known as El Niño. This has a great effect on tuna in the Federated States of Micronesia, including their recruitment, abundance, distribution and ease of capture. During an El Niño event, the thermocline becomes more distinct and closer to the surface in the western and central Pacific Ocean. This tends to restrict the vertical movement of tuna schools, making them more vulnerable to capture by purse-seine gear than in non-El Niño periods (referred to as La Niña). Importantly for the country, during El Niño periods the purse-seine fishery moves eastward and tuna catches tend to decline sharply.

There is considerable uncertainty concerning the levels of catches from the coastal fisheries. Coastal fisheries are not covered by a statistical system. An SPC study carried out in 2015 (Gillett, 2016) used several sources of information to estimate fisheries production:

- An estimate of fishery production in the Federated States of Micronesia by the Asian Development Bank in 2008 (Gillett, 2009a).
- Several specialized studies that give aspects of fish production in parts of the county.
- SPC population information.
- A 2015 household income and expenditure survey that was carried out with special attention to fish acquisition.
- Perceptions of knowledgeable individuals.

The SPC study concluded that coastal fisheries production in 2014 was 5 280 tonnes (1 725 tonnes commercial, 3 555 tonnes subsistence), with a value of USD 5 million for the commercial catch and USD 8.8 million for the subsistence catch.

The lack of a fisheries statistical system for coastal fisheries prevents the identification of quantitative trends in these fisheries. There is, however, a general perception that the important coastal resources are increasingly subject to over-exploitation close to urban areas.

3.3.2.2 *Landing sites*

Of the offshore fleets mentioned above, only the locally based longliners land fish in the Federated States of Micronesia. Purse-seine tuna catches are not landed.

Depending on the nationality of the vessel, the tuna is either transshipped for transport to a cannery (seiners from Taiwan Province of China and Republic of Korea), delivered directly to Pago Pago (United States of America-flagged vessels), or delivered to a port in Japan (Japanese vessels). Some vessels may make direct deliveries to canneries in the Philippines.

The pole-and-line vessels that occasionally fish in the Federated States of Micronesia zone do not land fish in country. Those fish are delivered to a port in Japan at the conclusion of each fishing trip.

Landings from the coastal commercial fishery are made mostly at population centres. That fish is generally sold to households where at least one member has formal employment. Subsistence fishery landings occur at villages throughout the coastal areas of the country, roughly in proportion to the distribution of the population. Chuuk State, which has about half of the population, receives about half of the landings.

3.3.2.3 *Fishing practices/systems*

The Federated States of Micronesia and the other countries of Micronesia have had a much longer involvement in offshore fishing than other parts of the Pacific Island region. To understand the current offshore practices of the Federated States of Micronesia and nearby countries, some understanding of the history of fisheries development is useful (Box 3.1).

BOX 3.1

Some history of offshore fishing in the Federated States of Micronesia

After the outbreak of World War I, Japan declared war on Germany in August of 1914 and subsequently wrested control of the German Pacific Island possessions to the north of the equator – now known as Palau, the Federated States of Micronesia, the Marshall Islands and the Northern Mariana Islands. After the war Japan was awarded control of these islands by a League of Nations mandate. In the early 1920s, an eight-year survey of the marine resources of the area was followed by subsidies from Japan for the purchase of tuna boats, fishing gear and processing equipment. Japanese tuna fishermen and fishing companies began entering the area in ever-increasing numbers in the early 1930s. The primary interest was pole-and-line tuna fishing and secondarily tuna longlining, with some tuna trolling trials. By the mid-1930s, Japanese tuna fishing was well-developed in the area with 45 pole-and-line vessels based in Palau, 52 in the Federated States of Micronesia and 19 in the Northern Mariana Islands. Tuna catches in Micronesia reached the highest level of 33 000 tonnes in 1937. Most of the production was processed into a dried tuna product, “katsuobushi”, which was shipped to Japan. There were also at least two tuna canneries in operation. During this period there was little participation by indigenous local residents in the tuna industry. Okinawan fishers crewed the tuna fishing vessels and Japanese operated the processing facilities ashore.

All commercial tuna fishing in the area came to a halt during World War II. Much of the fishery infrastructure and tuna vessels were destroyed by war activity and the Japanese and Okinawan fishers were repatriated after the war. Under a United Nations trustee arrangement, the United States assumed control of the area, but was much less interested than Japan had been in economic development, including fisheries. As part of the terms of surrender, geographic restrictions known as MacArthur Lines were placed on the movements of Japanese vessels, which effectively prevented their tuna fishing in

Micronesia. These lines were extended four times and finally the last MacArthur Line was lifted in April 1952. Although Japanese fishing activity in what were then high seas areas gradually returned to the Micronesian region, U.S. government restrictions on economic activity ashore were held in place until the mid-1970s, precluding any return to the fish processing bases developed before the war.

Source: Gillett (2007).

The offshore fleets operating in the Federated States of Micronesia EEZ use only three gear types: purse seine, longline, and pole-and-line:

- Purse-seine vessels tend to fish mostly in the equatorial part of the Federated States of Micronesia zone, especially the area near Kapingamarangi and Nukuoro islands. In terms of the number of days spent fishing in the Federated States of Micronesia zone by seiners, there is little seasonality between months. There is, however, much inter-annual variation.
- Fishing patterns are less clear for longline vessels. The only general geographic observation that can be made is that the fishing grounds of the vessels are influenced by the fishing base and the vessels tend to group in company fleets. The small Taiwanese and Japanese longline vessels based in Guam tend to fish in the north of the Federated States of Micronesia zone, while those longliners based in Pohnpei (both domestic and foreign) tend to fish closer to Pohnpei in the centre of the zone. It appears that longline activity is at a maximum during the middle of the year (June–August). There is a tendency for less activity six months later, possibly due to the Chinese New Year period and its effect on the operation of Chinese and Taiwanese longliners.
- A small number of Japanese pole-and-line vessels operate in the zone. These vessels return to Japanese ports at the end of each trip. Although they sometimes fish as far south as the Coral Sea off Australia, they typically fish in the area to the east and north east of the Federated States of Micronesia EEZ. Fishing in that zone, if any, tends to be in the north and east of the zone.

Table 3.6 presents the numbers of vessels licensed to fish in the Federated States of Micronesia EEZ by year, by gear type and by nationality.

Subsistence and coastal commercial fishing employ a wide range of fishing gear and techniques in the Federated States of Micronesia. Such fishing is actually a continuum from purely subsistence to purely commercial fishing, with the latter being much more prevalent close to population centres. The most common coastal fishing techniques are spearing (both by day and with the use of lights at night), trolling from 5 to 6 m outboard-powered skiffs, handlining, gillnetting and castnetting.

3.3.2.4 Main resources

The marine fishery resources of the Federated States of Micronesia can be split into two broad categories:

- Offshore resources, which include tunas, billfish and allied species. They are characterized by an open-water pelagic habitat, potentially extensive movement of individuals, and wide larval dispersal. Offshore fisheries target three main tuna species: skipjack (historically, about three quarters of the total tuna catch), yellowfin and bigeye. Albacore are also taken incidentally by longline. Other species commonly caught in association with industrial tuna fishing include black marlin, blue marlin, striped marlin, swordfish, sailfish, wahoo and various species of sharks.

TABLE 3.6
Number of vessels licensed to fish in the Federated States of Micronesia EEZ

	Longline			Pole and line			Purse seine		
	2013	2014	2015	2013	2014	2015	2013	2014	2015
Taiwan Province of China	23	10	12				35	31	33
Republic of Korea							28	29	26
United States of America							40	37	37
Japan	51	55	37	22	20	21	33	31	30
People's Republic of China		22	24				12	14	14
Vanuatu									
Papua New Guinea							35		
Tuvalu									
Kiribati							8		
The Federated States of Micronesia	3	18	19				10	9	12
The Marshall Islands							10		
Philippines									3
New Zealand								1	1
Total	77	105	92	22	20	21	211	152	156

Source: Phillip and Lebehn (2016).

- Coastal resources, which include many groups of finfish and invertebrates. A survey in the 1990s found that in Chuuk, Kosrae, Pohnpei and Yap, the number of reef fish species was 205, 351, 445 and 370, respectively. The important families of finfish were: Lutjanidae, Lethrinidae, Serranidae, Scaridae, Labridae, Siganidae, Acanthuridae, Carangidae, Muligidae and Holocentridae. Important non-fish coastal resources included giant clams, trochus, octopus, mangrove crabs, lobster, beche-de-mer, turtles and seaweeds (Smith, 1992a). Most inshore fishery resources are characterized by their shallow-water habitats or demersal lifestyles. Because of their relative accessibility, these resources form the basis of most of the small-scale fisheries in the Federated States of Micronesia.

In terms of the status of the offshore fish resources, the four major species of tuna in the Federated States of Micronesia mix freely with those of the neighboring countries in the western and central Pacific. Recent information from the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC, 2016) shows that for:

- **skipjack** – the stock is currently only moderately exploited and fishing mortality levels are sustainable;
- **bigeye** – recent analysis indicates that overfishing is occurring for the bigeye tuna stock and that in order to reduce fishing mortality to that at maximum sustainable yield, a large reduction in fishing mortality is required;
- **yellowfin** – the current total biomass and spawning biomass are higher than at levels associated with maximum sustainable yields. Therefore, yellowfin tuna is not considered to be in an overfished state;
- **albacore** – there is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries. It should be noted that longline catch rates are declining, and catches over the last 10 years have been at historically high levels and are increasing.

Coral reef biodiversity and complexity are high in the country and this diversity diminishes notably from west to east within the region. Using stony corals as an example, approximately 350 species are recorded in Yap, 300 in Chuuk, 200 in Pohnpei and 150 in Kosrae (Kronen *et al.*, 2009).

In terms of the status of the coastal fishery resources, there have been studies on specific fishery resources (e.g. sea cucumber, trochus) at particular locations, but little has been assessed across the country. In general, it can be stated that those fish and invertebrate species that are sought after and are located in areas readily accessible to many fishers tend to be heavily exploited or overexploited.

Rhodes *et al.* (2011) examined nearshore fisheries management across Micronesia, including the Federated States of Micronesia. The study showed declines in the coral reef finfishery of Pohnpei due to excess fishing. For Micronesia in general, a number of key socio-economic drivers were found to contribute to marine resource declines: (1) the change from a subsistence to a cash economy; (2) an erosion of customary marine tenure; (3) a lack of political will for protecting marine resources; (4) an absence of effective, responsive fisheries management; (5) increasing population pressures and demand for reef resources, including for export; (6) undervalued reef and pelagic resources; (7) high external commodity costs; (8) unsustainable use of modernized fishing gear; (9) an erosion of traditional fishing ethics and practices; and (10) a paucity of educational and alternative employment opportunities.

3.3.2.5 Management applied to main fisheries

In the Federated States of Micronesia, there are three levels of government which have special significance for fisheries management:

- National government – has jurisdiction over fisheries management in the zone outside 12 miles from islands up to the outermost limits of the EEZ. Fisheries management by the national government follows the Management Plan on Tuna Fisheries for the Federated States of Micronesia 2015 (see below).
- State governments – the four states (Chuuk, Kosrae, Pohnpei and Yap) have jurisdiction over fisheries management in the waters in their respective 12-mile zones. Each state has its own administrative organizations, several agencies involved in fisheries, and its own plans for fisheries development and management.
- Local governments – in some of the states, local communities have a high degree of autonomy in the management of nearshore fisheries resources.

In terms of supra-national cooperation in the management of offshore fisheries, the Federated States of Micronesia works:

- on the sub regional level with the other countries that are members of the Parties to the Nauru Agreement (PNA), which is described below;
- on the regional level, as a member of the Western and Central Pacific Fisheries Commission (WCPFC) that was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. The Federated States of Micronesia and the other 26 members of the commission enact tuna management measures at the annual WCPFC meeting. From the perspective of the Federated States of Micronesia one of the most important recent measure is the Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean.

A crucial aspect of the management of the offshore fisheries in the Federated States of Micronesia is the PNA and its Vessel Day Scheme. The early history of the PNA is given by Tarte (2002):

In February 1982, the Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest was opened for signature. The Nauru Agreement had been negotiated by seven Pacific Island states – the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea and Solomon Islands. This group of countries (later joined by Tuvalu) is known collectively as the Parties to the Nauru Agreement (PNA). The conclusion of the Nauru Agreement marked the beginning of a new era in Pacific Island cooperation in the management of the

region's tuna stocks. It was an important milestone in the exercise of coastal states' sovereign rights over their 200-mile EEZs. The PNA group accounts for much of the tuna catch in the Pacific Island region. In 1999, it produced 98 per cent of the tuna catch taken from the EEZs of Pacific Islands Forum Fisheries Agency (FFA) members; 70 per cent came from three PNA members: Papua New Guinea, the Federated States of Micronesia and Kiribati. The group also accounted for 94 per cent of the access fees paid to the FFA Pacific Island states. By controlling access to these fishing grounds, the PNA group collectively wields enormous influence and power.

The most important fishery management tool of the PNA is the Vessel Day Scheme (VDS), which is described in Box 3.2.

BOX 3.2

PNA Vessel Day Scheme

In 2000, a study suggested that the PNA purse-seine management scheme that was then based on vessel numbers be replaced by a scheme based on purse-seine fishing days. The transition was actually made seven years later. In 2007, the Parties to the Nauru Agreement began implementing the Vessel Day Scheme (VDS), transitioning from permitting a total number of purse-seine vessels in the region (205) to permitting a total allowable effort (TAE) in number of purse-seine fishing days (44 703 days for 2012; 44 890 days for 2016). Given the volume, value and multi-jurisdictional nature of the fishery, it is arguably one of the most complex fishery management arrangements ever put in place. Its key features are as follows:

- System of tradable fishing effort (days) allocated to the eight Parties
- Limit on total effort (the TAE) ~ 45 000 days
- TAE is allocated to Parties based on zonal biomass and historical effort as PAEs (Party Allowable Effort)
- Fishing days are sold to fleets for fishing in each EEZ
- There is a minimum benchmark price for VDS days sold to foreign vessels
- Fishing days are monitored by a satellite-based Vessel Monitoring System (VMS)
- VMS monitoring is supported by observers on board all vessels
- Days are tradable between Parties
- Scheme costs are financed by levies on vessels

Due to the complicated nature of the new VDS system and the various constraints of the government fisheries agencies of the region (e.g. under-funded, under-staffed), it was expected there would be problems in the introduction of the scheme. This is not to say that the VDS has not produced substantial benefits for PNA countries. The system is creating competition for a limited number of days, thereby increasing the value of each day. In practice, the value of a fishing day before the VDS was roughly USD 1 350, but this increased to about USD 5 000 in July 2011 and days were being sold in 2016 for over USD 12 000.

On a different and less tangible level, another benefit is that the VDS moves fisheries management in the region to a desirable rights-based system. That is, fishing rights (such as vessel days) can be defined, allocated, and traded. Consistent with this transition to a rights-based approach, a VDS-style arrangement for management of the tropical longline fishery is being implemented by PNA.

Source: Havice (2013); Campling (2013); Gillett (2014a); Clark and Clark (2014).

The Management Plan on Tuna Fisheries for the Federated States of Micronesia 2015 states that it is the country's high-level fisheries policy. It is a "living document" that contains the mandate for NORMA to deliver services with regard to the effective and sustainable conservation, management, exploitation and development of tuna fisheries in the country. It also ensures the necessary monitoring, control, surveillance and enforcement measures to support domestic development aspirations and deter IUU activities in the Federated States of Micronesia's fisheries waters. The plan, which is part of the overall Federated States of Micronesia fisheries policy, focuses on all fishing activities in the EEZ and by locally-flagged vessels fishing in the high seas and other EEZs. This includes longline, purse-seine and pole-and-line fisheries. The plan specifically focuses on the tuna species of skipjack, yellowfin, bigeye, albacore and billfish, recognizing the last two are not targeted by any gear or specific fisheries. The impacts of fishing on target tunas, bycatch and dependent species, as well as the general marine environment, are also covered under the plan.

As indicated above, the four states of the Federated States of Micronesia (Chuuk, Kosrae, Pohnpei and Yap) have jurisdiction over fisheries management in the waters of their respective 12-mile zones. GPA (2001) indicated that coastal fisheries in the four states were very different with respect to fishery management arrangements, and that in some respects, the management regimes were so dissimilar that the situation resembled four different countries. This statement remains valid today.

Chuuk has historically had the largest state fishery agency in the Federated States of Micronesia. It is also the state with the most serious fishery management problems. A high and rapidly growing population is creating greater pressure on fishery resources. There are large numbers of boats in the lagoon (reportedly over 2 000). Although many of these are used primarily for transport, many are also used for fishing at least occasionally. Good air connections exist to Guam, which provides a market for a component of the catch. Dynamite fishing is prevalent, and dredging and sand-mining for fill and for building materials are largely uncontrolled. The state's numerous municipalities (and in some cases, individual reef owners) nominally have some authority to control access to their fishing areas, but these seem to be upheld only in the outer island and more remote parts of Chuuk proper, and are largely ignored close to the population centres. There is no current data on fish catches or production, but anecdotal information suggests that quantities of reef fish are being exported by air to Guam, and strong declines in the abundance of some resources are said to have occurred in some areas.

Kosrae is the state with the least complex fishery management environment. It is a single, small, high island with a relatively small population (who are historically less ardent fishers than those of other the Federated States of Micronesia states) and limited resources, and is distant from most commercial marketing opportunities. Kosrae's fishery management problems are mainly related to the smallness of the resource. Harvests of certain key species, such as trochus and crabs, are – or need to be – controlled. Most threats to coastal resources come from land-based developments that cause erosion, increased run-off, pollution or sedimentation. However, Kosrae probably has the best-developed coastal management system of any state, with environmental review procedures being progressively implemented for all coastal development projects. Basic statistics on catches are said to be collected on a regular basis, but these are not analyzed or published.

Pohnpei is something of an intermediate case in terms of resources, degree of exploitation and the extent of fishery management problems. Some production statistics are collected by the state fisheries agency, but these are not analyzed to show trends. The general perception in Pohnpei seems to be that resources are

not yet in crisis, but that the time is approaching when management action will be needed, at least on Pohnpei proper. Unfortunately, there is also something of a fatalistic view that management will not be possible until a crisis situation develops. As in other states, enforcement of state fishery laws by state police or conservation officers is largely ineffective, while the absence of traditional reef/lagoon tenure systems on Pohnpei proper may impede the development of community-based management arrangements. A major issue in Pohnpei is land-based development: the island has lost a large proportion of its virgin forest to cultivation and this is thought to have caused increased run-off, sedimentation and chronic reef degradation.

Yap is unique in the degree to which traditional marine tenure arrangements have been preserved both in Yap proper and in the outer islands. Inshore fishery management in the state essentially needs to be community-based because the state constitution and laws recognize that communities and their leaders have authority over access to and use of coastal areas. Relative to other states, Yap has a large resource base and in most areas a small population, so management issues related to overexploitation are generally not pronounced. Nevertheless, some resources, especially of sessile types such as clams and beche-de-mer, or of other species close to the state centre of Colonia, have been seriously overexploited in the past, demonstrating that the traditional system of tenure does not guarantee effective stewardship. For several years, the State Government has been progressively trying to introduce a coastal area management plan that will be implemented through the actions of both government and traditional groups. As elsewhere, sand-mining and dredging are serious environmental problems.

Management objectives

The objectives of offshore fisheries management are set out in two locations:

- Title 24 of the Federated States of Micronesia Code, also known as the Marine Resources Act of 2002, states that management measures should be adopted that promote the objectives of (a) utilizing the fishery resources of the Federated States of Micronesia in a sustainable way; (b) obtaining maximum, sustainable economic benefits from these resources; and (c) promoting national economic security through optimum utilization of resources.
- The Management Plan on Tuna Fisheries for the Federated States of Micronesia 2015 contains the long-term objectives for the purse-seine and longline fisheries:
 - Harvest at the optimum sustainable level, including all WCPFC management limits and measures covering target species, time and area closures, and FAD closures and all PNA hard limits.
 - Further increase industry's level of participation in the management of tuna resources to benefit citizens.
 - Maintain the long-term viability of domestic fleets.
 - Minimize any adverse environmental effects of the fishing methods and gear used on the marine environment.
 - Promote effective management, conservation and sustainability of fish stocks and the marine environment.
 - Ensure best value is gained from tuna fisheries under subregional, regional and international conventions, treaties and declarations of which the Federated States of Micronesia is a signatory.
 - Consider support for an endowment fund so as to transfer a portion of licensing fees to support coastal fisheries initiatives, recognizing alternative funding is already available under other sources.

The objectives of fisheries management at lower levels of government are not as well articulated and therefore must be inferred from context. In most of the states,

the common objectives appear to be preventing destructive fishing, deterring over-harvesting and protecting endangered species. The objectives of management at the village level mainly revolve around assuring the sustainability of local marine foods.

Management measures and institutional arrangements

In the management of offshore fisheries, the main management measures are the PNA Vessel Day Scheme (Box 3.2) and various technical limits, which are detailed in the Management Plan on Tuna Fisheries for the Federated States of Micronesia 2015:

“Technical limits for purposes of managing tuna fisheries, which include, inter alia: (a) commercial tuna fishing is prohibited in territorial areas unless States indicate otherwise; (b) other prohibited areas declared by States and Federal governments; and (c) full compliance of all measures specified under PNA requirements and related initiatives including time and area closures, catch retention and FAD closures.”

As an example of the management measures used at the community level, Table 3.7 (from Rhodes *et al.* 2011) lists example traditional management measures in Yap State.

The main institutions in the Federated States of Micronesia involved in fisheries management are covered in section 3.7.

TABLE 3.7
Examples of traditional fishery management in Yap State

Component of management	Status in 2008
Reef tenure rights (customary control of marine usage area and resources usage)	Yes, still strong
- Ownership of reef areas and fishing rights by small groups (estate, or household and associated resources)	Yes
- Individuals within clan have right to fish any of own clan's waters, with no restrictions	Yes
- Individuals within clan require permission of chief, or head of the estate or clan	Yes
Power of chiefs to enforce traditional, customary, marine tenure laws	Moderate/strong
Use of closures	
- Area (stocks)	Yes
- Season (stocks)	
- Custom (funeral)	Yes
Punishment for infractions	Yes
Outsider access	No
Ethics to avoid waste (take only what will be consumed or not more than one's share)	Yes
Restrictions to maintain subsistence fisheries	Yes
- Chiefs banned boats and outboard motors; only paddling and sailing canoes permitted	Yes
- Banned night-time spearfishing and monofilament gillnets	Yes
- Line only, no trolling, for tuna	Yes
Restrict access to species to ensure supply	
- Milkfish, giant clams, sea cucumber, coconut crabs, turtles	Yes
Restrict use of fish poisons (<i>Derris</i> sp. root)	Yes
Fishing restrictions on species	
- Certain species are property of high-ranking people/clans	Yes
Fishing methods or gear restrictions	Yes
- Certain gear (e.g. fish traps) can only be used by higher-ranking people/groups	Yes
- Maintain traditional skills – no boat and motors; only paddle and sailing canoes in some areas	Yes
- Banned use of monofilament gillnets	Yes
- Banned use of flashlight spearfishing	Yes
- Restricted use of pelagics for bait	Yes

Source: Adapted from Rhodes *et al.* (2011)

3.3.2.6 Fishing communities

The concept of “fisher communities” is not very relevant to the Federated States of Micronesia. People involved in the offshore fisheries do not live in separate communities but rather are widely dispersed around where the vessels are based, mainly around Kolonia on Pohnpei. Coastal commercial fishers are found near all urban areas, but they do not reside in specific communities. Nearly all households in villages (all of which are coastal) are involved in coastal fishing activities. It could therefore be stated that all villages are “fishing communities”.

3.3.3 Inland sub-sector

The Federated States of Micronesia has no significant inland fisheries. The larger islands have freshwater streams and ponds in which freshwater fish and invertebrates are found, but only very small amounts are captured.

There is no management dedicated to the tiny inland fisheries.

3.3.4 Aquaculture sub-sector

Aquaculture has been the focus of technical and development attention in the country for over 40 years and numerous reports, reviews and evaluations have been produced. In general, those documents authored by aquaculture specialists emphasize the tremendous potential of aquaculture in the country, while those by economists and fisheries specialists (e.g. the 2004–2023 Strategic Development Plan) are not very optimistic as to current and likely future benefits.

The National Aquaculture Center (NAC) was established in Kosrae in 1991 to explore aquaculture potential and to undertake research, demonstration and training. Its primary work involved propagation of giant clams for farming and re-seeding in other states. NAC was reviewed by an Asian Development Bank project in 2001 (Preston, 2001a). The report suggested that the government should either divest itself of NAC, or enter into a partnership with another organization better positioned to deliver research and educational and extension outputs, probably based on species other than giant clams. NAC is currently leased by a business that is oriented to exporting cultured coral, cultured giant clams, and aquarium fish.

Amos *et al.* (2014) indicate that aquaculture activities consist of corals, giant clams, sponges, blacklip pearl oyster and sandfish. To this could be added a small amount of seaweed culture. Currently, all significant aquaculture activities are carried out in Kosrae and Pohnpei States.

An SPC project (Gillett, 2016) recently examined aquaculture production:

- Coral culture is being carried out in both Pohnpei and Kosrae. According to the two producers, a crude estimate of annual production in 2014 was about 22 000 pieces (J. Mendiola, M. Selch, personal communication, September 2015). The farm-gate value for that production is about USD 66 000. The Federated States of Micronesia export records from CITES for the latest year available (2013) show that 3 314 pieces of live coral were exported.
- Giant clam culture is being carried out in both Pohnpei and Kosrae. According to the two producers, a crude estimate of the annual production in 2014 is about 12 000 pieces (J. Mendiola, M. Selch, personal communication, September 2015). The farm-gate value for that production is about USD 60 000. Export records from CITES for the latest year available (2013) show that 11 321 pieces of live giant clams were exported.
- The pearl oyster (*Pinctada margaritifera*) has been cultured since 1994 on the remote atoll of Nukuoro. The farm is community-based (owned and operated by the municipal council) and has received funding and technical support since its inception. Wild spat is collected to supply the farm. According to a Pohnpei State fisheries officer with involvement in the Nukuoro farm, about 1 600 pearls were

actually sold in 2014 (I. Fred, personal communication, September 2015). Pearl shells are also sold, perhaps 8 tonnes per year. The farm-gate value of that pearl and shell production was about USD 34 000.

- Sponges are cultured in Pohnpei. Annual production is about 1 800 sponges per year (J. Mendiola, personal communication, September 2015). The farm-gate price of that production is estimated to be USD 4 800.
- Sandfish and seaweed culture is currently at a very small scale in the Federated States of Micronesia and the amounts harvested in 2014 were not significant.

Table 3.8 summarizes the Federated States of Micronesia's aquaculture production in 2014.

TABLE 3.8
The Federated States of Micronesia aquaculture production in 2014

	Volume (pieces and tonnes)	Farm-gate value (USD)
Corals	22 000	66 000
Giant clams	12 000	60 000
Pearls and pearl shells	1 600 and 8 tonnes	34 000
Sponges	1 800	4 800
Total	37 400 pieces and 8 tonnes	164 800

Source: Gillett (2016).

There is little management specifically directed at aquaculture in the Federated States of Micronesia. Aquaculture operations must follow all applicable general regulations, such as those for building in coastal areas and water management.

3.3.5 Recreational sub-sector

Although subsistence fishing may have a large social component and be enjoyed by the participants, recreational fishing is not a major activity for local residents. In Pohnpei, there is a fishing club with about 50 members, many of whom are expatriates. A few hotels offer fishing activities (many trolling outside the reef) to their overseas guests.

There is no active management of the recreational sub-sector.

3.4. POST-HARVEST SECTOR

3.4.1 Fish utilization

In general, coastal fisheries production is for local consumption, with small amounts of finfish airfreighted to Guam, Saipan and Hawaii. Beche-de-mer is exported to China. Although the country produces an average of 200 tonnes of trochus per year, there is no local processing. In the past 20 years, there have been three trochus button blank factories (all on Pohnpei), but all have ceased operation – thought to be due to irregularity in the supply of raw material and relatively high labour costs.

In contrast, post-harvest aspects of the offshore fisheries mainly involve external trade. The catch from the various purse-seine fleets operating in the Federated States of Micronesia is almost all for canning, but there is considerable variation in the mechanisms used to get the catch to the canneries:

- Japanese purse seiners return to Japanese ports to offload their catch and do not transship in the Federated States of Micronesia or other Pacific Island countries.
- US purse seiners offload their catch at the canneries in Pago Pago, American Samoa, and do not usually transship in the Federated States of Micronesia.
- Taiwanese and Korean seiners (and those vessels of other national fleets owned by Taiwanese/Korean interests) usually transship their catch in a port in the Federated States of Micronesia or in a port in a neighboring country, mostly Papua New Guinea or the Marshall Islands.

The majority of fish landed in the Federated States of Micronesia by locally based longline vessels – most of which are based in Pohnpei – is air-exported to Japan via Guam. The amount of fresh tuna exported depends on the number of longline vessels fishing in the country. The Chinese longliners occasionally switch bases to the Marshall Islands to the east and Palau to the west, depending on fishing conditions and local government policies. The foreign-based longliners fishing in the Federated States of Micronesia mainly unload in Guam or in their home ports in Asian countries.

Tuna transshipment⁹ is a very important aspect of the Federated States of Micronesia tuna industry. In June 1993, Pacific Island countries instituted a ban on in-zone transshipments of fish, except at authorized ports. This was intended to facilitate monitoring of catches, increase port usage and generate revenue. In subsequent years, a large amount of tuna has been transshipped through local ports. This results in benefits to the country from various port charges. In addition, overall payments to the private sector for services and supplies, such as food, accommodation, rental cars and minor repairs, are substantial. A report by NORMA to the Western and Central Pacific Fisheries Commission (Phillip and Lebehn, 2016) indicated that in 2015:

- a total of 9 278 tonnes of tuna were transshipped in local ports by national and distant water purse-seine vessels. The Korean fleet had the highest number of transshipments;
- longline transshipments in 2015 totalled 3 439 tonnes in Pohnpei and 423 tonnes in Kosrae.

3.4.2 Fish markets

Products from coastal fisheries are marketed in various ways:

- In the outer islands where subsistence fishing prevails, fish landings may exceed demand and excess catch may be given away or informally bartered in return for favours or obligations. Surplus catch may also be preserved using simple techniques such as smoking, salting and drying.
- The catch from artisanal fisheries is mostly marketed in the four main population centres where local demand for fresh fish is strong and generally exceeds supply. There are no central, domestic fish markets, and the catch is sold directly to consumers, retail outlets and restaurants. In practice, each centre has two or three smaller markets that operate privately as re-sellers.
- In Pohnpei, the road system now links the inhabited areas of the island with the population centre, as a result of which many people commute to work. This in turn has led to numerous, small fish markets springing up around the island. A fisheries study in Pohnpei (Rhodes *et al.*, 2011) found that 521 tonnes of reef fish are caught and sold in Pohnpei each year.
- A number of attempts have been made to improve access to markets for outer island fishers. Such schemes, whether sponsored by government or private entrepreneurs, have met with only limited success, constrained by low production levels, erratic or unsuitable shipping services and inadequate catch-handling infrastructure at the fishing sites.
- Finfish and invertebrates are exported to Guam and Saipan by air freight, but no regular supply lines exist and most goes to the expatriate Micronesians living there.

In the offshore fisheries, almost all of the purse-seine catch is canned and consumed in North America and Europe. The longline catch is mainly for the fresh fish markets in Japan and the United States of America. Fish from locally based longliners which are

⁹ In this report, “transshipping” refers to the transfer of tuna from one vessel to another without special handling or processing. Accordingly, the offloading of sashimi-quality fish, which entails grading, some processing and boxing, is not considered transshipment in this report.

not of export quality (about 20 percent of landings) are sold locally, either to processors who produce value-added products for export, or to restaurants and on the local market.

3.5. SOCIO-ECONOMIC CONTRIBUTION OF THE FISHERY SECTOR

A recent study by SPC (Gillett, 2016) attempted to quantify the fishery-related benefits received by the Federated States of Micronesia and other Pacific Island countries. The study gave the available information on the contribution of fishing to GDP, exports, government revenue, employment and nutrition. Unless otherwise noted, the information in this section is from that study.

3.5.1 Role of fisheries in the national economy

The official Federated States of Micronesia GDP estimates are contained in the FY 2014 statistical compendium (Graduate School, 2015a). The compendium was prepared by the Graduate School USA, Pacific Islands Training Initiative, Honolulu, Hawaii, in collaboration with the Federated States of Micronesia Office of Statistics, Budget and Economic Management, Overseas Development Assistance, and Compact Management. Fisheries aspects of the GDP were obtained from the compendium and are presented in Table 3.9.

TABLE 3.9
Fisheries contribution to GDP (USD million)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Fisheries contribution to GDP	28.4	30.7	37.2	46.5	37.3	31.8
GDP at purchasers' prices	278.5	295.6	310.4	325.8	315.7	318.1
Fisheries as percent of GDP	10.2%	10.4%	12.0%	14.3%	11.8%	10.0%

Source: Graduate School (2015a).

The contribution of fishing to GDP was re-estimated by the SPC study for the year 2014. It showed a contribution from fishing of USD 47.2 million or 14.8 percent of GDP. The major difference between this estimate and the official estimate is that the official one includes shore-based services and excludes the operations of some locally based, industrial fishing vessels. The SPC methodology more closely follows the standardized System of National Accounts (SNA 2009).

Access fees for foreign fishing activity form an important source of the government revenue. Table 3.10 shows the fees for recent years.

TABLE 3.10
Access fees as a percentage of government revenue

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Access fees cash (USD million)	17 727	18 811	26 384	35 050	47 518
Government revenue (USD million)	201 488	202 833	217 766	200 905	227 111
Access fees as percent of government revenue	8.8%	9.3%	12.1%	17.4%	20.9%

Source: Modified from Gillett (2016).

3.5.2 Trade

There is no existing requirement in the Federated States of Micronesia for exporters to complete an export declaration form for the Customs Department. Therefore, to estimate fishery exports, the Statistics Division uses a variety of data sources. For offshore fish exports, these sources include NORMA, the National Fisheries Corporation and staff estimates. Data sources for coastal fish exports are quarantine records and airlines' freight records for Chuuk State. The Statistics Division's policy for inclusion/exclusion of fish exports is that they should be included in exports if

the exporting company is considered part of the economy. Accordingly, the Statistics Division has deemed that the catch of the locally based longliners is not an export of the country. Exports of fishery products for 2013 and 2014 are given in Table 3.11.

TABLE 3.11
The Federated States of Micronesia exports of fishery products in 2013 and 2014

	Volume 2013 (kg)	Value 2013 (USD)	Volume 2014 (kg)	Value 2014 (USD)
Purse-seine tuna	14 105 931	21 501 445	18 797 325	18 211 276
Longline tuna	0	0	0	0
Reef fish	154 038	1 302 160	124 103	1 040 484
Crab/lobsters	6 230	35 657	12 029	248 176
Trochus shell	0	0	0	0
Live clams	4 003	173 744	196	853
Other marine products	8 033	124 253	3 734	99 401
Total	14 278 235	23 137 259	18 937 387	19 600 190

Source: Statistics Division (unpublished data).

From the table above, the nominal value of all exports of fishery products in 2014 (USD 19.6 million) can be compared to the country's total exports for 2014 of USD 26.6 million. Fishery products therefore represented 73.7 percent of exports in 2014.

In contrast, the FAO data presented in Part 1 of this profile shows that the value of fishery exports from the Federated States of Micronesia in 2014 was USD 54 721 000. Because the FAO data uses information from importing countries, it is likely to be more accurate than the data from the SPC study.

FAO data shows USD 9 185 000 of imports of fishery products in 2014.

3.5.3 Food security

Gillett (2009a) examined past estimates of fish consumption in the Federated States of Micronesia. The various studies gave annual per capita consumption in the range of 72 to 114 kg per person per year. The same study estimated that the consumption of domestic and imported fishery products (including leakage from tuna transshipment operations) in the mid-2000s was 142 kg per person per year.

Bell *et al.* (2009b) used information from household income and expenditure surveys (HIES) conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES were designed to enumerate fish consumption based on both subsistence and cash acquisitions. For the whole of the Federated States of Micronesia, the annual per capita fish consumption (whole weight equivalent) was 69.3 kg, of which 92 percent was fresh fish. For rural areas, per capita consumption of fish was 76.8 kg, and for urban areas, 67.3 kg.

For 2014, Gillett (2016) estimated coastal subsistence fishery production of 3 337 tonnes and non-exported coastal commercial fisheries production of 1 693 tonnes. Total non-exported coastal production was therefore 5 030 tonnes. With a population of 102 908, that equates to an annual per capita consumption of domestic coastal fishery products of 49.9 kg.

SPC's PROCFish Programme studied four locations in the Federated States of Micronesia – two in Yap State and two in Chuuk State. Kronen *et al.* (2009) indicated that the average annual per capita consumption of fresh fish at those sites was about 63 kg.

Rhodes *et al.* (2015) give information on fish consumption on Pohnpei, expressed as edible amounts (i.e. food actually consumed, as opposed to the whole weight equivalent used in the above studies). They estimated that the annual per capita consumption of reef fish, pelagic fish and non-fresh fish on Pohnpei ranged from 94 to 126 kg. This consumption rate does not consider imported fishery products, local sales of tuna from locally based offshore fishing, or leakage from tuna transshipment operations.

3.5.4 Employment

The Federated States of Micronesia Statistics Division collects employment information from the Social Security Administration and government payrolls. Table 3.12 (Graduate School, 2015a) shows nominal and relative employment in the fishing industry. This could be considered equivalent to the number of formally employed wage earners in the fishing industry, and would not include those who are self-employed or working for a small fishing business, unless taxes and social security are paid.

TABLE 3.12
Employment in the fishing industry

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Number of people employed in fishing industry	261	327	294	247	269	250
Total employment in the Federated States of Micronesia	15 969	16 063	15 733	14 956	14 950	15 537
Fishing as a percent of total employment	1.7%	2.1%	1.9%	1.6%	1.8%	1.7%

Source: Graduate School (2015a).

The 2013/2014 HIES (Statistics Division, 2014) contains some fisheries employment information:

- 1.8% of total wage and salary income comes from fishing
- 12.9% of households are involved in subsistence fishing
- The net monthly value of subsistence fishing is USD 18 per household.

FFA has a programme that collects information on tuna-related employment in a standard form. Table 3.13 shows tuna-related employment in recent years.

TABLE 3.13
Federated States of Micronesia tuna-related employment (2010–2014)

	2010	2011	2012	2013	2014
Employment in tuna processing and ancillary	183	151	97	65	66
Local crew on tuna vessels	47	44	49	--	49
Total	230	195	146	--	115

Source: FFA (2015b).

3.5.5 Rural development

An important characteristic of the social situation in the Federated States of Micronesia is the large difference in prosperity between urban residents (largely supported by government spending) and the subsistence-oriented communities in the outer islands. Income distribution is more unequal than in other countries of the region (Abbott, 2004). Fisheries development, at least in the short- and medium-term, is unlikely to rectify the situation as most of the formal employment in the fisheries sector is near urban areas. The difficulties of transporting perishable fisheries products to urban areas equate to few commercial fisheries development opportunities in the outer islands. Unrestricted emigration to the United States of America has had a large impact on entrepreneurial skills.

Aquaculture has been highlighted by national and state governments as having the potential to provide significant benefits to the Federated States of Micronesia, including local job creation. However, the results to date have been disappointing. Any impact of aquaculture on rural development is likely to come from the production of non-perishable products such as pearls.

3.6. TRENDS, ISSUES AND DEVELOPMENT

3.6.1 Constraints and opportunities

Major constraints for the fisheries sector include:

- the fully exploited nature of many of the inshore resources, especially those close to urban markets;
- difficulties for small-scale fishers in accessing offshore fishery resources;
- difficulties associated with marketing products from the remote areas where abundance is highest to the urban areas with the largest markets;
- challenging business conditions in the country;
- lack of local capital for private sector investment in offshore fisheries, and the poor track record of previous government investment;
- relatively expensive labour and a reluctance on the part of citizens to accept work in offshore fishing;
- unrestricted emigration to the United States of America, which has had a large impact on domestic entrepreneurial skills;
- the high price of the Federated States of Micronesia services and necessity of importing many of the goods used by the tuna industry, which make the country a high-cost location, with the industry not necessarily compensated by proximity to the tuna resources.

A growing constraint for coastal fisheries is the siltation of nearshore reefs caused by coastal development and run-off. Box 3.3 highlights this issue.

BOX 3.3

Coastal development and run-off

Over the past 20 years, the availability of large amounts of funding for infrastructure improvements under the Compact of Free Association with the United States of America has led to increased dredging, road construction and land clearing. For example, in fiscal year 2007, USD 6.1 million was allocated to the infrastructure sector. Sedimentation from these land-based activities, as well as from agriculture, has contributed to the degradation of nearshore coral reef ecosystems in all four states. Housing developments for residential and business purposes along the coast also contribute a great deal to the problem of sedimentation. Coastal development is one of the biggest stressors to the coral reefs of Pohnpei, with more than 50 dredge sites and mangrove clearings (artificial channels) surrounding the coast. According to the Yap Environmental Protection Agency, large volumes of dredged coralline materials are regularly used for construction projects.

Source: Adapted from George (2008).

Opportunities in the fisheries sector include:

- the presently under-utilized assets of failed government fisheries companies, which could provide a significant foundation for a private sector firm. Despite past unsuccessful attempts at privatization, if the buildings, cold storage and dock facilities could be expeditiously cut loose from government control, these could be the basis, or at least a component, of generating substantial economic activity by the private sector;
- improving the attractiveness of local ports to foreign fishing vessels, which could result in a large expansion of on-shore expenditure by foreign fleets;
- the increasing global demand for tuna products;
- greater use of partnerships (community, government, NGOs) in the management of coastal fisheries, which could improve the sustainability of coastal fisheries.

3.6.2 Government and non-government sector policies and development strategies

McCoy (2014) reviewed the background to the development of the Federated States of Micronesia tuna fisheries policy (Box 3.4).

BOX 3.4

History of the Federated States of Micronesia tuna fisheries policy

During the 1990s, no less than nine policy studies, initiatives, workshops, consultations or summits were aimed all or in part at defining the Federated States of Micronesia fisheries policy. A policy emerged in 1997 that was subsequently adopted with some changes by the Federated States of Micronesia Congress. The elements of the policy contained a mixed bag of strategies for fisheries development, strategies for fisheries management, and a goal of fisheries management. Much of this “policy” consisted of an incomplete list of strategies to support unspecified objectives. A more comprehensive two-volume planning document was produced and approved in 2003: The Federated States of Micronesia’s Strategic Development Plan 2004–2013. It contains policy statements and related actions critical to achieving development in oceanic (i.e. tuna) fisheries that are still relevant 10+ years after its adoption. These policy statements were enhanced somewhat by the results of a National Tuna Management and Development Workshop in 2011. Consultations with government officials and others from the four states took place during October–November 2013 to discuss tuna industry development, the desires of the four states in furthering that development, and their understanding of how such development could be realized. The results of those state consultations along with previously identified policy statements formed the basis of a policy options document discussed in depth at a National Tuna Fisheries Development Policy Workshop held in Pohnpei, 22–24 January 2014. That workshop deliberated on a range of policy options and agreed on a draft policy.

Source: Adapted from McCoy (2014).

The National Tuna Fisheries Development Policy Workshop, which included participants from the private sector, agreed on several policy subjects (Table 3.14). Each of those subjects was associated with a policy statement and several strategic objectives and actions.

TABLE 3.14
Policy subjects and policy statements agreed at National Tuna Fisheries Development Policy Workshop

Policy subject	Policy statement
Investment in tuna fisheries	Investment in the local tuna fisheries industry leading to increased economic activity in the Federated States of Micronesia is actively encouraged
Public tuna fisheries enterprises	Encourage public enterprise efficiencies through relevant corporate and business development strategies
National participation	National participation and increased employment in tuna fisheries-related activities are supported and encouraged
Regulatory environment	Regulatory constraints to commercial activity are to be identified and reviewed
Economic and social benefits	Economic and social benefits are prioritized in considering strategies for tuna resource exploitation
Domestic basing and transshipment	Domestic basing and transshipment by foreign licensed vessels are encouraged

On a different level, the Management Plan on Tuna Fisheries for the Federated States of Micronesia 2015 states: “The plan is part of the overall the Federated States of Micronesia Fisheries Policy”. In this regard, the following “guiding principles” of the plan could be considered indicative of the tuna fisheries policy:

- The tuna resource is shared with other countries in the region and is finite.
- The precautionary approach to fisheries management is most appropriate.
- Management measures will promote the objective of optimum utilization.
- Effective management requires participation in, and compliance with, regional and international measures.
- Surveillance and enforcement are important tools of management.
- Surveillance of state waters is important to resource management and should be supported.
- Tuna stock assessment is not exact and there may be differing scientific opinions on the status of resources.
- Special attention should be given to bigeye resources.
- Principles guiding tuna fisheries management are generally applicable to non-target species affected by tuna fishing.

As for the coastal fisheries policies, the Federated States of Micronesia 2004–2023 Strategic Development Plan states that the following policy themes are apparent for coastal fisheries:

- An increasing focus on resource management strategies encompassing traditional practice and protected areas.
- An increasing focus on ensuring resource exploitation is carefully managed and priority access is accorded to subsistence and low-level artisanal activities rather than to commercial fisheries.
- An increasing focus on aquaculture activities at the subsistence and artisanal levels.
- An increasing focus on community participation in management.

A review of the above Strategic Development Plan (CCIF, 2013a) states: “Most of the fisheries economic development efforts focus on developing domestic extraction and processing of offshore resources (e.g. tuna). Nearshore fisheries and coastal marine resources are viewed as small-scale community livelihood opportunities rather than as areas that require management interventions.”

With respect to the private sector, there are no formal policies. Coastal fisheries activities are driven to a large extent by the short-term interplay between local market prices and production costs, with little emphasis by fishery participants on long-term formal strategies. In regard to offshore fishing, the domestic private sector suffered huge losses in the previous decade and is reluctant to make further investments, preferring instead to offer services to locally based foreign vessels and vessels that transship.

3.6.3 Research

Tuna research has a long heritage in the Federated States of Micronesia – over 75 tuna research and exploratory projects have been carried out in the Micronesian area since the 1920s. These projects have been undertaken mainly by the Japanese and U.S. Governments, as well as by Pacific Island regional organizations. Three major tuna tagging programmes were carried out in the Federated States of Micronesia and surrounding countries by SPC in the late 1970s, late 1980s and late 2000s. Logsheet catch and effort data covering the major Japanese fleets prior to 1979 is available from the Fisheries Agency of Japan. Since the inception of the SPC regional tuna fishery database in 1979, the Federated States of Micronesia has been carrying out a relatively comprehensive observer programme. One of the objectives of this programme has been to verify the accuracy of logbook data. Overall assessments of the country’s tuna resources are done periodically by SPC.

Although a scientific research policy for the Federated States of Micronesia's tuna fisheries has not been formalized into a document, the major elements of such a policy can be construed from past and present activities:

- Making significant efforts to obtain reliable tuna resource assessments, including double-checking these assessments.
- Maintaining in-house tuna research expertise in the form of a tuna biologist.
- Operating a very active observer programme that allows for data verification.
- Utilizing high-quality, external scientific expertise.
- Recognizing that for tuna conservation efforts to be effective, the country should promote and be actively involved in regional and international research efforts.

The fisheries research policy is very different at the state level. There appears to be general lack of awareness or understanding of the marine resource base that is available to support coastal fishery development. Few assessments have been carried out of inshore resources, and comparative information from elsewhere has not been extrapolated to the country situation. Much of the earlier research is summarized in a report on the Federated States of Micronesia's marine resources (Smith, 1992a). In general, at the political level there is an over-optimistic view of the degree to which the coastal resources of the states can support commercial development, and lack of appreciation of the need for, and benefits of, fisheries research.

Kronen *et al.* (2009) summarized coastal fisheries research including: monitoring and stock assessment of specific resources; development-oriented research to identify new grounds or techniques with commercial fishing or aquaculture potential (clam farming or sponge aquaculture); baitfishing; depletion experiments; grouper spawning aggregations; turtle tagging and assessment; trochus reseedling; stock assessment (beche-de-mer, pearl shells, spiny lobster); recording of traditional fishing knowledge; investigations of inshore plankton; and fish poisoning studies.

3.6.4 Education and training

Education related to fisheries and marine resources in the country is provided by a variety of institutions:

- Basic aspects of fisheries science are taught at the College of Micronesia–FSM, with the main campus on Pohnpei and branches in each of the states.
- The College of Micronesia–FSM also includes the Fisheries and Maritime Institute, which delivers four fisheries modules: (1) Basic fishing knowledge, (2) Practical longline fishing, (3) Fishing gear design, instruments and machinery, and (4) Marine resources management/Financial management.
- Academic training in biological, economic and other aspects of fisheries is given to the Federated States of Micronesia students at the University of the South Pacific (USP) in Suva, although the Federated States of Micronesia is currently not a member of USP.
- Training courses are frequently organized by the major regional organizations involved in fisheries: SPC in New Caledonia and FFA in the Solomon Islands.
- Courses and workshops are also given by NGOs and by bilateral donors, such as those by Japan.
- Many government fisheries officers and other professionals have received advanced degrees in fishery-related subjects at overseas universities, especially those in Guam, Hawaii, mainland United States of America and Australia.

3.6.5 Foreign aid

Several donors and agencies have provided assistance to the fisheries sector in recent years. They include the Asian Development Bank, United Nations Development Programme, SPC, FFA, FAO, World Bank, Japan International Cooperation Agency, Pacific Regional Environment Programme, South Pacific Project Facility of the

International Finance Corporation, Republic of Korea, the Australian Agency for International Development, the Nature Conservancy and the National Oceanic and Atmospheric Administration (U.S. Department of Commerce).

Areas that have received donor support in recent years include tuna industry development, aquaculture, fisheries wharves, community-based management, fishing vessels and marine biodiversity conservation.

3.7. INSTITUTIONAL FRAMEWORK

The National Oceanic Resources Management Authority (NORMA) is the government's regulatory and management arm within the Federated States of Micronesia 200-mile EEZ. NORMA¹⁰ began operation on January 1 1979 at the same time as legislation entered into force establishing the 200-Mile Extended Fishery Zone. The mission of the Authority is to be "an effective guardian and manager of the marine resources in the Exclusive Economic Zone of the Federated States of Micronesia for people living today and for generations of citizens to come". The Authority works to: (a) ensure that these resources are used in a sustainable way; (b) obtain the maximum sustainable economic benefits from the resources; and (c) promote economic security for the nation through their use.

The Authority consists of five members/Directors, appointed by the President subject to the advice and consent of Congress. Four of the five are appointed after consultations with the four states and one is appointed at-large.

The Executive Director of NORMA has full responsibility for the operation of the office and is assisted by the Deputy Director in meeting his/her obligations. The position is appointed by the Authority and serves under the conditions it sets. The Executive Director and Deputy Director together form the Executive Management of NORMA, which has broad responsibility for (a) providing information, advice and, where appropriate, recommendations to the NORMA Board for decisions on policy, management and financial matters; (b) implementing the decisions of the Authority and reporting to the President and Congress on the affairs of NORMA; and (c) formulating, reviewing and promoting fisheries management measures within the EEZ.

According to the latest, publicly available NORMA annual report, NORMA has three functional divisions:

- The Management and Development Division (MDD) is tasked with a range of duties and responsibilities varying from day-to-day administrative office matters to implementation of the fishing agreements that the Authority has with its fishing partners. MDD is responsible, among other things, for receiving applications for and issuing fishing permits pursuant to fishing access agreements entered into by NORMA.
- The Research Division (RD) is the largest of NORMA's divisions and carries out some of its most significant programme activities. RD's core function is management of NORMA's National Fisheries Observer Programme (NFOP), which is the second largest NFOP in the Pacific Islands region. NFOP has trained and employed over 60 observers from throughout the country to collect and verify key scientific data while on board fishing vessels.
- The Statistics, Compliance and Technical Projects Division (SCTD) supports a number of NORMA's programme activities, from data collection and management to monitoring, control and surveillance. SCTD also engages in national and regional trade-related discussions where fisheries are concerned. A key component of SCTD is the national Vessel Monitoring System (VMS). The VMS is an important tool for fisheries management as it allows the Authority to see vessels wherever

¹⁰ It was then known as the Micronesian Maritime Authority (MMA).

they operate. NORMA's VMS is supported by a mirror system housed at the Maritime Surveillance Wing of the National Police.

Other national government agencies with fishery responsibilities are:

- the National Fisheries Corporation (NFC) – a public corporation established by the Government in 1984. The aim of the corporation is to develop and promote a profitable and long-term commercial fishery in the country. In addition to NFC's own industry development programmes, the corporation works closely with the individual states in joint fishery projects;
- the Fisheries Section of the National Government Department of Economic Affairs, which provides national and state governments with technical services and support for development and management of marine resources, including non-living resources. The section is also responsible for administration of the National Aquaculture Centre in Kosrae;
- government agencies with a range of roles in fisheries, including the:
 - Congress, for approval of access agreements involving 10 or more vessels;
 - Justice Department, for coordination of surveillance and enforcement activities;
 - Foreign Affairs Department, for fisheries aspects of bilateral and multilateral treaties, and attendance at regional fisheries management meetings;
 - Office of the President, for Cabinet meetings (NORMA's Executive Director is a Cabinet member), approval of travel and appointment of NORMA board members
 - Finance Department, for NORMA budget matters and all disbursements except for fishery observer activities.

At the state level, various government agencies are involved in marine resource use and management, including the:

- Pohnpei Marine Resources Division
- Pohnpei Economic Development Authority
- Kosrae Marine Resources Division
- Chuuk Department of Marine Resources
- Yap Marine Resources Management Division
- Yap Fishing Authority

As the country is a collection of numerous small islands, with a population highly dependent on marine resources, virtually everybody in the country is a stakeholder in fisheries due to its contribution to nutrition, employment and support to government.

The major private-sector association involved in tuna fisheries is the National Offshore Fisheries Association. The Association was established in 2002 and its members are companies involved in longlining, purse seining, vessel servicing and operation of shore facilities.

The Conservation Society of Pohnpei has an active marine programme. It helps to establish and manage marine protected areas and combines elements of traditional marine resource management with modern scientific methods to empower local communities to protect Pohnpei's fragile marine biodiversity.

Important internet links related to fisheries in the Federated States of Micronesia include:

- www.norma.fm – National Oceanic Resources Management Authority website
- www.comfsm.fm/fmi – Fisheries and Maritime Institute website
- www.fsmgov.org/nfc – National Fisheries Corporation website
- www.spc.int/coastfish/Countries/FSM/FSM.htm – information on fisheries, links to other sites concerning the Federated States of Micronesia and its fisheries, and some SPC reports on the Federated States of Micronesia fisheries
- www.serehd.org – Conservation Society of Pohnpei website

3.7.1 Regional and international institutional framework

The major regional institutions involved with fisheries are the Forum Fisheries Agency (FFA), located in Honiara, and the Pacific Community (SPC) in Noumea. Other players are the Parties to the Nauru Agreement (PNA) Office in Majuro, the Pacific Islands Forum Secretariat (PIFS) in Suva, the Secretariat of the Pacific Regional Environment Programme (SPREP) in Apia, and the University of the South Pacific (USP) in Suva. The characteristics of those institutions are given in Table 3.15.

TABLE 2.7
Pacific Island regional organizations involved in fisheries

	FFA	SPC	Other regional organizations with fishery involvement
Main area of emphasis	Providing management advice on tuna fisheries and increasing benefits to Pacific Island countries from tuna fishing activities	Most aspects of coastal fisheries and scientific research on tuna. Fisheries are only one aspect of SPC's work programme, which also covers such issues as health, demography and agriculture.	PNA – subregional grouping of the countries where most of the purse seining occurs. SPREP – environmental aspects of fisheries. USP – School of Marine Studies (SMS) is involved in a wide range of training. PIFS – major political initiatives, some natural resource economics; leads trade negotiations with EU, which have a major fisheries component.
Inter-regional relationships	The FFA/SPC relationship has had ups/downs over the years. It has been most difficult in the early 1990s, with tremendous improvement in the mid/late 1990s. An annual colloquium has helped the relationship. Staff who have moved between the two organizations have made a noticeable improvement in understanding. Much of the success/benefits achieved by FFA/SPC cooperation depends on the personalities of FFA's Director/Deputy and SPC's Director of the Division of Fisheries, Aquaculture and Marine Ecosystems.		At least in theory, all regional organizations come under the umbrella of PIFS with their activities coordinated to some degree by the Council of Regional Organisations in the Pacific (CROP). CROP has a Marine Sector Working Group that meets at least once per year, but is limited by lack of resources for follow-up. FFA originally provided secretariat services to PNA, but PNA broke away from FFA in 2010. Currently, there are some sensitivities in the relationship, but it appears to be improving.
Main strengths	Direct contact with its governing body many times per year results in a high degree of accountability. Mandate of tight focus on tuna eliminates considerable dissipation of effort.	Noumea being a pleasant place to work, there is considerable staff continuity. The Oceanic Fisheries Programme often sets the standard for tuna research in the world. Documentation of work is very good.	Because PIFS is under the national leaders, it is considered the premier regional organization. PNA has achieved considerable success and credibility in such areas as raising access fees, 100% observer coverage, eco-certification, high seas closures, and controls on FADs. USP is centrally located in the region and the SMS has substantial infrastructure. SPREP has close ties to NGOs active in the marine sector.
Membership	Australia and New Zealand, plus Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu	Includes the major metropolitan countries, all Pacific Island countries, and the French/UK/US territories – the most inclusive membership of any regional organization.	PNA: the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. USP: Cook Islands, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. SPREP: 21 Pacific Island countries and territories, plus Australia, France, New Zealand and United States of America. PIFS: same as FFA

Source: Adapted from Gillett (2014a).

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean entered into force in June 2004, and established the Western and Central Pacific Fisheries Commission (WCPFC). The Federated States of Micronesia is a member of the commission, along with 26 other countries. WCPFC has its headquarters in Pohnpei and has held 13 annual meetings to date.

3.8. LEGAL FRAMEWORK

The Federated States of Micronesia is a confederation of four states. Distribution of powers between the central and state level of government is dealt with in the Constitution. With regard to fisheries, the distribution of power is largely determined on a geographical basis. Article IX, section 2(m), of the Constitution stipulates that the National Government is empowered "...to regulate the ownership, exploration, and exploitation of natural resources within the marine space of the Federated States of Micronesia beyond 12 miles from island baselines." Conversely, state governments have jurisdiction over fisheries in the territorial sea and internal waters. Fisheries laws and regulations reviewed in this section are those adopted by the central level of government and thus apply to fisheries in the EEZ. Laws and regulations governing fishing activities in the territorial sea and internal waters are found in the code of each state.

With respect to national legislation, the country enacted the Marine Resources Act of 2002 (Public Law 12-34). The major features of the 122-page document are as follows:

1. No domestic fishing, commercial pilot fishing, foreign fishing or such other fishing or related activity is allowed in the exclusive economic zone unless it is in accordance with: (1) a valid and applicable permit issued under authority conferred by this subtitle; or (2) a valid and applicable licence issued by an administrator pursuant to a multilateral access agreement.
2. The Authority is authorized to enter into fisheries management agreements for cooperation in, or coordination of, fisheries management measures in all or part of the region, or for the implementation of a multilateral access agreement. Such agreements may, among other things, at the Authority's discretion, include provisions for the following:
 - authorization of a person, body or organization to perform functions required by a multilateral access agreement, including, but not limited to, the allocation, issuance and denial of fishing licences valid in the region or part thereof, including the exclusive economic zone;
 - an observer programme;
 - a port sampling programme;
 - fisheries monitoring and control;
 - any other matter relating to fisheries management.

The Marine Resources Act of 2002 has been amended several times in recent years:

- 2005: to enable the waiver of permit fees in certain circumstances
- 2007: to establish a two-term limit for members of NORMA
- 2014: to require that all vessels land their bycatch
- 2015: to restrict shark finning
- 2015: to allow the disposal at sea of bycatch after recording.

Subsidiary legislation implementing the previous Title 24 of the Federated States of Micronesia Code, particularly the Reefers and Fuel Tankers Licensing Regulations of 1990 and the Domestic Fishing and Local Fishing Vessel Licensing Regulations of 1991, remains in force.

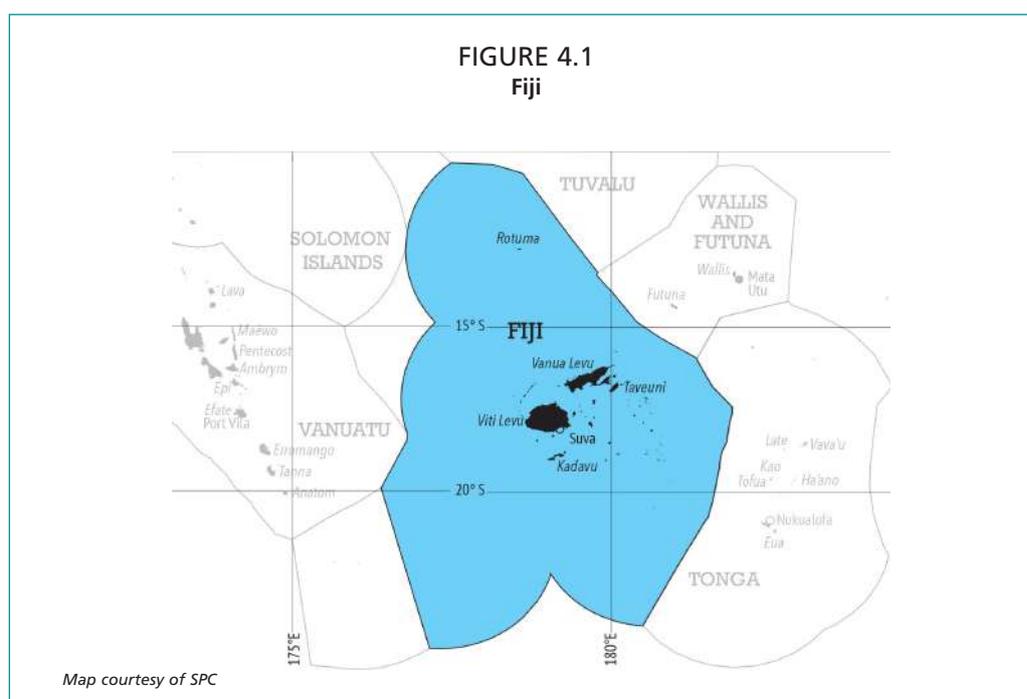
National conservation and management measures relevant to fisheries are in Title 23 of the Federated States of Micronesia Code.

- Chapter One addresses conservation of marine species. It prohibits fishing using destructive methods, including the use of explosives, poisons or chemicals. It also sets limits on the taking or killing of hawksbill sea turtles and regulates the taking of sponges. Penalties for violation of its provisions are inadequate, with a fine up to USD 100 and/or six months imprisonment.
- Chapter Two provides for the protection of endangered species of fish, shellfish and game, but there is a provision for taking of these species for subsistence food or traditional uses, provided such taking does not further endanger the species involved.

Each of the states has its own legislation dealing with fisheries management and development. These include:

- Chuuk State: Fisheries Act
- Kosrae State: Marine Resources Act of 2000
- Pohnpei State: Marine Resources Conservation Act 1981 and Fisheries Protection Act 1995
- Yap State: Public Law 06-01-07

4. Fiji



REPORTING YEAR

This profile was mostly written in 2016, based on data mostly from 2014.

PART 1. OVERVIEW AND MAIN INDICATORS

4.1 GENERAL GEOGRAPHIC AND ECONOMIC INDICATORS

TABLE 4.1
General geographic and economic indicators - Fiji

Land area ¹	18 333 km ²
Water area ²	1 290 000 km ²
Population (2007) ³	837 271
GDP of Fiji (2014) ⁴	USD 3 600 909 000
Fisheries contribution to GDP (2014) ⁵	USD 65 758 000
Fisheries contribution as a % of GDP (2014) ⁶	1.8

¹ Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

² Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

³ 2007 Census of Population and Housing from the Fiji Bureau of Statistics website: www.statsfiji.gov.fj

⁴ Reported in Gillett (2016) from the Fiji Bureau of Statistics website: www.statsfiji.gov.fj (provisional figure).

⁵ Reported in Gillett (2016) from the Fiji Bureau of Statistics website: www.statsfiji.gov.fj (provisional figure).

⁶ Reported in Gillett (2016) from the Fiji Bureau of Statistics website: www.statsfiji.gov.fj (provisional figure).

4.2 FAO FISHERIES STATISTICS

TABLE 4.2

FAO Fisheries statistics on total production, employment and trade – Fiji

2014		
Production (tonnes)	Aquaculture	194
	Capture	43 700
	Total	43 894
Employment (thousands)	Aquaculture	N/A
	Capture	N/A
	Total	N/A
Value of trade (USD 1000)	Fisheries exports	57 604
	Fisheries imports	205 358
	Total	262 962

Source: FAO Statistics and Information Branch of the Fisheries and Aquaculture Department. N/A: Data is not available.

PART 2. NARRATIVE

4.3 PRODUCTION SECTOR

4.3.1 Introduction

Fiji is made up of more than 300 islands, about 100 of which are inhabited. The exclusive economic zone (EEZ) is about 1.3 million km², much of which borders high seas areas.

Fish and fishing are extremely important to the economy of Fiji. A large number of people are employed in the fisheries sector and fish makes an important contribution to the diet of local residents. In addition, fishing is cherished for its recreational and social aspects. In relative terms, fisheries make up the third largest natural resource sector, behind sugar and “other crops”. Also important in Fiji is tourism, which has an important relationship to the fisheries sector.

Fisheries statistics can be presented in different forms to cater for different purposes. In the statistics published by FAO (Part 1 of this profile), the presentation follows the international conventions and standards used by FAO and its Member States for reporting catches, which are given by the flag of the catching vessel. Accordingly, the fishery and aquaculture production of Fiji in 2014 published by FAO (as given in Part 1) was 43 894 tonnes.

In Table 4.3 below, the Fiji fishery production statistics include catch by Fiji-flagged vessels (as reported to FAO), catch by canoes and skiffs in Fiji (which do not carry a flag) and catch from fishing activities in Fiji that do not involve a vessel (e.g. reef gleaning). The offshore category in the table is defined as the catch from Fiji-flagged, industrial-scale fishing operations that are carried out anywhere (i.e. inside or outside the Fiji zone).

TABLE 4.3

Fiji fisheries production (as per FAO reporting standards)

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Fiji-flagged offshore
Volume (tonnes)	205 tonnes plus 85 236 pieces ⁷	3 731	11 000	16 000	14 603
Value (USD)	1 452 307	3 741 414	37 878 788	29 292 929	n/a

⁷ The production of several important aquaculture products (e.g. spat, coral) is measured in pieces rather than in weight.

The amounts of production given in the above table differ slightly from those shown in Part 1. Table 4.3 consists of production estimated from a variety of sources (see SPC study below), whereas the quantities reported in Part 1 are estimates by the Fisheries Department.

The fishery statistics of Fiji are presented in a different way in a recent study by the Pacific Community (SPC). The SPC study reports on the amount of catch in Fiji fisheries waters, regardless of vessel flag. In the study, the catches are placed in different categories, which is useful for other purposes, such as administration of the foreign fishing that occurs in the waters of Fiji. A summary of the fishery production from the SPC study is given in Table 4.4.

TABLE 4.4
Fisheries production in Fiji waters

	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Offshore locally based ⁸	Offshore foreign-based ⁹
					Both Fiji- and foreign-flagged vessels	
Volume (tonnes)	205 tonnes plus 85 236 pieces	3 731	11 000	16 000	17 079	0
Value (USD)	1 452 307	3 741 414	37 878 788	29 292 929	54 364 955	0

Source: Gillett (2016).

Some comment is required to explain the difference between the information in this table and that in Part 1 of this profile.

- Catches can be given by the flag of the catching vessel (as in the FAO statistics in Part 1), or by the zone where the catch is made (the “offshore foreign-based” and “offshore locally based” columns above). These two different ways of allocating catch each have their purposes. Attribution by flag is important for consistency with international conventions, while attribution by zone is important for determining fishing contributions to GDP and managing revenue from licence fees for foreign fishing in a country’s zone.
- There is no functional fisheries statistical system in Fiji covering the categories of coastal fishing, freshwater fishing and aquaculture. The estimates above were made in a 2015 study by SPC that examined a large number of fishery and economic studies covering the last two decades. It is likely that the basis of the information in the FAO statistics in Part 1 was a more informal conjecture by a nominated person in the Fiji Fisheries Department.
- The aquaculture production in Table 4.4 includes non-food items, such as coral, spat and pearls.

4.3.2 Marine sub-sector

4.3.2.1 Catch profile

The marine sub-sector has two distinct components: offshore¹⁰ and coastal. Almost all offshore catches are currently made by longline gear. Historically, about 60 percent of the offshore catch is albacore. Catches in recent years are given in Table 4.5.

⁸ In the SPC study, “offshore locally based” is the catch in Fiji waters from industrial-scale tuna fishing operations that are (a) based at a port in Fiji, and (b) generally harvested more than 12 nautical miles offshore.

⁹ “Offshore foreign-based” is the catch in Fiji fisheries waters from catch from industrial-scale tuna fishing operations that are based at ports outside Fiji. Under the international standardized System of National Accounts (SNA, 2009), those catches do not contribute to Fiji’s GDP.

¹⁰ In this profile, “offshore” is defined as the area outside the zone normally frequented by small, usually undecked, coastal fishing vessels and is generally greater than 12 nautical miles from the nearest land.

TABLE 4.5
Annual catches by Fiji-flagged longliners (tonnes)

Species	2011	2012	2013	2014
Albacore	7 793	7 958	6 202	6 703
Bigeye	681	1 019	685	1 586
Yellowfin	2 248	2 081	1 328	3 594
Other tuna-like species	1 422	1 388	1 293	1 702
Total	12 144	12 446	9 508	13 585

Source: OFD (2016b).

The offshore catch level is determined by several factors, including the number of active vessels and oceanographic conditions. With respect to catch trends, OFD (2015b) reports an “annual fluctuating pattern of high and low total catches over five-year periods”.

Estimates of catches from the coastal fisheries vary widely. The status of the Fisheries Department’s statistics on coastal fisheries is given in Box 4.1. The SPC study mentioned above, using various sources of data (including non-fishery surveys), estimated that Fiji’s annual coastal fishery production consists of about 16 000 tonnes by subsistence fishing and 11 000 tonnes by commercial fishing.

BOX 4.1

Statistical systems for coastal fisheries

For several decades, the Fiji Fisheries Department surveyed municipal and non-municipal markets, other outlets and roadsides in the Central, Western and Northern Divisions for the sale of finfish and non-fish, and published estimates of those sales in its annual report. Detailed reporting of catches ceased in 2004 and summary reporting continued to 2013, with a gap for 2011 and 2012. Although there is summary production information in the 2013 annual report, the 37 percent drop in finfish production between 2012 and 2013 shown in that report casts doubt on the credibility of the estimates.

Subsistence fisheries production information is contained in the Department’s annual reports up to 2007, which stated: “The Department estimated a total removal of 19 000 tonnes by subsistence fishery in 2004”. For the 2008 annual report, an estimate made by a Canadian student research project was used. No estimates of subsistence production have been made in subsequent annual reports.

Source: Gillett *et al.* (2014).

It is difficult to discern trends in coastal fishing due to lack of reliable data. There is, however, a general perception that coastal fisheries accessible to urban residents are declining through over-exploitation and habitat destruction.

Subsistence fishing is greatest away from the urban centres, while commercial fishing is geared to supplying urban food markets and exporting. Exports consist of both food items (e.g. finfish) and non-food commodities (e.g. trochus for buttons, aquarium fish).

4.3.2.2 Landing sites

All locally based offshore vessels unload their catch in Suva, the capital and largest urban area. Foreign-based offshore vessels often come to Fiji to dispose of their catch, all of which is caught outside Fiji fishery waters. This foreign catch is landed at the

tuna processing plant in Levuka (located on the island of Ovalau, near Suva), or is transshipped at Suva.

Landings from the coastal commercial fishery are made mostly at population centres. It is estimated that the three main urban areas (Suva, Lautoka and Labasa) are the landing points for three quarters of the coastal commercial production of the country. The Suva urban area receives nearly half of the total commercial landings, or about 5 500 tonnes per year.

Subsistence fishery landings occur at villages throughout the coastal areas of the country, roughly in proportion to the distribution of the population.

4.3.2.3 Fishing practices/systems

Most of the current production from Fiji's offshore fisheries is by longline gear. OFD (2016b) gives the details of the three categories of the locally based longline fleet:

- **Vessels less than 21 m** – there are 10 vessels in this category, mainly using ice to preserve their catch, which targets the fresh sashimi market. They predominantly fish within Fiji's archipelagic waters and territorial seas, with each trip lasting one to two weeks.
- **Vessels 21 m and less than 30 m** – there are 45 vessels in this category, using ice slurry and freezers to preserve their catch. Vessels in this category mainly fish within Fiji's EEZ and spend three weeks to two months per fishing trip. Fresh catch is usually caught towards the end of the fishing trip to maintain standards that meet the market preference.
- **Vessels greater than 30 m** – there are 47 vessels in this category and they use freezers to preserve their catch. Vessels in this category mainly fish in the Fiji EEZ and outside Fiji's national jurisdiction targeting albacore. They spend more than three months on each trip.

In 2014, approximately 66 percent of the offshore fishing of the locally based longline fleet occurred in Fiji's waters with 34 percent in the high seas (OFD, 2015b).

A report by the Forum Fisheries Agency (FFA) contains some information on the recent changes in the Fiji-based longline fleet (McCoy *et al.*, 2015). Many Fiji-flagged longline vessels are old, with some initially intended for other fisheries such as pole-and-line. They are often not able to compete with the newer, subsidized vessels from China that have entered the fishery. As a result, in the past two to three years, two companies ceased longlining and their assets were acquired by the remaining companies.

Coastal fishing uses a wide variety of fishing techniques and mainly small outboard-powered vessels. The most common commercial methods are gillnetting, hook-and-line fishing and spearfishing. Some of the commercial fisheries use highly specialized techniques, such as for the capture of aquarium fish. A single fishing trip by a commercial operation often involves the use of several types of gear.

Subsistence fishing revolves around reef gleaning, hook-and-line fishing and spearfishing. It has been estimated that 50 percent of all rural households are involved in some form of subsistence fishing.

4.3.2.4 Main resources

The main offshore fishery resources are the tunas and tuna-like species. Albacore, yellowfin, and bigeye are the main target species of longlining. The tiny amount of purse seining in Fiji's fishing waters targets skipjack and yellowfin.¹¹

An FFA report (McCoy *et al.*, 2015) describes the most prominent pattern in tuna resources:

¹¹ No tuna purse seining occurred in 2014 and only a very small amount in 2015 (OFD, 2015b).

A decline in albacore catch rates that began around 2009 has coincided with an increase in fishing effort that began in 2008. Although the albacore resource does not appear threatened, i.e. stocks are not in an overfished state and no overfishing is occurring, the situation has resulted in some major economic problems for Fiji's domestic longline fleet.

In terms of the status of the offshore resources, recent information from the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC, 2016) shows that for:

- **skipjack** – the stock is currently only moderately exploited and fishing mortality levels are sustainable.
- **bigeye** – recent analysis indicates that overfishing is occurring for the bigeye tuna stock and that to reduce fishing mortality to that at the maximum sustainable yield, a large reduction in fishing mortality is required.
- **yellowfin** – the current total biomass and spawning biomass are greater than the levels associated with maximum sustainable yields. Therefore, yellowfin tuna is not considered to be in an overfished state.
- **South Pacific albacore** – there is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries. It should be noted that longline catch rates are declining and that catches over the last 10 years have been at historically high levels and are increasing.

According to the Fiji Tuna Management and Development Plan (2012–2016), a bio-economic analysis of the longline fleet during the period 2002–2004 suggested that to maintain a sustainable fleet, there should be about 52 longline licences issued for fishing in the Fiji EEZ. A follow-up analysis in 2012 indicated that the estimated maximum economic yield for the harvest sector occurs at an effort level of around 16.5 million hooks or around 45 longline vessels.

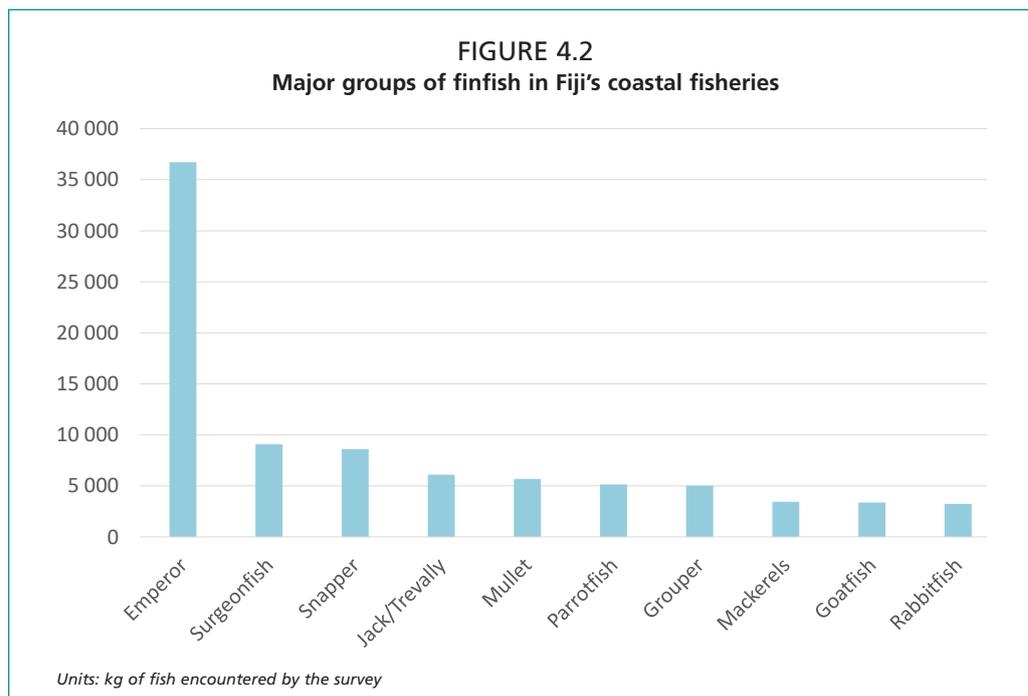
Fiji has a wide range of coastal fisheries resources, including finfish, invertebrates and plants. The most important coastal fishery resources of Fiji are given in Table 4.6. The table includes items that range from a single species to large categories and has some overlaps.

TABLE 4.6
Important coastal fishery resources of Fiji

inshore fish	sea urchins	trochus
mullet	sea cucumbers	black-lip pearl oyster
reef fish	coconut crab	giant clams
emperors	mangrove crab	ark shell
small pelagics	other crabs	other edible molluscs
chub mackerel	lobster	collectors shells
aquarium fish	banded prawn-killer	cephalopod molluscs
sharks	shallow marine prawns	ornamental coral
turtles	mangroves	black coral
large pelagics	edible seaweeds	live reef food fish

Source: Gillett *et al.* (2014).

The “inshore fish” category in the table covers many types of finfish. A survey in 2008/2009 (IAS, 2009) of the finfish fishing of 46 villages in 22 districts of 10 provinces in Fiji, involving 2 802 fishing trips, offers some insight into the types of finfish that are especially common in the coastal fisheries (Figure 4.2).



Little assessment work on coastal fishery resources has been carried out on a Fiji-wide basis since the early 1990s. Much surveying of resources has been done at the level of traditional fishing areas by the Fisheries Department (196 sites) and NGOs/IAS (about 135 sites), possibly on different spatial scales. However, there has been virtually no work from those surveys oriented towards examining the stock status of specific resources across all sites (e.g. the status of trochus in Fiji).

The only new assessments of specific coastal fishery resources across the country in the last two decades appear to be on pearl oysters (Passfield, 1995), humphead parrotfish (Dulvy and Polunin, 2004), corals (Lovell and Whippy-Morris, 2008), beche-de-mer (Pakoa *et al.*, 2013a) and groupers (Sadovy, personal communication). The following is a summary of the results of those assessments:

- **Beche-de-mer:** From the fishery-dependent information, it is apparent that the sea cucumber fishery in Fiji has experienced “boom-and-bust” cycles, as common elsewhere. In-water assessments indicate that densities are low across all sites and for some species they are critically low.
- **Pearl oysters:** Based on the survey results, present stock numbers of *Pinctada margaritifera* were considered too low to support an expansion of pearl farming in the areas surveyed.
- **Hard corals:** Overall, the survey showed the percent of extraction with regard to colony numbers is 0.0085 percent of the total estimated colonies on the reef flat. It was concluded that the *total* living coral cover reduced by coral collection is minimal.
- **Giant humphead parrotfish:** A survey at several locations in remote islands of Fiji indicated that the giant humphead parrotfish has often been overexploited to the point of local extinction.
- **Groupers:** The research indicates that a number of medium- to larger-size grouper species have undergone marked declines over the last several decades.

4.3.2.5 Management applied to main fisheries

Fiji's tuna fisheries are managed on regional and national levels.

- On the **regional** level, Fiji is a member of the Western and Central Pacific Fisheries Commission (WCPFC) that was established by the Convention for the

Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Fiji and the other 26 members of the commission enact tuna management measures at the annual WCPFC meeting. From Fiji's perspective, the two most important measures are: (1) the Conservation and Management Measure for South Pacific Albacore, and (2) the Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean.

- On the **national** level, the tuna fisheries are managed by the Fiji Tuna Management and Development Plan (2012–2016). The plan's two most important management tools for the longline fishery in Fiji fishery waters are: (1) a total allowable catch for all tuna species, and (2) a restriction on the number of vessels.

Coastal fisheries are managed on both national and local levels. At the national level, the Fisheries Department's main coastal fisheries management tool is the licensing of commercial fishers. Other activities related to management are enforcement of the Fisheries Act and related regulations, formal establishment of marine protected areas, surveying of traditional fishing areas, and work with the associated communities to prepare management plans.

At the local level, there are 409 traditional fisheries management areas ("qoliqoli" in Fijian) that have been demarcated and recognized by the national government. In those areas communities presently have use rights, but the actual ownership of inshore fishing areas is legally vested in the national government. This feature has its origins in Fiji's "Deed of Cession" of 1881, which states that the ownership of islands, waters, reefs and foreshores are vested in "Her Majesty and Her Successors". In practice, local traditional authorities establish rules for fishing in each qoliqoli, with the main management tool being the selective exclusion of outsiders from fishing in those areas. Other common management tools include the establishment of permanent or temporary no-take zones, seasonal bans on certain species, and prohibition of certain fishing practices (e.g. night spearfishing).

No discussion of coastal fisheries management in Fiji would be complete without mention of the Fiji Locally Managed Marine Area Network (FLMMA). The network is generally recognized as being very effective and has received regional and international acclaim. Box 4.2 summarizes the FLMMA's history and characteristics.

BOX 4.2

Fiji Locally Managed Marine Area Network

The community of Ucuivanua on the eastern coast of Fiji's largest island was the site of the first locally managed marine area (LMMA) in Fiji in 1997. Scientists from the University of the South Pacific supported environmentalists and local villagers in declaring a ban on harvesting within a stretch of inshore waters for three years, building on the tradition of prohibitions for certain species. After seven years of local management, the clam populations had rebounded and village incomes had risen significantly with increased harvests.

The success of the Ucuivanua LMMA spread rapidly, and a support network – the Fiji Locally Managed Marine Area Network – grew from this. By 2009, the network had increased to include some 250 LMMAs, covering some 10 745 km² of coastal fisheries, or more than 25 percent of Fiji's inshore area. The network has also inspired replication in countries across the Pacific.

Once a community in Fiji makes its interest in local marine management known, the FLMMA Network and various partner organizations determine who will be the lead agency, and discussions are held with the community to ensure that the goals of all parties are clear and aligned. This initial planning and education process can take up to one year.

Network staff then offer assistance through three types of workshop: action planning, biological monitoring and socioeconomic monitoring. The action-planning workshops are adapted from participatory learning and action methods and include sessions on mapping the village, understanding historical trends and identifying local stakeholders. The biological and socio-economic monitoring components of the workshops focus on identifying resource use patterns, threats to local resources, and the root causes of these threats. Finally, a community action plan is developed.

While the establishment of a tabu area (where a no-take zone or ban on destructive fishing practices is declared) is usually a central part of an LMMA, the action plan also contains ways to address other issues faced by the community, such as lack of income sources, poor awareness of environmental issues, pollution and, sometimes, declining community cohesiveness.

Source: Modified from UNDP (2012).

Management objectives

In general, all fisheries management measures of the national government must conform to the Fisheries Act and other legislation. The Fisheries Act (more formally known as “an act to make provision for the regulation of fishing”) is, however, silent on the objectives of the regulation.¹² In practice, the objectives of fisheries management in Fiji have historically been resource protection, extraction of economic benefits and safeguarding of the flow of food to communities.

For offshore fisheries, the Offshore Fisheries Management Decree 2012 states “The objective of this Decree shall be to conserve, manage and develop Fiji fisheries to ensure long-term sustainable use for the benefit of the people of Fiji”. The Fiji Tuna Management and Development Plan (2012–2016) lists the high-level goals of the management of offshore fisheries:

1. To contribute to Fiji’s GDP through promotion of economic development growth in onshore and offshore tuna fisheries.
2. To increase investment and employment opportunities in tuna fisheries.
3. To promote resilience of tuna fisheries against climate change risks, thereby protecting fisheries investments and ensuring food security.
4. To maintain ecosystem health (including addressing bycatch) and to exercise the precautionary principle and integrated fisheries management.
5. To manage Fiji’s tuna fisheries under rights-based and integrated fisheries management frameworks, thereby ensuring conservation and management of tuna resources.
6. To maintain stock sustainability to support economic growth in tuna fisheries.
7. To encourage institutional strengthening that promotes transparency, accountability and efficiency in delivery of services by the Fisheries Department, including supporting growth in the domestic fishing industry.

For coastal commercial fisheries, there are no formal objectives in the legislation. However, judging from the past activities of the Fisheries Department, the management objectives are to promote sustainability of resources, maximize economic returns, and assure that these commercial fisheries do not negatively interact with subsistence fisheries.

For coastal subsistence fisheries, management is generally for the protection of village food supplies. Recent initiatives sponsored by international NGOs also involve biodiversity conservation as a management objective.

¹² Neither the words “management” nor “objective” are found in the Act.

Institutional arrangements

The main institution involved in fisheries management in Fiji is the Fisheries Department.¹³ In practice, the main office of the Fisheries Department in Toorak, Suva, deals with offshore fisheries management, while much of the management of coastal fisheries is handled by the four divisional offices: Northern, Central, Eastern and Western. More information on the Fisheries Department is given below.

The Offshore Fisheries Management Decree specifies the fisheries management responsibilities of the Minister, Permanent Secretary and Director of Fisheries, and establishes the Offshore Fisheries Advisory Council. According to the Decree, the function of the Council is to advise the Minister on policy matters relating to offshore fisheries conservation, management, development and sustainable use.

With respect to coastal fisheries, the Fisheries Department has a role in advising traditional authorities and is responsible for legislation and enforcement and provision of support regarding commercial viability. The Department issues and regulates licences to fish in customary fishing areas upon receiving prior approval from the head of the designated ownership unit.

Many coastal communities in Fiji have institutions that deal with local fisheries management issues. Box 4.3 describes the arrangements at Navakavu, a well-managed area just to the west of Suva.

BOX 4.3

Institutional arrangements for fisheries management at Navakavu

The chief of the entire Navakavu area is the paramount guardian of the traditional fishing area (*qoliqoli*) but delegates much of the management to a qoliqoli committee. It was formed to administer all affairs relating to the fishing ground management regime. The committee also coordinates interactions with the Fiji Locally Managed Marine Area Network and is the voice of Navakavu in various institutions concerning environmental issues. It consists of a chair, secretary, treasurer and members, who include one representative from each of the seven land-owning units, community biological monitors, fish wardens (one from each village), leader of the youth drama group, and the four village headmen. The Navakavu qoliqoli committee has a total of 21 members.

Meetings are held once every two months. At each meeting, members discuss progress with their fisheries management action plan, provide meeting updates, review their specific action plans and address emerging concerns about MPA implementation.

In terms of substantive decision-making, the qoliqoli committee may propose an idea to meetings of the traditional council, which comprises representatives from the different clans of Navakavu. Those meetings have the final say on important issues. Decisions of the council are announced at village meetings by headmen, with people attending those meetings relaying the information to the rest of the community.

Source: Gillett (2014b).

4.3.2.6 Fishing communities

The concept of “fishing communities” is not very relevant to Fiji. Those involved in the offshore fisheries do not live in separate communities, but rather are widely dispersed around the locations where the vessels are based, mainly the Suva urban area. Coastal commercial fishers are found in all urban areas but do not reside in specific

¹³ In mid-2016, the Fisheries Department of the Ministry of Fisheries and Forests became a separate ministry.

communities. Nearly all households in coastal villages are involved in coastal fishing activities. It could therefore be stated that all villages in Fiji that are rural and coastal are “fishing communities”.

4.3.3 Inland sub-sector

Compared to the marine fisheries of Fiji, the production from inland fisheries is quite small. Most of the inland catch comes from the two largest islands, Viti Levu and Vanua Levu. Inland fishing is most important for villages that are isolated from the coast and those that are located next to rivers.

Harvests of freshwater finfish and invertebrates in Fiji consist mainly of freshwater clams (*Batissa violacea*), eels, various species of freshwater crustaceans, and introduced fish such as tilapia and carps.

There is no consolidated accounting of the catches of these species. Gillett (2016) summarizes the fragmented information that exists:

- A freshwater clam known locally as *kai* (*B. violacea*) is found in all major river systems in Fiji, and is the basis of the largest freshwater fishery in the country and one of the top three in the Pacific.
- The 2004 annual report of the Fisheries Department (DoF, 2005) gives the amounts of various fishery products sold in municipal and non-municipal markets in 2004: 2 526 tonnes of *Batissa*¹⁴ were sold at the two types of markets for a total price of about FJD 2.2 million (USD 1.8 million); and 500 tonnes of various species of freshwater crustaceans were sold for a total price of about FJD 6 million (USD 3.5 million).
- Richards *et al.* (1994a) reports annual markets sales of *Batissa* ranged from 1000 tonnes to 1 800 tonnes in the period 1986 to 1992.
- Fisheries Department staff indicate that the harvest of clams/crustaceans for non-market purposes is probably smaller than what is marketed.
- Eels are taken in fresh water in Fiji. Nandlal (2005) reports they are an important source of protein for the rural population, but Richards *et al.* (1994a) states there is not a strong local preference for freshwater eels and there is no organized fishery for them.
- Thaman (1990) indicates that flagtails (*Kulia* spp.) and a number of gobi species are important for interior villages, but that abundance has decreased in recent years.
- The number of fish species in Fiji rivers has been significantly affected by loss of catchment forest cover and introductions of tilapia. On average, stream networks with established tilapia populations have 11 fewer species of native fish than do intact systems (Jenkins *et al.*, 2009).

4.3.3.1 Catch profile

Any estimate of the production from Fiji’s freshwater fisheries is largely guesswork. Gillett (2016) ventured an approximation of 3 731 tonnes in 2014, with a value to the fishers of FJD 7 408 000 (USD 3 741 414).

Inland fishing is mainly for home consumption, with some market and roadside sales.

4.3.3.2 Fishing practices/systems

The largest inland fishery is the freshwater clam fishery. It is dominated by women, who may spend three to four hours per day, four to five days per week, free-diving for the clam in rivers and taking them from the mud by hand.

Most other types of inland fishing are carried out using very small-scale gear, such as baited lines, spears, a variety of traditional woven traps, hollow poles and cane knives. With the exception of *Batissa*, the typical fishing and landing areas are small streams near villages.

¹⁴ This includes the shell weight. Raw meat recovery from *B. violacea* is approximately 20 percent.

4.3.3.3 Main resources

As stated above, the main resources are the freshwater clam, various crustaceans, gobies, flagtails, eels and tilapia. No assessments have been made of the status of these resources.

4.3.3.4 Management applied to main fisheries

There is no active management of inland fisheries in Fiji. In general, the thinking in Fiji is that problems and solutions for fresh water run in parallel with those of inland fisheries, so interventions to improve water quality are likely to improve inland fisheries.

A current NGO initiative may be considered relevant to inland fisheries management. The International Union for Conservation of Nature (IUCN) is attempting to increase the economic benefits for communities from the freshwater clam fishery by developing a quality assurance programme. The project's focus is on enhancing consumer confidence and attracting investment in value-adding and export.

4.3.4 Aquaculture sub-sector

There has been considerable aquaculture work in Fiji (marine, brackish water, fresh water) stretching over a long period and covering a large variety of species. The Fiji Government and donors have made a substantial investment in aquaculture. The country's current annual aquaculture production is, however, quite small.

Recent aquaculture efforts in Fiji have included tilapia, freshwater prawns, carps, saltwater shrimp, milkfish, seaweed, giant clams, trochus, pearl oysters, beche-de-mer, sponges, turtles, mud crab and corals. The primary focus of the Fisheries Department in the last few years has been on tilapia, shrimp, seaweed and pearl oysters.

An SPC study used available documentation and interviews with Fisheries Department staff and producers of aquaculture products to determine Fiji's 2014 aquaculture production. The results are summarized in Table 4.7.

TABLE 4.7
Summary of Fiji aquaculture production in 2014

Commodity	2014 production volume (kg, or pieces if noted)	2014 production values (FJD)	2014 production values (USD)
Tilapia	150 500	526 750	266 035
Freshwater shrimp	11 462	183 392	92 622
Penaeid shrimp	5 617	140 425	70 922
Pearls	103.2	1 578 000	796 970
Pearl oyster spat	45 000 pieces	90 000	45 455
Seaweed	30 000	27 000	13 636
Cultured coral	2 706 pieces	150 000	75 758
Cultured rock	37 530 pieces		
Mud crab	7 000	180 000	90 909
Total	204 682.2 kg plus 85 236 pieces	FJD 2 875 567	USD 1 452 307

Source: Gillett (2016).

According to the SPC Aquaculture Portal,¹⁵ Fiji's aspirations in aquaculture are to:

- develop aquaculture in rural areas as a long-term alternative to the limited inshore fisheries resources;
- promote sustainable aquaculture development as a means of creating food security, income and employment, as well as increasing foreign exchange earnings;

¹⁵ https://www.spc.int/aquaculture/index.php?option=com_countries&view=country&id=5&Itemid=17

- carry out research and development, anticipating and meeting the needs of the aquaculture industry and the market;
- encourage education and training to ensure that personnel at all levels are appropriately skilled;
- ensure that aquaculture is conducted in an ecologically sustainable manner, including through controls on the introduction and movement of aquatic organisms;
- make effective extension services available to the aquaculture industry.

Recently the government opened a multi-species hatchery in Ra Province. The facility is to provide tilapia fry and post-larval shrimp for aquaculture operations.

The aquaculture sub-sector is currently subject to controls under several laws. In late 2016, a comprehensive aquaculture bill was being considered by parliament. The bill is expected to be enacted in 2017.

4.3.5 Recreational sub-sector

The Offshore Fisheries Management Decree defines recreational fishing as “fishing done for leisure and without regard to earnings, gain or profit”.

Recreational fishing is carried out in two main ways in Fiji: (1) local residents fish from the shore, bridges and docks, as well as trolling outside the reefs from small vessels, and (2) tourists charter larger vessels (often based at resorts) for trolling outside the reefs. There are several fishing clubs in Fiji, including those based in Suva, Pacific Harbour and Denarau Island, and several fishing competitions are held each year.

The recreational sub-sector is not actively managed from a fisheries perspective, but the operation of fishing charter vessels is tightly controlled from a safety perspective by the Maritime Safety Authority of Fiji.

4.4 POST-HARVEST SECTOR

4.4.1 Fish utilization

In general, Fiji’s offshore fisheries produce for export markets, with sub-prime grades of tuna and bycatch sold locally. The coastal fisheries generally supply domestic markets, with the important exceptions of beche-de-mer, trochus and aquarium fish, which are exported to China, Europe and the United States of America, respectively.

A recent report by FFA summarises the average annual tuna exports of Fiji over the 2008–2013 period (Table 4.8).

TABLE 4.8
Average annual volumes and values of Fiji tuna exports

Main market	Product category	Volume (tonnes)	Value (USD)	Destinations by value (percent)
Market in the United States of America	Whole round	1 506	5 875 203	United States of America (100)
	Fresh and frozen, value added	430	2 420 383	United States of America (100)
Market outside the United States of America	Fresh tuna	802	7 673 678	Japan (83) New Zealand (11) Australia (5) Others (1)
	Frozen tuna	6 430	19 503 833	Japan (59) Thailand (22) Republic of Korea (12) Others (7)

Source: Modified from McCoy *et al.* (2015).

Tuna processing in Fiji has historically been very important. Box 4.4 gives an overview of this area of activity in 2015.

BOX 4.4

Tuna processing in Fiji in 2015

The major government investment in the fisheries sector is in the Pacific Fishing Company (PAFCO), a loining and canning facility at Levuka. PAFCO is a loining and canning plant initially constructed in 1976 as a joint venture with a Japanese partner C. Itoh (now Itochu). The plant is fully owned by the Fiji government and since 1999 has produced albacore loins for Bumble Bee Seafoods on a contractual basis. Frozen, cooked albacore loins are produced by PAFCO and shipped to the Bumble Bee canning facility in California. Some canning is also done for the local market. Installed capacity is about 120 tonnes per day, but it has operated at around 80 tonnes for the last several years resulting in total annual throughput of from 20 000 to 23 000 tonnes.

There are six facilities of varying sizes that process and/or semi-process tuna (such as heading and gutting for fresh export) that serve the Fiji-based longline fleet. Most have access to products from their own fleets that are owned, chartered or otherwise associated with the enterprise. Two companies, Solander and SeaFresh, export fish but have processing done by TriPacific Marine Ltd. Fresh yellowfin, bigeye and some albacore is packed and sent to markets in the US, Japan, New Zealand, and Australia. One processor, TriPacific, a subsidiary of Foods Pacific, a family-owned food processing business in Suva does processing and servicing for vessel operators but does not have vessels of its own. The activities of the newest entrant, Blue Ocean Marine, are reported to be limited to frozen longline bycatch.

Viti Foods Ltd, a Fiji food processing subsidiary of the CJ Patel Group, cans tuna and mackerel for local sale and export. In 2014 it reportedly recently increased its investment in their plant by an undisclosed amount in order to increase production and meet global food safety compliance standards. The canning plant produces canned tuna and mackerel (the latter from imported raw material) under the Skipper (tuna) and Angel (mackerel) brands. The company reportedly also does some private label canning for local supermarket chains.

TriPacific Marine has invested in processing machinery and upgraded its plant to produce pouched tuna and wahoo for the domestic and export markets in addition to other fresh/frozen products. The pouch tuna products are aimed at catering markets in Australia and New Zealand, while wahoo is said to be produced in a smaller 300 g consumer size for domestic sale.

Source: Gillett McCoy et al. (2015).

There is little processing of the finfish catch that is sold domestically. Most is sold whole (either with or without ice), with some freezing and smoking of fish when there are large catches.

Much of the fish purchased by Fiji's large tourism industry is imported. Reasons cited are that tourists from overseas want types of seafood that they are familiar with (e.g. salmon), and that small-scale fishers are unable to produce consistently the quantities, species and quality of fish that the larger resorts demand.

4.4.2 Fish markets

Table 4.8 above gives the main overseas markets for Fiji's tuna. In general, fresh tuna is for the high-value sashimi market (Japan, United States of America) and the frozen tuna is for canning (American Samoa, Asia).

The domestic sales of finfish (both pelagic and reef-associated) and invertebrates take place either in (a) municipal markets, (b) non-municipal markets (fish shops, butchers, supermarkets and hotels), or (c) by the roadside. There are sixteen municipal markets in Fiji, seven in the Central Division, four in the Western Division and five in the Northern Division.

The subsistence fisheries, as the name implies, are focused on production of food for home use. Significant amounts of fish are, however, given away to friends and relatives. Often attempts are made to market any valuable species captured if a market exists (e.g. lobster to a resort).

4.5 SOCIO-ECONOMIC CONTRIBUTION OF THE FISHERY SECTOR

A recent study by SPC (Gillett, 2016) attempted to quantify the fishery-related benefits received by Fiji and other Pacific Island countries. The study gave the available information on the contribution of fishing/fisheries to GDP, exports, government revenue, and employment. Unless otherwise noted, the information in this section is from that study.

4.5.1 Role of fisheries in the national economy

The Fiji Bureau of Statistics makes the official estimate of the contribution of fishing to Fiji's GDP. The SPC study examined the official methodology and, using its independent estimate of the value of fisheries production, re-estimated the fishing contribution:

- The official contribution showed a 2014 fishing contribution to GDP of USD 65.8 million, or 1.8 percent of GDP.¹⁶
- The contribution of fishing to GDP was re-estimated by the SPC study for the year 2014. It showed a contribution of USD 59.3 million, or 1.6 percent of GDP.

In 2014, Fiji received USD 555 814 (FJD 1 100 513) as access fees for foreign fishing. Because the total revenue of the Fiji Government was FJD 2 380 735 000 (USD 1 202 391 414) in 2014 (Fiji Bureau of Statistics), the 2014 access fee payment amounted to about 0.04 percent of total government revenue for the year.

4.5.2 Trade

Table 4.8 above gives information on exports from Fiji's offshore fisheries. Information on Fiji's coastal fishery exports can be obtained from a database maintained by the Fisheries Department. The information in the database originates from the system of compulsory coastal fishery export permits. Table 4.9 shows 2014 exports in either pieces or kilograms.

Gillett (2016) shows that for each year in the period 2010–2014, the export of fishery products represented from 5.9 percent to 19.5 percent of the value of all Fiji's exports.

FAO import/export data for 2014 show that the value of fishery product exports was USD 57 604 000 and imports were USD 205 358 000.

TABLE 4.9
Coastal fishery exports 2014

	Unit	Total
Aquarium products	kg	1 169 303
	piece	736 566
Beche-de-mer	kg	132 127
	piece	70
Fish steak (reef fish)	kg	211
Gastropods	piece	100
Invertebrate products	kg	271
Ornamental products	kg	600
	piece	2 064 480
Other marine products	kg	24 823 233
Reef fish	kg	17 420
Shells	kg	39 061
	piece	2 005 676

Source: Fisheries Department unpublished data.

¹⁶ Source: Unpublished data, Fiji Bureau of Statistics

4.5.3 Food security

In recent years, there has been no national nutrition work in Fiji relevant to determining fish consumption. The results of some earlier studies on fish consumption in Fiji are available:

- The 1999 Annual Report of the Fisheries Division (2000) gave annual seafood consumption per head based on official production data divided by the Fiji population. The resulting rate in 1999 was 56 kg, of which the subsistence fishery provided 46 percent.
- Preston (2000), using 1995 FAO production, import and export information, found that the apparent per capita supply of fish in Fiji was 50.7 kg per year.
- The results of the 2004 Fiji National Nutrition Survey (NFNC, 2007) provide insight into the frequency of seafood consumption, rather than the level. Of indigenous Fijian households, 23.4 percent consumed fresh fish daily, with 8.3 percent eating canned fish on a daily basis. Of Indo-Fijian households, only 2.4 percent reported eating fresh fish and 1.9 percent eating canned fish on a daily basis.

Bell *et al.* (2009b) used information from household income and expenditure surveys (HIES) conducted between 2001 and 2006 to estimate patterns of fish consumption in

Pacific Island countries. The HIES were designed to enumerate fish consumption based on both subsistence and cash acquisitions. For Fiji, per capita fish consumption (whole weight equivalent) was 15 kg per capita per year in urban areas (fresh fish made up 45 percent of this amount) and 25.3 kg per capita per year in rural areas (66 percent fresh fish).

The SPC PROCfish programme carried out surveys at Dromuna, Muaivuso, Mali and Lakeba (Friedman *et al.*, 2010). That work included estimations of per capita fish consumption.

TABLE 4.10
Fishery product consumption at four PROCfish sites
(kg/person/year)

Village	Fresh fish consumption	Invertebrate consumption	Canned fish consumption
Dromuna	74	4.4	2.9
Muaivuso	68	10	3
Mali	81	13.1	1.8
Lakeba	73	10.5	1.8
Average across the four sites	74.0	9.5	2.4

Source: Friedman *et al.* (2010).

The results (Table 4.10) show very high consumption of fresh fish at the four sites.

Another aspect of food security is the role of fish in post-disaster periods. Fiji is prone to natural disasters, especially cyclones and floods, which devastate food crops. Fishery resources are much less affected and food production from fisheries is therefore important in disaster recovery periods.

4.5.4 Employment

In a study of coastal fisheries in Fiji (Gillett *et al.*, 2014), an attempt was made to quantify employment in coastal fisheries in the country. That report stated that:

- Starkhouse (2009) appears to be the most methodical study of employment in Fiji's coastal fisheries. That study estimated there were about (a) 23 000 subsistence fishers in the country, (b) 5 000 full-time artisanal fishers, and (c) 12 000 part-time artisanal fishers;
- an Asian Development Bank study (Hand *et al.*, 2005) estimated the number of subsistence fishers in Fiji to be "3 000 full-time equivalents" and the number employed in offshore fishing to be "510 full-time equivalents";
- if some assumptions are made about the data from the two sources (i.e. 3 part-time artisanal fishers equal one full-time equivalent, and 23 000 part-time subsistence fishers equal 3 000 full-time equivalents), then there are (full-time equivalents) 9 000 artisanal coastal fishers and 3 000 coastal subsistence fishers.

FFA has a programme that collects data on tuna-related employment in a standard form. FFA (2015b) contains information on the employment of people from Fiji in the

tuna industry (Table 4.11). A total of 3 667 Fijians were employed in the tuna industry in 2014. Across the Pacific in 2014, a total of 17 663 people were employed as crew on tuna vessels or in tuna processing and ancillary work. Tuna-related employment in Fiji therefore represents 20.8 percent of regional employment in the industry.

TABLE 4.11
Tuna-related employment in Fiji (number of people employed)

	2009	2010	2011	2012	2013	2014
Processing and ancillary	1 054	630	1 018	1 063	1 452	2 000
Local crew	1 290	228	353	531	1 227	1 667
Total	2 344	858	1 371	1 594	2 679	3 667

Source: FFA (2015b).

4.5.5 Rural development

An important aspect of the government's fishery development programme is enhancement of the livelihoods of fishers in the more isolated parts of the country. The main strategy for achieving this is through the establishment of rural fishery service centres. The concept is that the centres provide the necessary infrastructure to catalyze commercial fishing operations in rural areas, including ice plants, jetties and slipways, mechanical workshops and vehicles for transportation of fish and fisheries products to markets. Centres have been established in Wainikoro in Macuata, Levuka in Lomaiviti, Kavala in Kadavu, and two in Lau (Vanua Balavu and Lakeba).

The Fiji Government has a major investment in the tuna processing facilities of the Pacific Fishing Company (PAFCO) on Ovalau Island north-east of Suva. The main purpose of that investment is to provide employment in an area of Fiji where there are few jobs. PAFCO is the single largest fish-processing employer in the country with about 900 employees. In 2009, wages and salaries paid by fish processors in Fiji were estimated at FJD 8.9 million, with PAFCO's share at FJD 5.4 million (McCoy *et al.*, 2015).

Aquaculture development is also associated with rural development. The Fisheries Department's annual reports state that the objective of promoting aquaculture in the country includes improving the nutritional status of rural populations and stemming the flow of migration from rural to urban areas. In practice, the effects of aquaculture on rural livelihoods are most noticeable in the interior of the two largest islands and in the isolated islands in the Eastern District (Ono-i-Lau, Gau and Batiki).

4.6 TRENDS, ISSUES AND DEVELOPMENT

4.6.1 Constraints and opportunities

Some of the major constraints of the fisheries sector are:

- the fully exploited nature of many of the coastal resources, especially those close to the urban markets;
- difficulties associated with selling products from remote areas, where abundance is highest, in urban areas where the largest marketing opportunities exist;
- difficulties for small-scale fishers in accessing offshore fishery resources;
- competition by offshore vessels for access to limited infrastructure and services;
- high exploitation of tuna resources outside the Fiji zone by foreign fishing vessels, and the associated reduction in catch rates in the Fiji zone;
- slow development of the aquaculture contribution to the domestic food supply;
- competition from more efficient foreign producers of fishery and aquaculture products;
- lack of awareness on the part of coastal communities of the limitations for fisheries development and the consequences of over-exploitation.

Opportunities in the fisheries sector include:

- value-adding to fishery products for both domestic consumption and export;
- stronger linkages to the expanding tourism industry;
- expansion of the marine aquarium fishery;
- exploitation of offshore resources outside the Fiji EEZ;
- greater use of fish aggregating devices (FADs) to promote offshore fishing by small-scale fishers;
- more use of management partnerships (community, government and NGO) in managing coastal fisheries;
- increasing the effectiveness of the Fisheries Department by enhancing stakeholder input;
- creating a coastal fisheries management division in the Fisheries Department to deal with the over-exploitation of important coastal fishery resources.

4.6.2 Government and non-government sector policies and development strategies

The Fiji Government has recognized for some time the need for a fisheries policy to guide the work of the Fisheries Department and other government agencies involved in the fisheries sector. Planning for such a policy started in early 2014. In 2015, FAO, SPC and FFA worked with the Fisheries Department and other fishery stakeholders in the country to formulate a fisheries policy. Two national workshops were held and a draft Fiji National Fisheries Policy 2017–2037 was produced in late 2016. That draft policy contains principles, key policy goals, and cross-cutting issues and strategies.

Until the national fisheries policy is finalized and released, indications of the government's fishery policies are obtainable from various documents. The Fiji Government's offshore fisheries policies are implied in the text of the "principles and approaches" section of the Fiji Tuna Management and Development Plan. The plan states that the work of the Fisheries Department in the offshore fisheries is to feature:

- rights-based and integrated fisheries management systems
- an ecosystem and integrated-based approach
- the precautionary principle
- participatory and co-management approaches
- equal and fair distribution of wealth
- trans-boundary and bycatch management
- robust monitoring, control and surveillance.

For coastal fisheries, the two major *de facto* policies are that the Fisheries Department should be oriented to: (1) expanding fisheries production, particularly in the more remote areas of the country, and (2) protecting the flow of fish to the people of Fiji. There is considerable ongoing debate among fishery stakeholders on the relative importance of these two policies, especially when they conflict.

The Fiji Fishing Industry Association represents the interests of the offshore fishing industry. The association has no formal policies, but its policy orientation is apparent from a statement in its constitution on its purpose:

- To work with Fiji government agencies in the promotion, development, and management of Fiji's offshore fisheries.
- To represent the interests of Fiji offshore fishing companies on Fiji delegations at regional and international negotiations dealing with offshore fishery resources.

4.6.3 Research

A large amount of fisheries research has been undertaken in Fiji over the years, much of which is listed in the "Fiji fisheries bibliography" (McDowell, 1993). The research carried out on 44 of the main fishery resources in Fiji is summarized in the "Fiji fisheries resources profiles" (Richards *et al.*, 1994a).

Research needs for Fiji's offshore tuna fisheries are very different from those for inshore fisheries or aquaculture. Due to the regional nature of tuna resources, and the high cost of tuna research and level of expertise required for data analysis, much of the research on tuna is undertaken in collaboration with SPC's Oceanic Fisheries Programme, located in New Caledonia.

Gillett *et al.* (2014) comment that little research related to coastal fishery resources has taken place since the early 1990s. It is possible that such research may have been carried out, but survey reports were not obtained or preserved. Other explanations could be a re-focusing of the research efforts of the then Fisheries Division on offshore fisheries, or an orientation to surveys that did not produce publicly available reports (such as those produced for environmental impact statements), or the changing preferences of donors and academic institutions. There was also a considerable turnover of staff in the late 1980s.

The University of the South Pacific (USP), located in Suva, also regularly undertakes marine research activities in Fiji, often focusing on commercially important species. The university has undertaken biological studies on sea cucumbers, deep-water shrimps and marine algae, and also carries out social, economic and post-harvest research relevant to fisheries. In recent years much of the research has been oriented to the genetics of marine organisms.

Starting in the early 2000s (and continuing to the present), the Fisheries Department has been involved in a new wave of research: marine resource inventory surveys (MRIS), which are undertaken at the level of local traditional fishing areas. These surveys do not focus on producing national-level resource information but rather local inventories.

4.6.4 Education and training

Education related to fisheries in Fiji is undertaken in a variety of institutions:

- Academic training in biological, economic and other aspects of fisheries is provided at USP in Suva.
- Training in the practical aspects of fisheries and certification of vessel officers is undertaken at Fiji National University in Suva.
- Training courses are frequently organized by two regional organizations: SPC in New Caledonia and FFA in the Solomon Islands.
- Courses and workshops are also given by NGOs and by bilateral donors, such as those by Japan.
- Many government fisheries officers and academics in Fiji have obtained advanced degrees in fishery-related subjects at overseas universities, especially in Australia, Japan and the United Kingdom.

4.6.5 Foreign aid

Fiji receives technical assistance in the fisheries sector from a number of bilateral donors including Japan, Australia, New Zealand, the United Kingdom and the European Union. Assistance is also obtained from the international organizations of which Fiji is a member, including FAO and other United Nations agencies. The regional organizations serving Pacific Island countries, including FFA, SPC, SPREP and the Pacific Islands Forum Secretariat have also been active in supporting Fiji's fisheries sector.

The major areas receiving donor support in recent years are aquaculture, fisheries wharves, community-based management, rural service centres, turtle conservation, tuna data management, groupers and marine biodiversity conservation.

External funding of the large number of NGOs that work in Fiji's fisheries is substantial. Gillett *et al.* (2014) estimate that the 10 most important of those agencies spend about USD 1.9 million (FJD 3.4 million) annually. The major sources of that funding are (by far) United States of America-based philanthropic foundations, mainly

Packard and MacArthur. Other major donors are smaller foundations based in the United States of America, Europe and Australia, with some government money from the United States of America, Germany and New Zealand.

4.7 INSTITUTIONAL FRAMEWORK

The Fisheries Department is the government agency with primary responsibility for the fisheries sector. The evolution of that institution is described in Box 4.5.

BOX 4.5

Evolution of Fiji's Government Fisheries Agency

The British Colonial Office sponsored a visit of the fisheries specialist, James Hornell, to Fiji in 1939 to make recommendations on the development and protection of fisheries. He commented, "Fisheries was looked after by no government officer and no person was deputed to see the enforcement of the few fisheries regulations which are on the Statute Book". He recommended a fisheries service within the Department of Agriculture, consisting of a Superintendent of Fisheries, three Fisheries Officers and a clerk/statistician, assisted by "trustworthy persons" to collect statistics. H. van Pel of the South Pacific Commission visited Fiji in 1954 and recommended the establishment of a fisheries service within the Department of Agriculture, staffed by a biologist, a technical fisheries officer, and three local assistant fisheries officers. In the mid-1960s, a single fisheries officer position was created within the Department of Agriculture and in the late 1960s a Fisheries Division was organized to be located in the new Ministry of Agriculture and Fisheries. That ministry became the Ministry of Primary Industries in 1985; in 1994, it was re-named the Ministry of Agriculture, Fisheries and Forests. In 2001, Fisheries became a Department within the new Ministry of Fisheries and Forests. In late 2016, a separate Ministry of Fisheries was established.

Source: Modified from Gillett *et al.* (2014).

According to the Department of Fisheries Annual Business Plan 2016, the Fisheries Department is responsible for:

- administering and enforcing fisheries legislation;
- ensuring conservation, sustainable utilization and management of fisheries resources;
- approving and issuing fisheries-related licenses and permits;
- providing training (staff and stakeholders), extension services and research;
- coordinating with key stakeholders including fisheries resource owners;
- aligning fisheries-related activities to international and regional commitments;
- implementing related regulations/legislation administered by other government agencies.

The Fisheries Department is organized into several divisions. There is one division for each of the four geographical divisions of Fiji, and a division each for aquaculture, fleet and offshore. There is presently considerable discussion about the need for a coastal fisheries management division.

The Fisheries Department maintains four divisional offices: Eastern (located in Lami), Central (Nausori), Western (Lautoka) and Northern (Labasa), plus several smaller offices around the country. There are a total of 23 fisheries stations nationwide. The Department has 19 ice plants (3 in Lautoka alone), including those at the rural fisheries service centres. Two sea-going vessels are also operated by the Fisheries

Department: the *Tui ni Wasabula* (over 30 years old) and the larger *Bai ni Takali*, which arrived in 2010.

There are many NGOs active in the fisheries sector. The two that have the most activities and most influence are:

- the Wildlife Conservation Society (WCS), which opened its office in Fiji in 2001. Currently, WCS has four main types of interactions with fisheries in Fiji: (a) determining sustainable extraction levels (in both periodically closed areas and general areas) and associated means to achieve this sustainability through wise use of management tools (e.g. quotas, licensing, gear restrictions) and monitoring indicators of vulnerable species; (b) maintaining or increasing populations of five iconic species – camouflage grouper, squaretail coral grouper, white-tipped reef shark, humphead parrotfish, and humphead wrasse; (c) working on marine protected areas (MPAs) – since 2005, WCS has worked with communities to establish 257.61 km² of locally managed MPAs; and (d) studying land-based impacts on coastal fisheries, including work on modelling the impacts of sedimentation;
- the World Wide Fund for Nature (WWF) has had an office in Fiji since the mid-1990s, but its interaction with coastal fisheries in the country started about a decade later when WWF commenced work with MPAs, focusing initially on biodiversity issues. Currently, WWF has two major initiatives: (1) The Great Sea Reef, and (2) Sustainable Fisheries and Seafood. A major NZ-funded activity to connect the tourism sector with community-based fisheries management began in May 2014. That work includes tracing the supply chain from LMMA sites to hotels, developing stock assessment in data-deficient fisheries for management, and trialling adoption of pricing based on willingness to pay for a managed fishery.

The private sector fisheries stakeholders in the country are extremely fragmented. There is no grouping that represents the interests of small-scale fishers in the country. For the offshore fisheries, there are two competing associations, which in mid-2016 formed an umbrella association, the Fiji Fishing Industry Association.

Important internet links related to fisheries in Fiji include:

- www.fisheries.gov.fj – details of the Fiji Government’s Fisheries Division
- <http://www.spc.int/coastfish/en/countries/fiji-islands.html> – information on Fiji’s fisheries, links to other sites concerning Fiji and its fisheries, and some SPC reports on Fiji’s fisheries.
- <http://www.paclii.org/countries/fj.html> – text of Fiji’s fishery legislation

4.7.1 Regional and international institutional framework

The major regional institutions involved with fisheries are FFA, located in Honiara, and SPC in Noumea. Other players are the Parties to the Nauru Agreement (PNA) in Majuro, the Pacific Islands Forum Secretariat (PIFS) in Suva, the Secretariat of the Pacific Regional Environment Programme (SPREP) in Apia, and the University of the South Pacific (USP) in Suva. The characteristics of those institutions are described in Table 4.12.

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean entered into force in June 2004 and established the Western and Central Pacific Fisheries Commission (WCPFC). Fiji is a member of the commission along with 26 other countries. The WCPFC has its headquarters in Pohnpei, Federated States of Micronesia, and has held 13 annual meetings to date.

TABLE 4.12
Pacific Island regional organizations involved in fisheries

	FFA	SPC	Other regional organizations with fishery involvement
Main area of emphasis	Providing management advice on tuna fisheries and increasing benefits to Pacific Island countries from tuna fishing activities.	Most aspects of coastal fisheries and scientific research on tuna. Fisheries are only one aspect of SPC's work programme, which also covers such issues as health, demography and agriculture.	PNA – subregional grouping of countries where most purse seining occurs; SPREP – environmental aspects of fisheries; USP – School of Marine Studies (SMS) involved in a wide range of training; PIFS – major political initiatives, some natural resource economics; leads trade negotiations with EU, which have a major fisheries component
Inter-regional relationships	The FFA/SPC relationship has had ups/downs over the years. It was most difficult in the early 1990s, but tremendous improvement in mid/late 1990s. An annual colloquium has helped the relationship. Staff who have moved between the two organizations have made a noticeable improvement in understanding. Much of the success/benefits achieved by FFA/SPC cooperation depends on the personalities of FFA's Director/Deputy and SPC's Director of the Division of Fisheries, Aquaculture and Marine Ecosystems.		At least in theory, all regional organizations come under the umbrella of PIFS. Their activities are coordinated to some degree by the Council of Regional Organisations in the Pacific (CROP), which has a Marine Sector Working Group that meets at least once per year, but is limited by lack of resources for follow-up. FFA originally provided secretariat services to the PNA, but the PNA broke away from FFA in 2010. Currently, there are some sensitivities in the relationship, but it appears to be improving.
Main strengths	Direct contact with its governing body many times per year results in a high degree of accountability. Mandate of tight focus on tuna eliminates considerable dissipation of effort.	Noumea being a pleasant place to work, there is considerable staff continuity. The Oceanic Fisheries Programme often sets the standard for tuna research in the world. Documentation of work is very good.	Because PIFS is under the national leaders, it is considered the premier regional organization. PNA has achieved considerable success and credibility in such areas as raising access fees, 100 percent observer coverage, eco-certification, high seas closures, and controls on FADs. USP is centrally located in the region and SMS has substantial infrastructure. SPREP has close ties to NGOs active in the marine sector.
Membership	Australia and New Zealand, plus Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu	Includes the major metropolitan countries, all Pacific Island countries, and the French/UK/US territories; the most inclusive of any regional organization.	PNA: the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. USP: Cook Islands, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. SPREP: 21 Pacific Island countries and territories, plus Australia, France, New Zealand and United States of America. PIFS: same as FFA

Source: Adapted from Gillett (2014a).

4.8 LEGAL FRAMEWORK

According to the Department of Fisheries Annual Business Plan 2016, the legal framework for the fisheries sector is articulated in the:

- Fisheries Act (Cap 158)
- Marine Spaces Act (Cap 158 A)
- Fisheries Regulations (in various legal notices)
- Offshore Fisheries Management Decree 2012
- Offshore Fisheries Management Regulations 2014

- Related legislation and regulations – Environment Management Act 2005, Endangered Protected Species Act 2002, Fiji Maritime Transport Decree, and the Surfing Decree.

The main features of the Fisheries Act are that the law:

- defines Fiji’s fisheries waters as all internal waters, archipelagic waters, territorial seas and all waters within the exclusive economic zone;
- establishes a Native Fisheries Commission charged with the duty of ascertaining the customary fishing rights in each province of Fiji;
- prohibits the taking of fish in Fiji’s fisheries waters by way of trade or business without a licence;
- states that every licence granted under the Act terminates on 31 December next after the day of issue; licences are personal to the holder and not transferable;
- empowers any licensing officer, police officer, customs officer, honorary fish warden and any other officer empowered by the Minister to enforce the Act;
- empowers the Minister to appoint honorary fish wardens whose duties shall be the prevention and detection of offences.

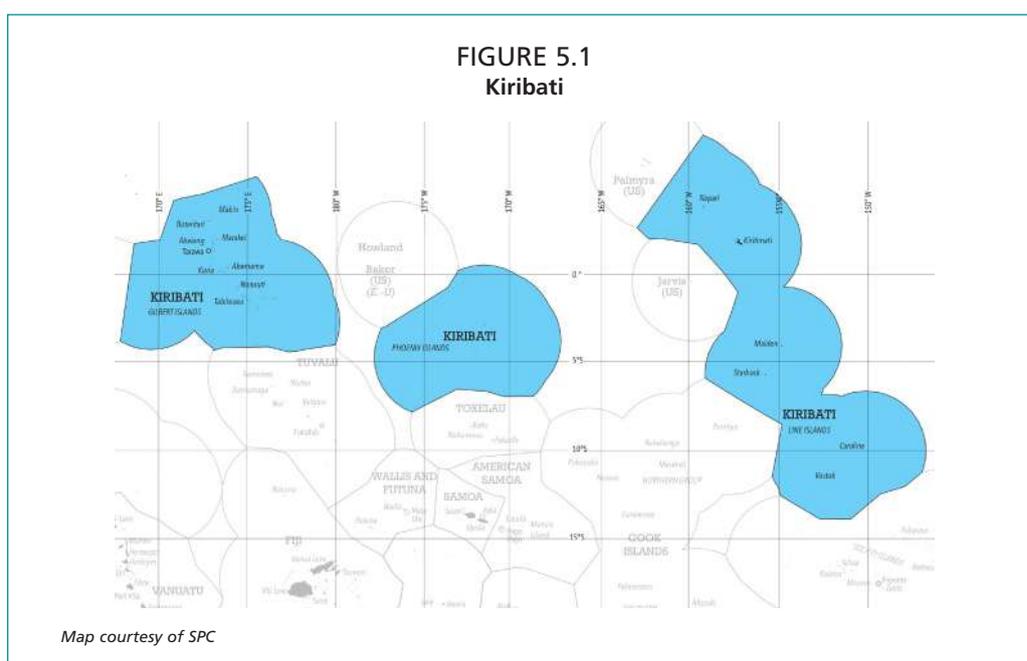
The Fisheries Act also empowers the Minister to make regulations (a) prohibiting any practices or methods, or employment of equipment or devices or materials, which are likely to be injurious to the maintenance and development of a stock of fish; (b) prescribing areas and seasons within which the taking of fish is prohibited or restricted, either entirely or with reference to a named species; (c) prescribing limits to the size and weight of fish of named species which may be taken; (d) prescribing limits to the size of nets or the mesh of nets which may be employed in taking fish either in Fiji’s fisheries waters or in any specified part thereof; (e) regulating the procedure relating to the issue of and cancellation of licences and the registration of fishing boats, and prescribing the forms of applications and licences and the conditions to be attached; (f) prescribing “the fees to be charged upon the issue of licences, and the registration of fishing vessels which fees may differ as between British subjects and others”; (g) regulating any other matter relating to the conservation, protection and maintenance of a stock of fish which may be deemed requisite.

The Offshore Fisheries Management Decree was promulgated in 2012, with the subsidiary regulations coming into force in 2014. The decree covers:

- functions of the Minister, Permanent Secretary, Director of Fisheries and the Offshore Fisheries Advisory Council;
- fisheries conservation, management and development;
- licences and authorizations;
- monitoring, control, surveillance and enforcement;
- port measures, transshipment and other services;
- jurisdiction and evidence.

In late 2016, a comprehensive aquaculture bill was being considered by parliament. The bill is expected to be enacted in 2017.

5. Kiribati



REPORTING YEAR

This profile was written in 2017, based on data mainly from 2014.

PART 1. OVERVIEW AND MAIN INDICATORS

5.1 GENERAL GEOGRAPHIC AND ECONOMIC INDICATORS

TABLE 5.1

General geographic and economic indicators - Kiribati

Land area ¹	811 km ²
Water area ²	3 550 000 km ²
Population (2015) ³	110 136
GDP of Kiribati (2014) ⁴	USD 158 075 000
Fisheries contribution to GDP (2014) ⁵	USD 13 568 000
Fisheries contribution as a % of GDP (2014) ⁶	8.6

¹ Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

² Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

³ 2015 Total Population Census from the Kiribati National Statistics Office website: www.mfed.gov.ki/statistics

⁴ Reported in Gillett (2016) from the Kiribati National Statistics Office (provisional figure).

⁵ Reported in Gillett (2016) from the Kiribati National Statistics Office (provisional figure). “Fishing and seaweed” contribution to GDP.

⁶ Reported in Gillett (2016) from the Kiribati National Statistics Office (provisional figure). “Fishing and seaweed” contribution to GDP.

5.2 FAO FISHERIES STATISTICS

TABLE 5.2

FAO Fisheries statistics on total production, employment and trade – Kiribati

2014		
Production (tonnes)	Aquaculture	2
	Capture	116 708
	Total	116 710
Employment (thousands)	Aquaculture	N/A
	Capture	N/A
	Total	N/A
Value of trade (USD 1000)	Fisheries exports	133 348
	Fisheries imports	705
	Total	134 053

Source: FAO Statistics and Information Branch of the Fisheries and Aquaculture Department. N/A: Data is not available.

PART 2. NARRATIVE

5.3 PRODUCTION SECTOR

5.3.1 Introduction

Kiribati comprises 33 islands, with a total land area of only 810 km², located in one of the world's largest exclusive economic zones (EEZ) of about 3.5 million km². There are three main island groups: Gilbert Islands in the west, Phoenix Islands in the centre and Line Islands in the east. With more water area than land, the people of Kiribati (I-Kiribati) rely heavily on fishing activities for subsistence and commercial purposes.

Kiribati's fishery sector has two main categories: (1) coastal fisheries, which are subsistence and small-scale commercial – also known as artisanal – fisheries that occur in lagoons, reefs, reef slopes and nearshore ocean areas; and (2) offshore fisheries, which are the industrial-scale commercial tuna fisheries in offshore¹ waters.

Subsistence and small-scale commercial fishing is conducted throughout the islands using traditional canoes powered by sail or paddle, plywood canoes with outboard motors, and larger craft also powered by outboards. Small-scale commercial fishing is concentrated around Tarawa, where a sizable population, cash-oriented economy, and ice and cold-store facilities provide suitable market conditions. A large amount of tuna is captured by the industrial offshore fisheries, but the vast majority of the catch is taken by vessels based outside the country.

Kiribati's small land area and poor soil limit agriculture production. There is heavy reliance on marine resources for livelihoods, government revenue and, especially, nutrition. By several estimates, Kiribati has the highest per capita consumption of fish of any country in the world.

Fisheries statistics can be presented in different forms to cater for different purposes. In the statistics published by FAO (Part 1 of this profile), the presentation follows the international conventions and standards used by FAO and its Member States for reporting catches, which are given by the flag of the catching vessel. Accordingly, the fishery production of Kiribati in 2014 published by FAO (as given in Part 1) was 116 710 tonnes.

In Table 5.3 below, the Kiribati fishery production statistics are based on FAO reporting standards, including estimates of production from other sources.

⁷ In this profile, "offshore" is defined as the area outside the zone normally frequented by small, usually undecked, coastal fishing vessels and is generally greater than 12 nautical miles from the nearest land.

The production shown in the various categories is from “Kiribati-flagged vessels” even though (a) some vessels are not “flagged” (e.g. canoes and skiffs), and (b) some fishing activity does not involve a vessel (e.g. reef gleaning). For the offshore category, this is defined as the catch from Kiribati-flagged, industrial-scale fishing operations that are carried out anywhere (i.e. inside or outside the Kiribati zone).

TABLE 5.3
Kiribati fisheries production (as per FAO reporting standards)

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Kiribati-flagged offshore
Volume (tonnes, and pieces where indicated)	255 tonnes and 8 642 pieces	0	7 600	11 400	124 221 ⁸
Value (USD)	237 506	0	15 459 836	16 259 016	n/a

Source: Gillett (2016); MFMRD (2015).

The amounts of production given in Table 5.3 differ from those shown in Part 1. Table 5.3 consists of production estimated from a variety of sources (see SPC study in Table 5.4 below). The offshore category in Table 5.3 is derived from the report of the Kiribati Ministry of Fisheries and Marine Resources Development (MFMRD) to the Western and Central Pacific Fisheries Commission (WCPFC).

The fisheries statistics of Kiribati are presented in a different way in a recent study by the Pacific Community (SPC). Instead of catches given by the flag of the catching vessel (as in the FAO statistics in Part 1), the zone where the catch is made (the “offshore foreign-based” and “offshore locally based” columns in Table 5.4) is reported. These two different ways of allocating catch each have their purposes. Attribution by flag is important for consistency with international conventions, while attribution by zone is important for determining fishing contributions to GDP, and managing revenue from licence fees for foreign fishing in a country’s zone. A summary of fishery production from the SPC study is given in Table 5.4 below.

TABLE 5.4
Estimates of Kiribati fisheries production

	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Offshore locally based ⁹	Offshore foreign-based ¹⁰
					Both Kiribati- and foreign-flagged vessels	
Volume (tonnes)	255 tonnes and 8 642 pieces ¹¹	0	7 600	11 400	510	701 067
Value (USD)	237 506	0	15 459 836	16 259 016	3 606 557	1 111 106 457

Source: Gillett (2016).

⁸ This is the sum of Kiribati offshore tuna catches by vessel (gear) type, i.e. purse seine (123 068 tonnes), longline (913 tonnes) and pole-and-line (240 tonnes), reported by the Ministry of Fisheries and Marine Resources Development to the Scientific Committee of WCPFC in 2016 for the year 2014.

⁹ In the SPC study “offshore locally based” is the catch in Kiribati waters from industrial-scale tuna fishing operations that are (a) based at a port in Kiribati, and (b) generally harvested more than 12 nautical miles offshore.

¹⁰ “Offshore foreign-based” is the catch in Kiribati fisheries waters from catch from industrial-scale tuna fishing operations that are based at ports outside Kiribati. Under the international standardized System of National Accounts (SNA, 2009), those catches do not contribute to the GDP of Kiribati.

¹¹ The production of several important aquaculture products is measured in pieces rather than in weight.

¹² This value was sourced from the Forum Fisheries Agency and MFMRD. It differs slightly from the total value of offshore fisheries production from the SPC study (Table 5.4). All are estimates and subject to revision.

5.3.2 Marine sub-sector

5.3.2.1 Catch profile

In 2014, Kiribati was considered the most productive tuna fishing EEZ in the western and central Pacific. A report on fishing licence revenue by the Ministry of Finance and Economic Development (MFED) and MFMRD showed that total annual offshore catches reached a record high of 725 854 tonnes in 2014 (MFED and MFMRD, 2015). This continued an increasing trend from previous years. Catches were dominated by skipjack in all years (Table 5.5).

TABLE 5.5

Total offshore annual catches by target species (tonnes), Kiribati, 2010–2014

Species	2010	2011	2012	2013	2014
Albacore	1 320	573	1 287	920	1 644
Bigeye	15 693	29 461	33 005	26 879	39 223
Skipjack	167 294	151 854	406 876	225 071	572 217
Yellowfin	49 006	40 610	123 047	44 618	112 770
Total	233 313	222 498	564 214	297 487	725 854

Source: Gillett (2016); MFMRD (2015).

As is the case for other countries in the region, estimating the total catches for coastal fisheries in Kiribati has been difficult. There have been several attempts made in both past and recent years to consolidate information on coastal fisheries production (e.g. Dalzell *et al.*, 1996; Gillett and Lightfoot, 2001; Preston, 2008a; Gillett, 2009a; Gillett, 2016). While coastal subsistence fishing has been predominant in the past, fishing has become more commercialized in recent years; Gillett (2016) has provided an estimate of production from coastal subsistence fisheries for 2014 of 11 440 tonnes valued at USD 16 259 016, and for coastal commercial fisheries of 7 600 tonnes valued at USD 15 459 836. The total number of coastal, artisanal fishing vessels during the same year was estimated to be 4 766 (MFMRD, 2015).

The main general trend in coastal fisheries appears to be the increasing exploitation of coastal resources, especially those close to urban markets. Gillett (2016) gathered findings from various sources and studies to report major influences affecting coastal fisheries in Kiribati in the last few years:

- An overall increase of 90 percent in the number of boat-owning families from 2005 to 2010. All islands surveyed experienced an increase in the number of boat-owning households except South Tarawa.
- A noticeable decrease in the fisheries production of Tarawa Lagoon, with a stark example being the ark shell (*Anadara* sp. – “te bun”). Campbell and Hanich (2014) report that in the early 1990s when harvestable quantities were high, commercial harvesters collected about 1 000 tonnes of clams annually around Tarawa. However, over-exploitation of the resource by both commercial and subsistence harvesting has led to collection levels of less than one-tenth their former size, as well as speculation that the fishery has almost collapsed.
- Several studies have reported a decrease in the abundance of important coastal fisheries resources: Purcell *et al.* (2012) for beche-de-mer; Basabe (2012); MFMRD (2013) for aquarium fish on Christmas Island; and Siaosi (2012) for finfish on Abemama Atoll.
- The trend of increasing commercialization of Kiribati coastal fisheries production, as previously noted by Gillett (2009a), continues. An increasing number of islands have refrigeration enabling storage for local sale and shipment to Tarawa. There has been some mention of the purchase of reef fish from outer islands for frozen

export to mainland China. While this could be having a positive temporary impact on local livelihoods, it may jeopardize long-term, future food security.

- According to data from the SPC PRISM website, the population of Kiribati increased 14.1 percent between 2007 (the focal year for the Gillett (2009a) study) and 2014 (the focal year for the present study). The long-term trend of rural to urban (South Tarawa) migration has eased.
- For artisanal tuna fisheries, there has been a decrease in the production of tuna and other pelagic species from trolling from small boats based in South Tarawa. One reason for this could be that the availability of reject fish from tuna transshipment operations in Tarawa Lagoon has driven a number of tuna trollers out of business.

5.3.2.2 Landing sites

The majority of Kiribati's offshore catches are destined for export and thus are not landed but rather transshipped locally at three designated ports or at overseas ports. In 2014, 81 percent of catches caught by Kiribati-flagged purse seiners were transshipped in Kiribati as frozen tuna while the remainder were offloaded in other ports, mainly the Marshall Islands (MFMRD, 2015). In the same year, all pole-and-line catches were transshipped locally, while 90 percent of longline catches were transshipped in Samoa (MFMRD, 2015).

In 2012, the Kiribati Government also established a joint-venture tuna processing plant called Kiribati Fish Limited (KFL), based in Betio, Tarawa (MFMRD, 2015). Catches from the company's vessels are landed and processed at the plant and destined for export to the United States of America and Japan (MFMRD, 2015).

The catches from small-scale commercial fishing are mostly landed in South Tarawa, but much smaller quantities are landed at villages throughout Kiribati. Small-scale commercial landings at locations other than Tarawa have expanded in recent years due to increasing ice production in outer islands. Many islands have cold storage, enabling storage for local sale and shipment to Tarawa. Subsistence fishery landings occur at coastal villages throughout the country, roughly in proportion to the distribution of the population.

5.3.2.3 Fishing practices/systems

Kiribati's offshore tuna fisheries include Kiribati-flagged vessels and foreign-flagged vessels, which comprise longline, purse-seine and pole-and-line vessels, with additional support vessels (bunkers and reefer carriers). In the period 2010–2014, offshore tuna catches were mainly caught by purse-seine vessels, which took up to 96 percent of total offshore catches (Table 5.6). It is presumed that good catches, particularly in 2014, were strongly influenced by El Niño conditions providing favourable fishing conditions (Gillett, 2016). To a certain extent, catch size was also influenced by the number of vessels licensed by Kiribati during the same period (Table 5.7). According to the Ministry's annual report to the Scientific Committee of the WCPFC, Kiribati-flagged purse seiners in 2014 concentrated their fishing efforts in the Kiribati EEZ, with some effort expanded to other areas such as the Marshall Islands, Tuvalu, Papua New Guinea and the high seas.

TABLE 5.6
Total offshore annual catches by gear (tonnes), Kiribati, 2010–2014

Gear	2010	2011	2012	2013	2014
Purse seine	209 010	197 759	537 613	280 120	697 176
Longline	11 145	12 137	16 324	11 942	24 046
Others*	13 159	12 602	10 277	5 425	4 632
Total	233 314	222 498	564 214	297 487	725 854

Source: MFED and MFMRD (2015).

*Note: "Others" include pole-and-line vessels

TABLE 5.7
Number of Kiribati offshore vessels¹³ by vessel/gear type, 2010–2014

Gear/vessel type	2010	2011	2012	2013	2014
Purse seine	6	7	9	13	14
Longline	1	1	4	7	6
Pole-and-line	-	1	1	1	1
Total	7	9	14	21	21

Source: MFMRD (2015).

Subsistence and small-scale artisanal fishing is conducted throughout the islands. The most common fishing location for fishing households is the lagoon, followed by the lagoon flat, reef flat and outer reef (NSO, 2016). Fishing vessels used include traditional canoes powered by sail or paddle, plywood canoes with outboard motors, and larger outboard-powered skiffs. The skiffs or craft used for artisanal tuna fishing are usually less than 7 m long with 15–40 horsepower engines (MFMRD, 2015). Canoes were the most common type of fishing boat owned by fishing households (NSO, 2016) (Table 5.8).

TABLE 5.8
Number of Kiribati offshore vessels¹³ by vessel/gear type, 2010–2014

Number of wooden fishing boats owned								
	0	1	2	3	4	5	6	Not stated
Number of households	17 130	501	104	18	15	2	1	1
Number of aluminium fishing boats owned								
	0	1	2	3	4	5	6	Not stated
Number of households	17 016	698	41	7	7	1	1	1
Number of fibreglass boats owned								
	0	1	2	3	4	5	6	Not stated
Number of households	17 570	171	25	1	2	3	-	-
Number of canoes owned								
	0	1	2	3	4	5	6	Not stated
Number of households	15 883	1 743	133	10	3	-	-	-
Number of double canoes (waa uoa) owned								
	0	1	2	3	4	5	6	Not stated
Number of households	17 580	161	30	1	-	-	-	-
Number of other fishing boats owned								
	0	1	2	3	5	Not stated		
Number of households	17 645	90	29	3	2	3		

Source: Compiled from NSO (2016).

Coastal fishing is by bottom handlining, trolling, pole-and-line fishing, mid-water handlining, spearing, trapping, netting and reef gleaning or collecting. According to the latest population census in 2015, the most common fishing method used by fishing households was net fishing (Table 5.9). Gillnets of various sizes are the most popular type of fishing nets used in the lagoon and reefs (Ram-Bidesi, 2011).

¹³ Reported by MFMRD as Kiribati-flagged fishing vessels that have been registered on the WCPFC Record of Fishing Vessels to fish in the WCPFC area.

TABLE 5.9
Type of fishing methods used by fishing households in Kiribati, 2015

Fishing method	Trolling	Line fishing	Net scooping	Net fishing	Collecting	Spearing	Other	Total
Number of fishing households	758	2 193	532	5 849	1 233	1 111	520	12 196

Source: NSO (2016).

5.3.2.4 Main resources

Kiribati's offshore fisheries target four main tuna species: skipjack (*Katsuwonus pelamis*), yellowfin (*Thunnus albacares*), bigeye (*Thunnus obesus*) and albacore (*Thunnus alalunga*). In 2014, total offshore catches were approximately 79 percent skipjack, 16 percent yellowfin, 5 percent bigeye and <1 percent albacore (MFED and MFMRD, 2015).

In terms of the status of the above resources in the region, recent information from the Scientific Committee of the WCPFC (WCPFC, 2016) shows that for:

- **skipjack** – the stock is currently only moderately exploited and fishing mortality levels are sustainable;
- **bigeye** – recent analysis indicates that overfishing is occurring for the bigeye tuna stock and that to reduce fishing mortality to that at maximum sustainable yield, a reduction in fishing is required;
- **yellowfin** – the current total biomass and spawning biomass are higher than at levels associated with maximum sustainable yields. Therefore, yellowfin tuna is not considered to be overfished;
- **South Pacific albacore** – there is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries. It should be noted that longline catch rates are declining, and catches over the last 10 years have been at historically high levels and are increasing.

Compared to offshore tuna fisheries, catch species in Kiribati's coastal fisheries are diverse, but there is little quantitative stock assessment information available for these species.

Sullivan and Ram-Bidesi (2008) reported the main finfish species sold at the fish market and on the roadside in Tarawa (Table 5.10).

A more recent study by Campbell and Hanich (2014) also reported key artisanal and subsistence fishery species (Table 5.11).

TABLE 5.10
Common fish species sold in South Tarawa, Kiribati

Local Name	English Common Name	Latin Species Name
Bokaboka	Leatherjacket fish	<i>Siganus</i> sp.
Bawe	Red-tail snapper	<i>Lutjanus fulvus</i>
Okaoka	Orange-striped emperor fish	<i>Lethrinus obsoletus</i>
Ikanibong	Paddletail snapper	<i>Lethrinus gibbus</i>
Morikoi	Spangled emperor	<i>Lethrinus nebulosus</i>
Ati	Skipjack	<i>Katsuwonus pelamis</i>
Ingimea	Yellowfin tuna	<i>Thunnus albacares</i>
Ikarii	Bonefish	<i>Albula glossodonta</i>

Source: Sullivan and Ram-Bidesi (2008).

TABLE 5.11
Key artisanal and subsistence coastal fishery species in Kiribati.

Offshore artisanal	Skipjack tuna
	Yellowfin tuna
	Bigeye tuna
Coastal finfish	Shark
	Bonefish
	Milkfish
	Goatfish
	Spangled emperor
	Snapper
	Grouper
	Flame angel
Coastal invertebrates	Sea cucumber (beche-de-mer)
	Ark shell
	Giant clams
	Pearl oyster
	Spider conch
	Spiny lobster

Source: Campbell and Hanich (2014).

5.3.2.5 Management applied to main fisheries

Offshore fisheries management

At the national level, the management measures for offshore fisheries fall within the mandate of the Kiribati National Tuna Development and Management Plan (2014–2017). Two out of the three goals of the plan have a direct focus on offshore tuna fisheries, i.e. to provide opportunities to harvest and process tuna, and to ensure proper conservation and protection of tuna resources. A Kiribati Shark Sanctuary was also established under the Shark Sanctuary Regulations 2015. It prohibits commercial fishing and finning of five species of shark within all Kiribati waters.

At the subregional level, Kiribati cooperates with other member countries of the Parties to the Nauru Agreement (PNA), which is described below (Box 5.1).

BOX 5.1

Parties to the Nauru Agreement

The early history of the PNA is given by Tarte (2002):

In February 1982 the Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest was opened for signature. The Nauru Agreement had been negotiated by seven Pacific Island states – the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea and Solomon Islands. This group of countries (later joined by Tuvalu) is known collectively as the Parties to the Nauru Agreement (PNA). The conclusion of the Nauru Agreement marked the beginning of a new era in Pacific Island cooperation in the management of the region's tuna stocks. It was an important milestone in the exercise of coastal states' sovereign rights over their 200-mile EEZs. The PNA group accounts for much of the tuna catch in the Pacific Island region. In 1999, it produced 98 percent of the tuna catch taken from the EEZs of Pacific Island Forum Fisheries Agency (FFA) members; 70 percent came from three PNA members: Papua New Guinea, the Federated States of Micronesia and Kiribati. The group also accounted for 94 percent of the access fees paid to FFA Pacific Island states. By controlling access to these fishing grounds, the PNA group collectively wields enormous influence and power.

The most important fishery management tool of the PNA is the Vessel Day Scheme (VDS), which is described in Box 5.2.

BOX 5.2

PNA Vessel Day Scheme

In 2000, a study suggested that the PNA purse-seine management scheme that was then based on vessel numbers be replaced by a scheme based on purse-seine fishing days. The transition was actually made seven years later. In 2007, the Parties to the Nauru Agreement began implementing the Vessel Day Scheme (VDS), transitioning from permitting a total number of purse-seine vessels in the region (205) to permitting a total allowable effort (TAE) in number of purse-seine fishing days (44 703 for 2012; 44 890 days for 2016). Given the volume, value and multi-jurisdictional nature of the fishery, it is arguably one of the most complex fishery management arrangements ever put in place. Its key features are as follows:

- System of tradable fishing effort (days) allocated to the eight Parties
- Limit on total effort (TAE) ~ 45,000 days

- TAE is allocated to Parties based on zonal biomass and historical effort as PAEs (Party Allowable Effort)
- Fishing days are sold to fleets for fishing in each EEZ
- Minimum benchmark price for VDS days sold to foreign vessels
- Fishing days are monitored by satellite-based Vessel Monitoring System (VMS)
- VMS monitoring is supported by observers on board all vessels
- Days are tradable between Parties
- Scheme costs are financed by levies on vessels

Due to the complicated nature of the new VDS system and the various constraints of the government fisheries agencies of the region (e.g. under-funded, under-staffed), it was expected there would be problems in the introduction of the scheme. This is not to say that the VDS has not produced substantial benefits for PNA countries. The system is creating competition for a limited number of days, thereby increasing the value of each day. In practice, the value of a fishing day before the VDS was roughly USD 1 350, but it increased to about USD 5 000 in July 2011 and days were being sold in 2016 for over USD 12 000.

On a different and less tangible level, another benefit is that the VDS moves fisheries management in the region to a desirable rights-based system. That is, fishing rights (such as vessel days) can be defined, allocated, and traded. Consistent with this transition to a rights-based approach, a VDS-style arrangement for management of the tropical longline fishery is being implemented by PNA.

Source: Havice (2013); Campling (2013); Gillett (2014a); Clark & Clark (2014)

At the regional level, there has been, and continues to be, a large amount of regional cooperation in the management of Kiribati's offshore fisheries. Kiribati is a member of the WCPFC, which was established by the 2004 Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. As a member of the Commission, Kiribati is obligated to comply with its conservation and management measures (CMMs). A management plan for fish aggregation devices (FADs) was also developed in 2014 under these measures to ensure sustainable FAD use by offshore fishing fleets. Kiribati participates at meetings of the Inter-American Tropical Tuna Commission, which manages and controls tuna fisheries in the eastern Pacific (MFMRD, 2013). Kiribati is also a member of SPC, FFA and PNA. The management of the tuna fishery is mainly exercised through the PNA and its VDS (Box 5.2). In 2012 alone, Kiribati earned USD 60 million from implementing the VDS for purse-seine vessels fishing in its EEZ (MFMRD, 2013).

Coastal fisheries management

Some long-standing fisheries legislation related to coastal fisheries management still exists. It includes prohibitions on the use of explosives, poison or other noxious substances for killing, stunning, disabling or catching fish (Fisheries Ordinance 1977), protection of customary fishing rights (Fisheries Ordinance 1977) and designated 'prohibited fishing areas' in coastal areas (Prohibited Fishing Areas (Designation) Regulations 1978).

Preston (2008a) reviewed coastal fisheries management in Kiribati and reported that coastal fisheries management was ineffective. Resource-specific regulations existed only for one species (rock lobster) and for bonefish on Christmas Island. There were no quotas and no limits on the number of licences issued, and only two formally established, local fishery management areas (in North Tarawa and on Christmas Island).

In recent years, with the intensifying impacts on Kiribati's coastal resources, such as increasing population, immense fishing pressure, climate change and pollution, there has been a growing need to strengthen coastal fisheries management. Since 2014, there has been some progress in efforts to strengthen coastal fisheries management in Kiribati. Some recent efforts are highlighted below:

- A Live Reef Fish Management Plan was developed by MFMRD and approved in February 2017. The plan sets out seasonal fishing closures (SFCs) for the commercial harvesting of seven species of groupers for the live reef fish trade. An Islands Total Catch of 77 100 kg of groupers has also been set as a national total allowable catch, which is then allocated to 14 islands as Island Grouper Entitlements. Other management measures in the plan include access and harvest controls (including licences), a minimum size limit, and prohibited fishing gear and methods.
- The Community-based Fisheries Management (CBFM) project for Kiribati was initiated in 2014 to empower communities in managing their own coastal marine resources (Uriam, 2016). The approval of Island Councils¹⁴ was required to implement the project. In 2015, community-based fisheries management plans were developed for five pilot communities in Butaritari and North Tarawa. Management measures in the plans include establishing marine reserves and the banning of:
 - destructive fishing gear and practices
 - use of small-mesh-size nets and excessively long gillnets
 - splashing water using metal bars to scare fish and drive them towards nets (*te ororo*)
 - destroying corals to reach fish or octopus
 - fishing on spawning aggregations.

Management objectives

Kiribati's Fisheries Act 2010 provides general guidelines for fisheries management through the development of fisheries management plans with management objectives. However, it does not identify any specific management objectives.

Kiribati's National Fisheries Policy covers five overarching goals and strategic objectives:

- Contribute to economic growth and employment through sustainable fisheries, aquaculture and marine resources development.
- Protect and secure food security and sustainable livelihoods for I-Kiribati.
- Ensure long-term conservation of fisheries and marine ecosystems.
- Strengthen good governance, with a particular focus on building the capacity of the Ministry of Fisheries and Marine Resources Development and relevant sectors to implement and support fisheries management, development and monitoring, control and surveillance.
- Build climate change resilience for fisheries and marine resources in Kiribati.

An integrated fisheries master plan for Christmas Island was also developed with the assistance of SPC for the period 2014–2017 to improve management and sustainable development of the island's fisheries. Its five main priority areas are coastal fisheries, offshore fisheries, aquaculture, tourism and environment.

Management measures and institutional arrangements

In Kiribati, the main institution involved with fishery management is the Ministry of Fisheries and Marine Resources Development (MFMRD). The role of this agency is covered in more detail in section 5.7.1.

¹⁴ Outer islands have Island Councils, which are composed of elected representatives from the islands' villages.

5.3.2.6 Fishing communities

The concept of “fishing communities” has limited applicability to Kiribati, as a majority of households in the country are involved in fishing activities. The Kiribati 2015 census found that a total of 12 196 households (67 percent of total households) had at least one member who fished regularly. The majority of these households fished for consumption purposes and were from South Tarawa and Betio. It could therefore be stated that all villages in Kiribati are “fishing communities”.

5.3.3 Inland sub-sector

There are no freshwater fisheries in Kiribati.

5.3.4 Aquaculture sub-sector

In the past, there have been attempts to culture a wide variety of aquatic species in Kiribati, including seaweed, brine shrimp, cockles, mojarra, mullet, pearl oyster, tilapia and giant clams. Currently, the only significant aquaculture production is milkfish, seaweed and giant clams (Gillett, 2016).

Total aquaculture production of Kiribati for 2014 was estimated to be 255 tonnes plus 8 642 pieces worth USD 237 506 to the fishers/farmers (Gillett, 2016).

MFMRD’s Strategic Plan for 2016–2019, amongst other areas, prioritizes aquaculture development in Kiribati for the next five years. Specific aquaculture activities included in the plan are:

- building a hatchery at two sites (Kiritimati and Tanaea)
- re-instating pearl and mabe farming
- enhancing milkfish and fry production for offshore fishing bait
- building capacity in community-based aquaculture practices
- integrating community-based aquaculture with coastal fisheries management.

5.3.5 Recreational sub-sector

The only significant sport fishery in Kiribati is on Christmas Island. Overseas tourist anglers visit the island to fish for bonefish and, to a lesser extent, for large coastal pelagic species such as trevallies, wahoo, tunas and occasionally marlins. Christmas Island also attracts small numbers of divers. Tourists originate mainly from the United States, Japan, Australia and New Zealand. The sport fishery generates economic benefits for Christmas Island, with an estimated total economic benefit of USD 1.9 million per year (Campbell and Hanich, 2014). This is generated through sport-fishing licence fees, jobs for professional fishing guides, and tourist expenditure in island hotels. In the Line Islands, tourists from the United States primarily target bonefish and trevally (Campbell and Hanich, 2014).

5.4 POST-HARVEST SECTOR

5.4.1 Fish utilization

The majority of Kiribati’s offshore tuna catches are not landed in the country but are destined for export for canning. Offshore fishing vessels either transship locally at three designated ports or at overseas ports. In 2014, 81 percent of catches caught by Kiribati-flagged purse seiners were transshipped in Kiribati as frozen tuna, while the remainder were offloaded in other ports, mainly the Marshall Islands (MFMRD, 2015). In the same year, all pole-and-line catches were transshipped locally, while 90 percent of longline catches were transshipped in Samoa (MFMRD, 2015).

Although there are several Kiribati-flagged purse seiners and longliners, they are not based in Kiribati. Longliners have been feeding fish into the tuna processing plant, Kiribati Fish Limited (KFL), in Tarawa since 2012. Processed tuna from this plant is mainly exported to the United States of America and Japan (MFMRD, 2015).

In the outer islands, catches are mainly used for home consumption or shared. Some excess catch may be salted and dried for later consumption or sale. The Kiribati 2015 census reported that for those households engaged in fishing, 75 percent fished for home consumption only, 19 percent for both consumption and sale, and 4 percent for sale only. Many islands have cold storage, enabling storage for local sale and shipment to Tarawa. In the past, schemes to transport fish to urban markets have met with limited financial success due to the difficulties and cost of maintaining the infrastructure and transporting the product.

5.4.2 Fish markets

Catches taken by small-scale commercial fishers in South Tarawa are mainly sold on the roadside from insulated ice boxes. Some catches are disposed of through small commercial fish markets.

5.5 SOCIO-ECONOMIC CONTRIBUTION OF THE FISHERY SECTOR

5.5.1 Role of fisheries in the national economy

A recent study by SPC (Gillett, 2016) attempted to quantify the fishery-related benefits received by Kiribati. The study gave the available information on the contribution of fishing or fisheries to GDP, exports, government revenue and employment. With respect to estimates of the contribution of fishing to GDP:

- the last official estimation of Kiribati's GDP was done in 2012. Provisional estimates for 2014 found that fishing and seaweed made a contribution to GDP of USD 13.6 million, or 8.6 percent of the GDP of Kiribati;
- in contrast, the contribution of fishing to Kiribati's GDP was re-estimated using a different methodology by the SPC study in 2016 for the year 2014. It showed a contribution of USD 25.6 million or 16.2 percent of the GDP of Kiribati that year.

Since the introduction of the VDS, there has been a significant increase in total revenue collected by the Kiribati government from the fishing industry in the period 2009–2014 (MFED and MFMRD, 2015). In 2014, the total revenue earned from fishing licence fees alone was USD 116 million, which was 75 percent of total government revenue, exceeding its budget estimate by USD 84.9 million (Gillett, 2016). The total revenue from fishing licence revenue sources was USD 116 million, with transshipment fees being the second most important (unpublished MFED data from Gillett, 2016).

5.5.2 Trade

Gillett (2016) summarized Kiribati's fishery exports from 2009 to 2014 from unpublished data from the Kiribati National Statistics Office:

- In 2014, fish exports were the major type of commercial fishery export of the country, accounting for around USD 2.5 million in export value. It is unclear what proportion of fish exports are from coastal and offshore catches.
- Other fishery export products include pet fish, shark fins, seaweed, giant clams and beche-de-mer.
- Total fishery exports accounted for around 40 percent of total exports in 2014.

As reported in Part 1, FAO import/export data for 2014 show that the value of fishery product exports was USD 133 348 000 and imports were USD 705 000.

5.5.3 Food security

Fish is an important element of food security in Kiribati. The FAO Food Balance Sheets show that in 2013, fish and seafood contributed 22 g/capita/day as a source of protein.

5.5.4 Employment

Some fisheries employment information is provided by Gillett (2016) based on the Kiribati 2010 census of population and housing (Table 5.12).

TABLE 5.12
Fisheries employment information by sex, age, and occupation

Age →	Total	Both sexes				Male				Female			
	All	15-24	25-34	35-49	50+	15-24	25-34	35-49	50+	15-24	25-34	35-49	50+
Job category ↓													
Fishing guides	14	3	4	4	3	3	4	4	3	0	0	0	0
Seaweed farmers	126	38	27	44	17	22	18	29	11	16	9	15	6
Coastal fishers	2730	751	749	845	385	707	715	787	362	44	34	58	23
Other fisheries workers (Kereboki etc.)	152	37	49	43	23	31	39	27	12	6	10	16	11
Deep-sea fishers	122	30	34	45	13	29	32	42	12	1	2	3	1
Other fisheries workers	7	2	5	0	0	1	4	0	0	1	1	0	0
Fishery assistants	27	5	9	11	2	5	6	6	2	0	3	5	0
Total	3178	866	877	992	443	798	818	895	402	68	59	97	41

Source: Gillett (2016) from Kiribati 2010 census.

A recent review by Gillett (2015a) of employment opportunities for Kiribati offshore fishing crew members compared crew jobs between 1997 and 2014. The report found that the total number of jobs on offshore fleets declined by 15 percent. Only purse-seine jobs increased, while they decreased for longliners and pole-and-line vessels.

5.5.5 Rural development

In the Kiribati context, “rural development” could be thought of as any development efforts that take place outside the South Tarawa urban area. The primary mechanism for fisheries development in those areas is through promoting income-earning opportunities, mostly by encouraging the capture and culture of products that are subsequently shipped to Tarawa and/or exported. The success of those efforts has been mixed. Outer-island fish collection schemes and seaweed culture have certainly produced benefits for the producers, but this has come at considerable costs in terms of government subsidies and donor funding. Constraints on the feasibility of rural fisheries development schemes relate to business skills, regular maintenance of mechanical equipment, and government involvement in commercial activities.

The Community-based Fisheries Management (CBFM) project, which targets five pilot communities in Butaritari and North Tarawa, focuses on sustainable fisheries management and development initiatives.

5.6 TRENDS, ISSUES AND DEVELOPMENT

5.6.1 Constraints and opportunities

Major constraints for fisheries sector development include the following:

- Many of the inshore fishery resources, especially those close to the urban markets, are fully or over-exploited.
- Small-scale fishers have difficulties in economically accessing the relatively abundant offshore fishery resources.
- There are difficulties associated with transporting and marketing fishery products from the remote areas where abundance is highest to the urban areas where marketing opportunities are greatest.

- There is a lack of government orientation to the private sector, which is poorly developed.
 - For export fisheries, operating costs are relatively high compared to those in competing countries.
 - Purse-seine transshipments place substantial amounts of cheap fish on the Tarawa market, causing hardship for small-scale commercial tuna fishers.
- Opportunities in the fisheries sector include:
- increasing the effectiveness of the Fisheries Division by creating incentives to promote private sector development;
 - improving the sustainability of inshore fishery resources by more active management;
 - for industrial fishing, taking advantage of Kiribati's strengths including: (1) proximity to very substantial tuna resources, (2) the abundant supply of highly productive, competitively priced labour, and (3) the availability of well-trained graduates from the Marine Training Centre.

5.6.2 Government and non-government sector policies and development strategies

As mentioned in Section 5.3.2.5, Kiribati's National Fisheries Policy has five overarching goals and strategic objectives:

- Contribute to economic growth and employment through sustainable fisheries, aquaculture and marine resources development.
- Protect and secure food security and sustainable livelihoods for I-Kiribati.
- Ensure long-term conservation of fisheries and marine ecosystems.
- Strengthen good governance, with a particular focus on building the capacity of the Ministry of Fisheries and Marine Resources Development and relevant sectors to implement and support fisheries management, development and monitoring, control and surveillance.
- Build climate change resilience for fisheries and marine resources in Kiribati.

5.6.3 Research

The Fisheries Division, usually with the support of external donors or organizations, undertakes fisheries and aquaculture research in Kiribati. The objectives are typically to conduct research on marine resources that have potential for development and to coordinate collaborative research activities with regional research organizations. Recent research projects include, but are not limited to, the following:

- Regional tuna tagging programmes: Kiribati has continued to support SPC's regional research on tuna resources, whereby a national tag recovery officer based in the country collects tuna tagging information received from observers and local fishers (MFMRD, 2015).
- Kiribati is also one of the recipient countries of the Australian Centre for International Agricultural Research (ACIAR) project, "Diversification of seaweed industries in Pacific Island countries". This broadly includes biochemical research analysis of various seaweed products, such as *Ulva* sp., *Acanthophora* sp. and *Kappaphycus* sp.

5.6.4 Education and training

Education related to fisheries in Kiribati is undertaken in a variety of institutions:

- Academic training in biological, economic and other aspects of fisheries is given at the University of the South Pacific in Suva, and to a lesser extent at universities in New Zealand, Australia, Japan and the United Kingdom.
- Training courses, workshops and attachments are frequently organized by the regional organizations: SPC in New Caledonia and FFA in the Solomon Islands.

The subject matter has included such diverse topics as fish-quality grading, stock assessment, seaweed culture, fisheries surveillance, and on-vessel observing.

- Courses and workshop are also given by NGOs and bilateral donors.

5.6.5 Foreign aid

Bilateral programmes of technical cooperation, collaboration and assistance in fisheries have been provided by the Governments of Japan, Australia, New Zealand, the United Kingdom and the United States of America, and by multilateral donors including the United Nations Development Programme (UNDP), Asian Development Bank (ADB), FAO and the United Nations Capital Development Fund (UNCDF). Kiribati also enjoys technical assistance, or the channelling of multilateral donor assistance from various regional agencies including FFA, SPC and the University of the South Pacific (USP).

A few ongoing projects in 2017 with MFMRD include the second phase of the Community-based Fisheries Management project (partnered by the ministry, ACIAR, SPC, the University of Wollongong and WorldFish), improving community-based aquaculture, sea cucumber (sandfish) culture, sustainable coastal fisheries, maritime safety awareness and artisanal tuna data sampling (T. Teemari, personal communication, May 2017). Upcoming projects with the ministry include revitalizing milkfish pond farming in the outer islands, milkfish cage farming, and aluminium boat welding in South Tarawa (T. Teemari, personal communication, May 2017).

5.7 INSTITUTIONAL FRAMEWORK

5.7.1 National institutional framework

The Ministry of Fisheries and Marine Resources Development (MFMRD) is the Kiribati Government agency responsible for developing and managing the nation's fisheries as well as other marine resources (marine aggregates, deep-sea minerals). The ministry comprises Administration and Finance sections as well as the two main technical divisions, the Fisheries Division and Mineral Resources Division. The Coastal Fisheries Branch alone currently employs around 82 staff (T. Teemari, personal communication, May 2017).

The Fisheries Division comprises three technical branches:

- The Oceanic Fisheries Branch, which deals with tuna fishery licensing and access arrangements, operation of the vessel monitoring system, deployment of observers and other relevant activities.
- The Coastal Fisheries Branch, which deals with development and management of coastal and inshore fishery resources.
- The Aquaculture Research and Development Branch. It was previously a section of the Coastal Fisheries Branch but is now separate under the current organizational structure.

Each branch is managed by a Principal Fisheries Officer, under the overall supervision of the Director of Fisheries. A separate unit of the division exists to deal with fishery issues in Christmas Island and the Line Islands, which administratively falls under the Aquaculture Research and Development Branch, along with the division's extension and research vessel. A competent authority, the Kiribati Seafood Verification Agency (KSVA), was established to regulate and control fish processing establishments and make provision for the verification of all seafood exports (Campbell and Hanich, 2014). KSVA is a unit managed under the Coastal Fisheries Branch.

Several other institutions in Kiribati are considered fishery stakeholders, including government ministries and other agencies. Campbell and Hanich (2014) list the relevant ministries and agencies and summarize their involvement:

- Eight government ministries have direct involvement in fisheries:
 - The Ministry of the Environment, Lands and Agriculture Development (MELAD) is responsible for evaluating the environmental impacts of marine resource export developments and is also concerned with the protection of subsistence fisheries, and the protection of marine habitats and marine life.
 - The Ministry of Communications, Transport and Tourism Development (MCTTD) maintains the register of the operators of vessels flying the Kiribati flag, including their nationality, and clearance of vessels entering port.
 - The Ministry of Commerce, Industry and Cooperatives (MCIC) is charged with evaluating foreign investment in the marine resources sector and local companies involved in marine product export, and with supporting private sector development.
 - The Ministry of Health regulates food safety and food imports, including fish.
 - The Ministry of Line and Phoenix Islands Development (MLPID) coordinates fishing activities in these islands.
 - The Ministry of Justice (MOJ), which houses the police and maritime services, plays an important role in fisheries compliance and enforcement.
 - The Ministry of Finance and Economic Development (MFED) houses fisheries statistics data, such as from the household income and expenditure survey and fisheries exports. It is also the recipient agency of the foreign fishing access fees.
 - The Ministry of Internal Affairs (MIA) liaises with Island Councils on local fisheries bylaws and outer-island development activities.
- Other agencies:
 - Civil organizations with involvement in fisheries are mostly active in Tarawa (Campbell and Hanich, 2014). They include the Betio Fishermen's Association, Tarawa Fishermen's Cooperative, and Nareau Tuna Boat Owners' Association, which is an amalgamation of three former associations (Katonu Tuna Boat Owners' Association, Causeway Tuna Association and Bonnano Tuna Association (Campbell and Hanich, 2014).

5.7.2 Regional and international institutional framework

The major regional institutions involved with fisheries in Kiribati are FFA (Honiara) and SPC (Noumea). Other players are the Parties to the Nauru Agreement (PNA) Office in Majuro, the Pacific Islands Forum Secretariat (PIFS) in Suva, the Secretariat of the Pacific Regional Environment Programme (SPREP) in Apia, and the University of the South Pacific (USP) in Suva. The various characteristics of those institutions are given in Table 5.13.

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean entered into force in June 2004 and established the Western and Central Pacific Fisheries Commission. Kiribati is a member of the commission, along with 26 other countries. The WCPFC has its headquarters in Pohnpei, Federated States of Micronesia, and has held 13 annual meetings to date.

5.8 LEGAL FRAMEWORK

The main fisheries law of Kiribati is the Fisheries Act. The current (2010) Act's purpose is to make provision for the promotion and regulation of fishing and fishing industries in Kiribati and its fishery limits.

Important aspects of the Act are as follows:

- The Minister is empowered to appoint a Director of Fisheries and any other fisheries officers and licensing officers the Minister considers necessary for the Act.
- The President, acting in accordance with the advice of the Cabinet, has wide powers to make regulations relating, inter alia, to the licensing of foreign fishing vessels, the conditions to be observed by foreign fishing vessels, the conservation

TABLE 5.13
Pacific Island regional organizations involved in fisheries

	FFA	SPC	Other regional organizations with fishery involvement
Main area of emphasis	Providing management advice on tuna fisheries and increasing benefits to Pacific Island countries from tuna fishing activities.	Most aspects of coastal fisheries and scientific research on tuna. Fisheries are only one aspect of SPC's work programme, which also covers such issues as health, demography and agriculture.	PNA – subregional grouping of countries where most purse seining occurs; SPREP – environmental aspects of fisheries; USP – School of Marine Studies (SMS) involved in a wide range of training; PIFS – major political initiatives, some natural resource economics; leads trade negotiations with EU, which have a major fisheries component
Inter-regional relationships	The FFA/SPC relationship has had ups/downs over the years. It was most difficult in the early 1990s, but tremendous improvement in mid/late 1990s. An annual colloquium has helped the relationship. Staff who have moved between the two organizations have made a noticeable improvement in understanding. Much of the success/benefits achieved by FFA/SPC cooperation depends on the personalities of FFA's Director/Deputy and SPC's Director of the Division of Fisheries, Aquaculture and Marine Ecosystems.		At least in theory, all regional organizations come under the umbrella of PIFS. Their activities are coordinated to some degree by the Council of Regional Organisations in the Pacific (CROP), which has a Marine Sector Working Group that meets at least once per year, but is limited by lack of resources for follow-up. FFA originally provided secretariat services to the PNA, but the PNA broke away from FFA in 2010. Currently, there are some sensitivities in the relationship, but it appears to be improving.
Main strengths	Direct contact with its governing body many times per year results in a high degree of accountability. Mandate of tight focus on tuna eliminates considerable dissipation of effort.	Noumea being a pleasant place to work, there is considerable staff continuity. The Oceanic Fisheries Programme often sets the standard for tuna research in the world. Documentation of work is very good.	Because PIFS is under the national leaders, it is considered the premier regional organization. PNA has achieved considerable success and credibility in such areas as raising access fees, 100 percent observer coverage, eco-certification, high seas closures, and controls on FADs. USP is centrally located in the region and SMS has substantial infrastructure. SPREP has close ties to NGOs active in the marine sector.
Membership	Australia and New Zealand, plus Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu	Includes the major metropolitan countries, all Pacific Island countries, and the French/UK/US territories; the most inclusive of any regional organization.	PNA: the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. USP: Cook Islands, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. SPREP: 21 Pacific Island countries and territories, plus Australia, France, New Zealand and United States of America. PIFS: same as FFA

Source: Adapted from Gillett (2014a).

and protection of all species of fish, prohibited fishing gear and methods, and the organization and regulation of marketing, distribution and export from Kiribati of fish and fish products.

- There is provision for fishery management plans.
- A regulatory framework for the operation of fish processing establishments is created.
- There is provision for prohibiting the taking of fish in any sea or lagoon area or on any reef forming part of the ancient customary fishing ground of the people,

except by members of the concerned group or under a licence granted at the discretion of the Minister.

- There is a prohibition on the use of explosives, poisons and noxious substances for the purpose of catching fish.

The Act has been amended several times. The most recent amendment was made in 2009 to take away the discretionary power of the Court to forfeit a vessel or its catch, gear, instruments or appliances, equipment, stores and cargo when found guilty of breaching the provisions of the Fisheries Ordinance.

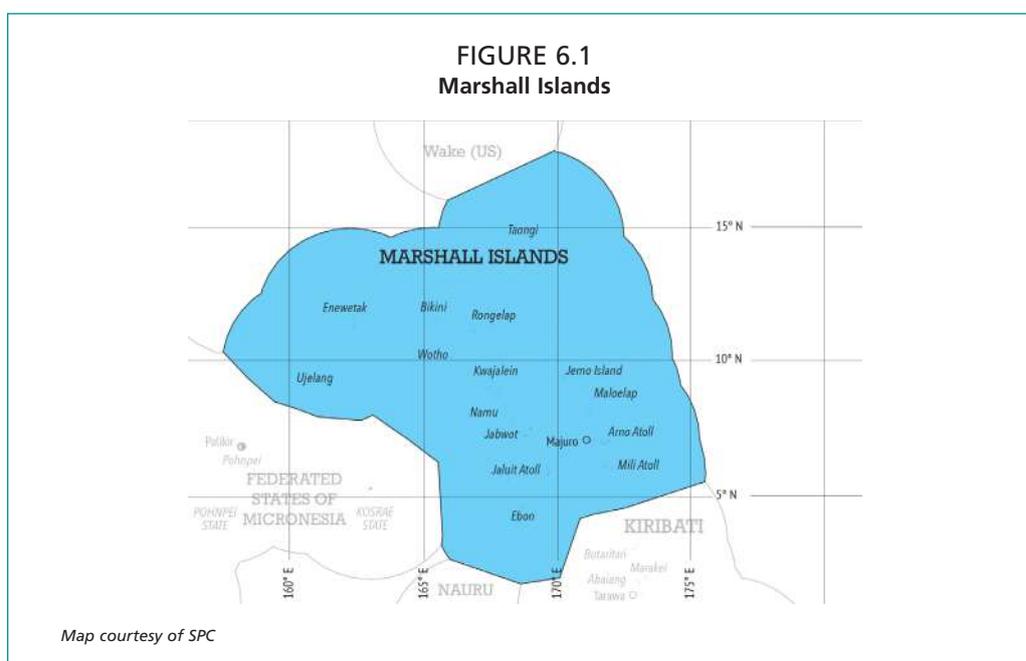
Other legal instruments relevant to fisheries include:

- the Marine Zones (Declaration) Act 2011, which defines and establishes internal waters, the archipelagic waters, the contiguous zone, the territorial sea, the 200-nautical mile EEZ and the continental shelf of Kiribati;
- the Fisheries (Pacific Island Parties' Treaty with the United States of America) Act 1988, which implements the Treaty on Fisheries between the Governments of Certain Pacific Island States and the Government of the United States of America.
- the Native Lands Code, which gives legal recognition to ownership of fish traps, reefs and fish ponds;
- rules concerning fishery practices declared by many of the Island Councils throughout Kiribati.

Several fisheries regulations have been promulgated under the Fisheries Act, although the majority are long-standing, e.g. the Prohibited Fishing Areas (Designation) Regulations 1978, Fisheries Conservation and Protection (Rock Lobsters – *Panulirus* species) Regulations 1979, Fisheries (Processing and Export) Regulations 1981, Fisheries (Vessel Licences) Regulation 1982, and the Shark Sanctuary Regulations 2015.

More information on Kiribati's fisheries legislation can be found on the FAOLEX database (<http://www.fao.org/faolex/country-profiles/general-profile/en/?iso3=KIR>).

6. Marshall Islands



REPORTING YEAR

This profile was written in 2017, based on data mostly from 2014.

PART 1. OVERVIEW AND MAIN INDICATORS

6.1 GENERAL GEOGRAPHIC AND ECONOMIC INDICATORS

TABLE 6.1

General geographic and economic indicators - Marshall Islands

Land area ¹	181 km ²
Water area ²	2 131 000 km ²
Population (2011) ³	53 158
GDP of Marshall Islands (2014) ⁴	USD 186 700 000
Fisheries contribution to GDP (2014) ⁵	USD 26 300 000
Fisheries contribution as a % of GDP (2014) ⁶	14.1

¹ Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

² Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

³ 2011 Population Census from the Republic of the Marshall Islands Economic Policy, Planning and Statistics Office website: rmi.prism.spc.int.

⁴ Reported in Gillett (2016) from the FY 2014 Statistical Compendium (Graduate School, 2015c). Excludes most of the locally based industrial fishing vessels but includes industrial processing operations.

⁵ Reported in Gillett (2016) from the FY 2014 Statistical Compendium (Graduate School, 2015c).

⁶ Reported in Gillett (2016) from the FY 2014 Statistical Compendium (Graduate School, 2015c).

6.2 FAO FISHERIES STATISTICS

TABLE 6.2

FAO Fisheries statistics on total production, employment and trade – Marshall Islands

2014		
Production (tonnes)	Aquaculture	0
	Capture	78 727
	Total	78 727
Employment (thousands)	Aquaculture	0.055
	Capture	N/A
	Total	N/A
Value of trade (USD 1000)	Fisheries exports	96 441
	Fisheries imports	5 791
	Total	102 232

Source: FAO Statistics and Information Branch of the Fisheries and Aquaculture Department. N/A: Data is not available.

PART 2. NARRATIVE

6.3 PRODUCTION SECTOR

6.3.1 Introduction

The Republic of the Marshall Islands consists of an archipelago of twenty-nine atolls and five low coral islands. The two island chains, the eastern Ratak (Sunrise) and western Ralik (Sunset), lie 208 km apart in a north-west to south-east orientation. Nineteen atolls and four islands are inhabited.

Fish has historically been an important component of the diet of the Marshall Islands population. Although imported food has become more important since the 1960s, the consumption of fish remains substantial and is critical in the outer islands. The money obtained from licensing foreign fishing vessels to operate in the Marshall Islands zone is a large component of government revenue. Employment related to servicing fishing vessels and processing fish has become significant in the last decade.

The capital of the Marshall Islands, Majuro, possesses much of the necessary infrastructure and facilities for fishing vessel activities. The port in Majuro is one of the country's most important assets for overall economic development as well as for tuna fisheries. The lagoon area fronted by "downtown" Majuro offers secure anchorage for transshipping purse seiners and frozen fish carriers. Facilities in Majuro include a floating dry dock; a deep-water harbour with container-handling facilities; a fish base complex equipped with a bulk ice facility and a satellite chiller plant at the airport for air shipment; a 1 million litre, bulk fuel storage bunker facility; regular international shipping services; and an international airport. In addition, Majuro has many stores well stocked with supplies and goods, mostly imported from the US. Ebeye, the Marshall Islands second largest urban centre, is also equipped with fishing facilities such as a protected harbour and marina and fish base (McCoy *et al.*, 2015; MRAG, 2011).

Fisheries statistics can be presented in different forms, to cater for different purposes. In the Marshall Islands statistics published by FAO in Part 1 of this profile, the presentation follows the international conventions and standards used by FAO and its Member States for reporting catches, which are given by the flag of the catching vessel. Accordingly, the fishery and aquaculture production of Marshall Islands in 2014 published by FAO (Part 1) was 78 727 tonnes.

In Table 6.3, the Marshall Islands fishery production statistics include the catch by Marshall Islands-flagged vessels, the catch by small boats (which do not carry a flag) and the catch from fishing activities that do not involve a vessel (e.g. reef gleaning).

The offshore category in the table is defined as the catch from Marshall Islands-flagged, industrial-scale fishing operations that are carried out anywhere in the western and central Pacific Ocean (i.e. inside or outside Marshall Islands waters).

TABLE 6.3
The Marshall Islands fisheries production (as per FAO reporting standards)

	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Marshall Islands-flagged offshore
Volume (tonnes)	10 000 pieces ⁷	0	1 500	3 000	79 562
Value (USD)	50 000	0	4 350 000	6 000 000	n/a

The amounts of production given in the above table differ from those shown in Part 1. The table gives production estimated from a variety of sources (see SPC study below), whereas the quantities given in Part 1 are generally those reported to FAO by the Marshall Islands Marine Resources Authority (MIMRA). The major difference between the above table and the data in Part 1 is in the category “Marshall Islands-flagged offshore”. The amount listed in Table 6.3 for this category is from the official report of the Marshall Islands to the Western and Central Pacific Fisheries Commission (MIMRA, 2015a).

A recent study by the Pacific Community (SPC) presents the fishery statistics of the Marshall Islands in a different way from that of FAO. The SPC study reports the amount of catch in Marshall Islands fishery waters, regardless of vessel flag. In the study, the catches are placed in different categories, which is useful for other purposes, such as administration of the foreign fishing that occurs in the fishery waters of the Marshall Islands. A summary of fisheries production from the SPC study is given in Table 6.4.

TABLE 6.4
Fisheries production in Marshall Islands waters

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Offshore locally based ⁸	Offshore foreign-based ⁹
					Both Marshall Islands- and foreign-flagged vessels	
Volume (tonnes)	10 000 pieces	0	1 500	3 000	85 918	29 754
Value (USD)	50 000	0	4 350 000	6 000 000	133 530 000	38 700 638

Source: Gillett (2016).

Some comment is required to explain the difference between the information in this table and that in Part 1 of this profile:

- Catches can be given by the flag of the catching vessel (as in the FAO statistics in Part 1), or by the zone where the catch is made (the “offshore foreign-based” and “offshore locally based” columns in the table above). These two different ways of allocating catches each have their purposes. Attribution by flag is important

⁷ The production of several important aquaculture products (e.g. giant clams) is measured in pieces rather than in weight.

⁸ In the SPC study, “offshore locally based” is the catch by industrial-scale tuna fishing operations that are (a) based at a port in Marshall Islands, and (b) generally harvested more than 12 nautical miles offshore.

⁹ “Offshore foreign-based” is the catch in the Marshall Islands zone from catch from industrial-scale tuna fishing operations that are based at ports outside Marshall Islands. Under the international, standardized System of National Accounts (SNA, 2009), those catches do not contribute to the GDP of the Marshall Islands.

for consistency with international conventions, while attribution by zone is important for determining fishing contributions to GDP and managing revenue from licence fees for foreign fishing in a country's zone.

- There is no fisheries statistical system covering the categories of aquaculture and coastal subsistence/commercial fishing. The estimates above were made by a study carried out by SPC in 2015 that examined a large number of fishery and economic studies covering the last two decades. It is likely that the basis of the information for the three categories in the FAO statistics in Part 1 was a more informal conjecture by a nominated person in MIMRA.
- Aquaculture production in the Marshall Islands includes non-food items, such as coral and giant clams for the aquarium trade.

6.3.2 Marine sub-sector

6.3.2.1 Catch profile

The marine fisheries have two very distinct components, offshore and coastal:

- Offshore fisheries are focused on tuna and consist of longlining, purse seining and pole-and-line fishing. These are conducted by vessels that are both locally and foreign based.
- Coastal fishing is carried out for subsistence purposes and for sale in local and export markets.

The Marshall Islands paper submitted in mid-2015 to the Scientific Committee of the Western and Central Pacific Fisheries Commission (MIMRA, 2015a) states:

The Republic of the Marshall Islands continued to operate 10 purse-seine vessels fishing throughout the Western and Central Pacific Ocean (WCPO). The total catch by the national purse-seine fleet in 2014 was 79 562 metric tonnes, of which 18 percent was taken within the exclusive economic zone (EEZ) of the Marshall Islands. There was no national longline catch recorded as the longline vessels formerly flagged to the Marshall Islands were reflagged to the Federated States of Micronesia in 2013.

MIMRA (2015a) gives information on the 2014 catches of the offshore fleets that operate in the waters of the Marshall Islands:

- The domestically based, foreign longline fleet comprises vessels from China, Taiwan Province of China and the Federated States of Micronesia. Those vessels were operated under Marshall Islands Fishing Venture, Ltd, which is a subsidiary of Luen Thai. All longliners that operate in the Marshall Islands zone are based in Majuro except for the Japanese longline vessels, which offload their catch in ports in Japan. Total longline catches increased from 6 002 tonnes in 2013 to 7 798 tonnes in 2014.
- Available logsheet data indicates that the total catch by purse-seine fleets operating in the EEZ of the country increased from 27 608 tonnes in 2013 to 43 571 tonnes in 2015. Thirty-three percent of the catch was taken by the Marshall Islands fleet followed by twenty-six percent by the United States of America fleet.

Catches in recent years, by main gear type, in the Marshall Islands waters are given in Table 6.5.

There is considerable uncertainty concerning the levels of catches from coastal fisheries, which are not covered by a statistical system. Available information for estimating catch levels includes records of government fish purchases in the outer islands, a household income and expenditure survey in 2002, some specialized fisheries surveys, and data on exports of fishery products. Using that information, an SPC study (Gillett, 2016) made a crude estimate of the total coastal fisheries production in Marshall Islands in 2014:

TABLE 6.5
Catches, by main gear type, in
Marshall Islands waters (2010–2014)

	Purse seine	Longline
2010	13 794	5 663
2011	16 565	5 081
2012	17 777	6 390
2013	27 608	6 002
2014	43 571	7 798

Source: MIMRA (2015a); units - tonnes.

- The coastal commercial component was estimated to be 1 500 tonnes. Considering MIMRA buying prices in the outer islands and prices paid to fishers in Majuro, the dockside value of the 2014 coastal commercial catch was about USD 4 350 000. The coastal commercial catch consists of both food items (e.g. finfish) for domestic consumption, and non-food commodities (e.g. trochus, aquarium fish and coral) for export.
- Coastal subsistence catches were estimated to have been about 3 000 tonnes in 2014. The value of subsistence production was estimated to be USD 6 million per year.

The lack of a fisheries statistical system for coastal fisheries prevents the identification of quantitative trends in these fisheries. There is, however, a general perception that the important coastal resources are increasingly subject to over-exploitation close to urban areas.

6.3.2.2 Landing sites

The domestically based, foreign longline fleet lands its catch in Majuro. The foreign-based longline vessels that operate in Marshall Islands fisheries waters (all Japanese) land their catch in Japan.

Some of the purse-seine catch is landed in Majuro for use at the Pan Pacific tuna loining plant. The vast majority of the purse-seine catch by the domestic purse-seine fleet and by foreign fleets fishing in Marshalls Islands waters is transshipped in Majuro or another Pacific Island port for eventual landing at an Asian port. MIMRA (2016) states that an estimated 704 purse-seine transshipments were undertaken in Majuro in 2015, with a provisional total of 444 393 tonnes transshipped.

Most coastal commercial catches are landed at the islands that have urban areas: Majuro and Kwajalein. In addition, the government purchases fish in some of the outer islands – including Arno, Jaluit, Maloelap, Aur, Ailinglaplap, Namu, Likiep and Ailuk – for transport for sale in those urban areas.

Subsistence fishery landings occur at villages throughout the coastal areas of the country, roughly in proportion to the distribution of the population.

6.3.2.3 Fishing practices/systems

The Marshall Islands report to the Western and Central Pacific Fisheries Commission (MIMRA, 2015a) gives information on the number of Marshall Islands-flagged tuna vessels in recent years (Table 6.6).

TABLE 6.6
Number of Marshall Islands-flagged fishing vessels active in the WCPO (2010–2014)

GRT	Purse seine				Longline			
	0–10	10–50	50–200	200–500	0–500	500–1000	1000–1500	1 500+
2010	0	0	4	0	0	0	7	3
2011	0	0	4	0	0	0	7	3
2012	0	0	4	0	0	0	7	3
2013	0	0	3	0	0	0	7	3
2014	0	0	0	0	0	0	7	3

McCoy *et al.* (2015) give information on the 10 Marshall Islands-flagged purse seiners. Six are owned by Koo's of Taiwan Province of China, three by Pan Pacific Fisheries (PPF) and its parent company in China, and one by MIMRA.

- Koo's vessels were all built in Taiwan Province of China between 2002 and 2010. Their fish-carrying capacities range from about 900 to 940 tonnes. The newer vessels show a slight increase in overall length, from 62 to just under 65 m.

In addition to its purse seiners, Koo's also owns three fish carriers with capacity in the range of 1 500 to 2 000 tonnes.

- The MIMRA purse seiner is the oldest of the Taiwanese-built vessels, having been built in 1999. It is also the smallest at just over 60 m, with a carrying capacity of 900 tonnes.
- PPF's three Marshall Islands-flagged purse-seine vessels were built in China (2) in 2010 and Spain (1) in 1992. The PPF vessels are considerably larger than Koo's: the two Chinese-built vessels are just under 72 m in length with a carrying capacity of 1 100 tonnes. The Spanish-built vessel is of similar length with a carrying capacity of 1 740 tonnes.

MIMRA (2016) states that 225 foreign-flagged vessels were licensed to fish in the Marshall Islands in 2014. They consisted of 50 longliners, 162 purse seiners and 13 pole-and-line vessels.

In the coastal fisheries, capture methods for food fish are diverse. They include spearing, handlining, trolling, gillnetting and cast-netting. Paddling and sailing canoes are widely used for subsistence fishing in the outer atolls, while most small-scale commercial fishing is conducted from craft of 4.5–6 m in length, powered by outboard motors in the 15–40 horsepower range.

Aquarium fish and trochus are the two most important non-food coastal fisheries in the country:

- An aquarium fishery has operated in Majuro for more than 15 years, with one principal operator and several smaller ones. Virtually all the catch is taken from the Majuro lagoon and outer reef, by both freediving and scuba diving. It has been estimated that around 3 000 fish of up to 50 species are exported each week.
- Trochus were transplanted to several atolls in the Marshall Islands from Chuuk and Palau by the Japanese in the 1930s. Enewetak atoll is the location for most of the Marshall Islands trochus catch. Trochus is collected either by freediving on the reef or gleaning while walking on the reef.

6.3.2.4 Main resources

MIMRA (2015a) gives the catch composition of the purse-seine and longline catches in the waters of the Marshall Islands (Tables 6.7 and 6.8).

TABLE 6.7
Composition of the purse-seine catch

Year	Bigeye	Skipjack	Yellowfin	Other	Total
2010	179	13 058	557	0	13 794
2011	321	15 448	791	5	16 565
2012	283	16 916	564	14	17 777
2013	1 165	25 796	641	6	27 608
2014	2 419	40 596	538	18	43 571

Units: tonnes.

TABLE 6.8
Composition of the longline catch

Year	Albacore	Bigeye	Yellowfin	Other	Total
2010	242	3 301	1 417	703	5 663
2011	133	3 164	1 087	697	5 081
2012	254	4 027	1 372	737	6 390
2013	237	2 972	2 014	779	6 002
2014	172	4 680	2 346	600	7 798

Units: tonnes.

In terms of the status of its fish resources, the four major species of tuna in the Marshall Islands mix freely with those of neighboring countries in the western and central Pacific. Recent information from the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC, 2016) shows that for:

- **skipjack** – the stock is currently only moderately exploited and fishing mortality levels are sustainable;
- **bigeye** – recent analysis indicates that overfishing is occurring for the bigeye tuna stock and that to reduce fishing mortality to that at the maximum sustainable yield, a large reduction in fishing mortality is required;
- **yellowfin** – the current total biomass and spawning biomass are higher than at levels associated with maximum sustainable yields. Therefore, yellowfin tuna is not considered to be in an overfished state;
- **albacore** – there is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries. It should be noted that longline catch rates are declining, and catches over the last 10 years have been at historically high levels and are increasing.

The Arno Atoll Fisheries Development Project was established in 1989 to develop small-scale coastal commercial fishing in the Marshall Islands. Catches made by the project could be considered indicative of generalized, small-scale commercial fishing in the country. Table 6.9 shows the 15 most important finfish and 10 most important invertebrates landed by the project in recent years.

TABLE 6.9
Species capture by the Arno Atoll Fisheries Development Project

English name	Scientific name	English name	Scientific name
Finfish		Invertebrates	
Forktail rabbitfish	<i>Siganus argenteus</i>	Elongated clam	<i>Tridacna maxima</i>
Rainbow runner	<i>Elagatis bipinnulata</i>	Bear's paw clam	<i>Hippopus hippopus</i>
Humpback snapper	<i>Lutjanus gibbus</i>	Scaly clam	<i>Tridacna squamosa</i>
Parrotfish (white)	<i>Scarus longiceps</i> and <i>Scarus</i> spp.	Pacific asaphis	<i>Asaphis violascens</i>
Marbled grouper	<i>Epinephelus fuscoguttatus</i> , <i>E. microdon</i> and <i>Epinephelus</i> spp.	Smooth beach clam	<i>Atactodea</i> sp.
Yellowfin tuna	<i>Thunnus albacares</i>	Turban shell	<i>Turbo</i> spp.
Parrotfish (blue and green)	<i>Scarus</i> spp.	Trochus	<i>Trochus niloticus</i>
Rudderfish	<i>Kyphosus cinerascens</i> and <i>K. bigibbus</i>	Money cowries	<i>Cypraea moneta</i> and <i>C. annulus</i>
Surgeonfish (black)	<i>Acanthurus olivaceus</i> and <i>Acanthurus</i> spp.	Ellodid snail	<i>Pila luteus</i>
Dash-dot goatfish	<i>Parupeneus barberinus</i>	Octopus	<i>Octopus</i> spp.
Convict surgeonfish	<i>Acanthurus triostegus</i>		
Skipjack	<i>Katsuwonus pelamis</i>		
Orangespine unicornfish	<i>Naso lituratus</i>		
Yellowstripe goatfish	<i>Mulloidichthys vanicolensis</i>		
Bigeye emperor	<i>Monotaxis grandoculis</i>		

Source: MIMRA (unpublished data).

With respect to export-oriented coastal commercial fishing:

- in the aquarium fishery about 50 species are taken, with the most common being the flame angel fish (*Centropyge loriculus*);
- the trochus fishery is based on a single species, *Trochus niloticus*.

Documentation on the catches from subsistence fishing is not readily available. However, it is likely that subsistence catches are similar to those made by small-scale commercial fishing at the Arno atoll (listed in the table above), excepting species (mainly skipjack) that are caught by motorized fishing craft trolling outside the reef. Those species are less common in subsistence catches.

An interdisciplinary study of market forces and nearshore fisheries management in Micronesia (Rhodes *et al.*, 2011), which used a variety of sources, commented on the status of coastal fisheries resources in the Marshall Islands (Box 6.1).

BOX 6.1

Status of coastal fisheries resources

The current status of coastal fisheries resources in the Marshall Islands is overfished or fully exploited. Common signs of fishery decline include lower catch volumes, spawning aggregation loss, smaller fish sizes and reduced catch-per-unit-effort (CPUE). In some areas, late-maturing, slower-growing species such as the green bumphead parrotfish (*B. muricatum*) have become virtually extinct, while top predators are rare in some atolls. Fish populations have also been impacted on nearby reefs (e.g. Arno), as a direct result of fishing subsidies. The main drivers of overfishing in the Marshall Islands are population pressure and fish exports to overseas markets. Local demand is manifested in country's strong subsistence and commercial market fisheries, which exert significant pressure on available resources. According to local NGO and fisheries resource management representatives, overfishing has occurred in the majority of fishing grounds proximate to Majuro, with commercial demand increasingly being met from the outer islands. Overexploitation of nearshore fish resources close to Majuro is driven by unsustainable fishing practices and under-valued fish pricing, similar to other Micronesian jurisdictions. Overfishing has been exacerbated by scuba and night-time spearfishing.

6.3.2.5 Management applied to main fisheries

The offshore fisheries in the Marshall Islands are managed on national, subregional, and regional levels:

- On the national level, the management measures for the offshore fisheries of the Marshall Islands are detailed in the Marshall Islands Tuna Management and Development Plan. The plan was prepared pursuant to Section 25 of the Marine Resources Act 1997.
- On the subregional level, the Marshall Islands cooperates with the other countries that are members of the Parties to the Nauru Agreement (PNA), which is described below.
- On the regional level, the Marshall Islands is a member of the Western and Central Pacific Fisheries Commission (WCPFC) that was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. The Marshall Islands and the other 26 members of the commission enact tuna management measures at the annual WCPFC meeting. From the Marshall Islands perspective, the most important recent measure is the Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean.

A crucial aspect of the management of the offshore fisheries in the Marshall Islands is the PNA and its Vessel Day Scheme. The early history of the PNA is given by Tarte (2002):

In February 1982, the Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest was opened for signature. The Nauru Agreement had been negotiated by seven Pacific Island states – the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea and Solomon Islands. This group of countries (later joined by Tuvalu) is known collectively as the Parties to the Nauru Agreement (PNA). The conclusion of the Nauru Agreement marked the beginning of a new era in Pacific Island cooperation in the management of the region’s tuna stocks. It was an important milestone in the exercise of coastal state sovereign rights over their 200-mile EEZs. The PNA group accounts for much of the tuna catch in the Pacific Island region. In 1999, it produced 98 percent of the tuna catch taken from the EEZs of Pacific Islands Forum Fisheries Agency (FFA) members; 70 percent came from three PNA members: Papua New Guinea, the Federated States of Micronesia and Kiribati. The group also accounted for 94 percent of the access fees paid to the FFA Pacific Island states. By controlling access to these fishing grounds, the PNA group collectively wields enormous influence and power.

The most important fishery management tool of the PNA is the Vessel Day Scheme (VDS), which is described in Box 6.2.

BOX 6.2

PNA Vessel Day Scheme

In 2000, a study suggested that the PNA purse-seine management scheme that was then based on vessel numbers be replaced by a scheme based on purse-seine fishing days. The transition was actually made seven years later. In 2007, the Parties to the Nauru Agreement began implementing the Vessel Day Scheme (VDS), transitioning from permitting a total number of purse-seine vessels in the region (205) to permitting a total allowable effort (TAE) in number of purse-seine fishing days (44 703 for 2012; 44 890 days for 2016). Given the volume, value and multi-jurisdictional nature of the fishery, it is arguably one of the most complex fishery management arrangement ever put in place. Its key features are as follows:

- System of tradable fishing effort (days) allocated to the eight Parties
- Limit on total effort (TAE) ~ 45,000 days
- TAE is allocated to Parties based on zonal biomass and historical effort as PAEs (Party Allowable Effort)
- Fishing days are sold to fleets for fishing in each EEZ
- There is a minimum benchmark price for VDS days sold to foreign vessels
- Fishing days are monitored by a satellite-based Vessel Monitoring System (VMS)
- VMS monitoring is supported by observers on board all vessels
- Days are tradable between Parties
- Scheme costs are financed by levies on vessels

Due to the complicated nature of the new VDS system and the various constraints of the government fisheries agencies of the region (e.g. under-funded, under-staffed), it was expected there would be problems in the introduction of the scheme. This is not to say that the VDS has not produced substantial benefits for PNA countries. The system is creating competition for a limited number of days, thereby increasing the value of each day. In practice, the value of a fishing day before the VDS was roughly USD 1 350, but it increased to about USD 5 000 in July 2011 and days were being sold in 2016 for over USD 12 000.

On a different and less tangible level, another benefit is that the VDS moves fisheries management in the region to a desirable rights-based system. That is, fishing rights (such as vessel days) can be defined, allocated and traded. Consistent with this transition to a rights-based approach, a VDS-style arrangement for management of the tropical longline fishery is being implemented by PNA.

Source: Havice (2013); Campling (2013); Gillett (2014a); Clark and Clark (2014).

While the PNA's minimum price for a fishing day is USD 8 000, about one-third of MIMRA's fishing days are being sold in 2017 at prices ranging from USD 10 000 to USD 12 500 per day. The Marshall Islands share of the 45 000 total allowable fishing days is somewhat less than 3 000 days (Johnson, 2017).

Although oceanic fishery management tends to dominate MIMRA's agenda, the Authority encourages the development of coastal management plans for outer islands. These conservation and management plans are essential to maintaining sustainability in local fisheries (MIMRA, 2015b). A key component of this process is work with outer island communities, including local governments and traditional leaders, to develop resource management plans. MIMRA staff engage with outer island communities to build understanding of the need for a management plan, identify resources essential to the sustainability of these remote communities, and draft a sustainable management plan for inshore or coastal fishery resources (www.mimra.com).

National plans for coastal fisheries have been developed by MIMRA, including:

- **Sea Cucumber Regulations**, which promote the sustainable use, proper conservation and management, and export of sea cucumbers by providing for certain conservation and management measures, prohibiting the export of sea cucumbers without authorization by the MIMRA Director, and providing for certain prohibitions. Under the Regulations, MIMRA deals with issuing licenses for export, while the local government deals with issuing harvesting licenses. Licences can only be granted to three exporters of sea cucumber under the regulations.
- **Aquarium Fishery Regulations**, which put in place measures to ensure the proper conservation of coastal marine resources and management of the country's aquarium fishery by regulating the holding, purchase, sale and export of marine ornamentals, and by providing general measures to control and support local governments' capacity to regulate the collection of marine ornamentals.

The traditional system of management in the Marshall Islands is described in Box 6.3 (Rhodes *et al.*, 2011).

Management objectives

The Marshall Islands Tuna Management and Development Plan states that the national goals are to improve economic benefit from the fisheries sector within sustainable limits; to promote responsible and sustainable private-sector-led fisheries developments; and to strengthen institutional capacity to facilitate the responsible development and management of the nation's fisheries resources.

Although MIMRA responsibilities include coastal fisheries management, the Authority's current interventions in coastal fisheries are largely oriented to assisting with developing resource management institutional arrangements in the outer atolls, and fish transporting and marketing arrangements. In practice, the authority for fisheries management is devolved to local island governments. Management objectives and measures vary considerably between islands, ranging from virtually no measures to various types of bans. Perhaps the best-known measure is the prohibition on taking trochus on several islands except during short open seasons.

BOX 6.3

Traditional marine management in the Marshall Islands

In the Republic of the Marshall Islands, all land and nearshore resources are owned and managed under a matriarchal lineage. In the past, customary marine tenure (CMT) was strong in the country, with a traditional leader of the highest ranked family group on the island or atoll filling the role of “paramount chief.” This chief also controlled surrounding marine ecosystems, including coral reefs. A chief could apply a taboo to any section of a reef to control fishing. Otherwise, the residents of any atoll or island were permitted to fish along any section of the reef. However, outsiders were strictly prohibited from exploiting the resources of an atoll without obtaining permission from the chief. In 1934, following colonization, the Japanese declared reef areas open to everyone. By 1958, a researcher noted that “...the power of the paramount chief has become weakened since the arrival of the foreigners, but the concept that the right to exploit the marine resources of an atoll is the prerogative of the inhabitants of that atoll still persists”. Today, traditional CMT still exists in, but has declined in importance, with varying degrees of effectiveness depending on geographical location. Paramount chiefs control the laws regarding fishing times and fishing areas for the reefs they have tenure over. Adjacent coral reef and lagoon areas near Majuro are open access, whereas outer islands and atolls are still controlled under traditional CMT. The current conservation action plan seeks to strengthen CMT throughout the country.

6.3.2.6 Fishing communities

The concept of “fishing communities” has limited applicability to the Marshall Islands. Nearly all households, especially those away from Majuro, are involved in fishing activities. It could therefore be stated that most villages in the Marshall Islands are “fishing communities”.

6.3.3 Inland sub-sector

There are no inland fisheries in the Marshall Islands.

6.3.4 Aquaculture sub-sector

A large number of aquaculture activities have been carried out in the Marshall Islands. Table 6.10 (p. 152) lists many of them.

Hambrey Consulting (2011) states that current aquaculture production in Marshall Islands consists of relatively steady but small production of tridacnid clams for the aquarium market, as well as small amounts of hard and soft corals for the same aquarium trade and sporadic production of black pearls.

An SPC study (Gillett, 2016) scrutinized all readily available sources of information on aquaculture in the Marshall Islands, including the Hambrey report, export documentation, views of MIMRA officials, and MIMRA annual reports. The study concluded that annual aquaculture production in Marshall Islands in 2014 consisted of giant clams, pearls and hard and soft corals, producing an estimated 10 000 pieces worth USD 50 000.

Mariculture development and management in the Marshall Islands is guided by traditional land tenure, national policy and legislation, local government bylaws and institutional arrangements that allow government bodies to coordinate decision making and proactively integrate non-governmental interests. Governance of mariculture on a national level exists in the form of policy, agencies and their mandates, and specific requirements under a number of legislative acts. In contrast to fisheries, existing legislation can be interpreted as enabling for mariculture development rather than

TABLE 6.10
Aquaculture operations in the Marshall Islands since the late 1980s

Activity	Species	Location	Time Period
Public and educational			
Kwajalein giant clam mariculture	Smooth giant clam from Palau (<i>Tridacna derasa</i>)	Kwajalein	1989–?
Namdrik Black Pearl Project	Black-lip pearl oyster (<i>Pinctada margaritifera</i>)	Namdrik	1990–1995
Giant clam hatchery/ Outer Island Farmers Program	Fluted clam (<i>T. squamosa</i>)	Ailuk, Aur, Jaluit, Likiep, Maloelap, Ujae, Wotje	1993–1995
Likiep Clam Farm	Elongated giant clam and giant clam (<i>Tridacna</i> spp., mostly <i>maxima</i> and <i>gigas</i>)	Likiep	1993–present
Arrak Experimental Pearl Oyster Hatchery	Black-lip pearl oyster (<i>P. margaritifera</i>)	Majuro	2001– present
Arrak Demonstration Pearl Oyster Farm	Black-lip pearl oyster (<i>P. margaritifera</i>)	Majuro	2003–present
Seaweed cultivation	Seaweed (<i>Eucheuma cottonii</i>)	Majuro Jaluit	2002–present
Arno Clam Hatchery	Elongated giant clam (<i>Tridacna</i> spp., mostly <i>maxima</i>) and potentially rabbitfish (<i>Siganus</i> spp.)	Arno	2003–present
Commercial			
Giant clam aquaculture	Giant clam (<i>T. gigas</i>)	Mili	1988
Mili Giant Clam Farm	Giant clam (<i>T. gigas</i> , <i>T. squamosa</i> ,)	Wau Island, Mili	1988–present
Marshall Islands Mariculture Farm	Giant clams (esp. <i>T. maxima</i> and <i>T. crocea</i>), hard and soft coral, live rock	Wau Island, Majuro	1995–present
RRE Pearl Oyster Farm at Arno	Black-lip pearl oyster (<i>P. margaritifera</i>)	Arno	1995–present
RRE Pearl Oyster Farm at Jaluit	Black-lip pearl oyster (<i>P. margaritifera</i>)	Jaluit	2001–present
BPOM Pearl Oyster Farm at Arno	Black-lip pearl oyster (<i>P. margaritifera</i>)	Arno (relocated from Majuro in 2002)	1998–present
Woja Pearl Oyster Hatchery	Black-lip pearl oyster (<i>P. margaritifera</i>)	Majuro (requires modifications to be operational)	1998–present
Outer Island Pearl Oyster Development Project	Black-lip pearl oyster (<i>P. margaritifera</i>)	Jaluit	2003–present

Source: Anon. (2005).

prescriptive. There are no regulations for mariculture activities issued under the Marine Resources Act or any other statute. Establishment of a mariculture facility or project requires approval from the Director of MIMRA and clearance from the Manager of the Environmental Protection Agency in relation to possible environmental impacts (Anon., 2005).

6.3.5 Recreational sub-sector

Although subsistence fishing may have a large social component and be enjoyed by the participants, there is little recreational fishing in villages as a leisure activity. In Majuro

and Kwajalein, there is some sport fishing (mainly offshore trolling). One hotel/retail company operates a sport charter vessel based in Majuro. The website of the Marshalls Billfish Club (www.billfishclub.com) states that since 1983, the club has been the biggest proponent of sport fishing in the Marshall Islands and Micronesia, organizing more than 140 sport fishing tournaments.

The Marshall Islands Marine Resources Authority Act defines “sport fishing” as “the use or hiring out of a fishing vessel or services thereof for recreational fishing purposes, but does not include commercial fishing”. Although sport fishers must comply with fisheries legislation, there is no specific management of sport fishing in the country.

6.4 POST-HARVEST SECTOR

6.4.1 Fish utilization

Fish processing for export in Majuro is undertaken by the Marshall Islands Fishing Venture (MIFV) and Pan Pacific Fisheries (PPF). There is also some small-scale local processing for the domestic market. McCoy *et al.* (2015) give details of the three operations:

- MIFV’s plant processes fresh, longline-caught fish from the company’s vessels and produces loins and other sashimi-grade products for air shipment to the United States of America and Japan. Only fish over 15 kg are loined according to the company. It also processes lower-grade tuna (below B grade) as carbon-monoxide-treated steaks and loins for freezing and shipment to the US. Longline bycatch is frozen for containerized shipment to Asia. The volumes of fresh/frozen value-added products (e.g. loins, including those treated with carbon monoxide) exported to the United States of America increased from 2011 to 2013 as the parent company expanded distribution of its products in the United States of America through its Hawaii and Seattle-based distributor.
- PPF took over and refurbished a defunct loining plant on leased land in Majuro, which had gone bankrupt in 2004. After refurbishing and expanding the plant, PPF began processing loins in 2009. The plant currently processes a maximum of about 20 tonnes per day, far below installed capacity. The company also has an oil-fired fishmeal plant that processes scraps and rejected fish from the loining plant. PPF sources about 90 percent of its raw material from its own fleet. According to the MIMRA Annual Report for 2014, a total of 3 768 tonnes of precooked tuna loins and related products were exported to various markets in 2014.
- A small amount of sun-dried fish jerky for local sale is produced by the Outer Islands Fish Market operated by MIMRA in Majuro. The facility, built with aid from Japan with operations heavily subsidized by MIMRA, sells primarily reef fish brought in by MIMRA’s outer-islands fish collection scheme. The facility, which can produce up to 100 two-ounce bags per day of fish jerky from tuna and marlin, reports strong local demand for the products.

During 2014, Majuro became the busiest tuna transshipment port in the western Pacific as the volume of fish offloaded from purse seiners to carrier vessels for transport to offshore canneries rose 73 percent compared to 2013, from 182 382 tonnes to 315 909 tonnes. The number of transshipments nearly doubled, from 270 in 2013 to 495 in 2014 (MIMRA, 2015b).

Air freight support is provided to MIFV by its sister company, Asia Pacific Air (APA). APA operates three Boeing 727 freighters that fly between Guam and Hawaii, with stops in Pohnpei and Majuro to pick up fish and deliver air freight. The highest quality bigeye and yellowfin are carried to Guam for transfer to larger, wide-body passenger jets for markets in Japan and sometimes China. Processed fresh yellowfin and bigeye are sent to distributors in Hawaii and the United States of America

mainland in a variety of forms: loins, *saku* blocks and *poke*. APA plans to add a Boeing 757 freighter that will add further capacity to the route.

The subsistence catch is largely for domestic consumption in the outer islands. Most of the coastal commercial food catch is for sale in the Majuro and Kwajalein urban areas. The exports from coastal commercial fisheries are primarily non-food, with aquarium fish and coral going to markets in the United States of America and trochus to button factories in Asia and Europe. Food fish exports mainly consist of shipments of fish taken as personal baggage on regular commercial flights to Honolulu, Hawaii.

6.4.2 Fish markets

Offshore fishing in the Marshall Islands is export oriented. In general terms, the purse-seine catch (almost all tuna) targets canning, while the longline catch targets the Japanese sashimi market. The longline bycatch from locally based vessels is mostly sold in Majuro, with some being exported frozen or dried to Asia. The retained bycatch of foreign-based longliners is mostly sold in the home ports of those vessels.

Market access and the availability of transportation is an important component of success for the three commercial entities involved in the tuna sector in the Marshall Islands. According to McCoy *et al.* (2015):

- Koo's has for some time had direct access to the Japanese *katsubushi* market in southern Japan for its catch. Since that market prefers smaller skipjack and discounts the larger sizes, Koo's can also market the larger sizes in Thailand or other canning destinations. It can segregate its catch for the various markets via transshipment in Majuro using its own fleet of carriers. As Majuro is a major transshipment port, Koo's can also market its catch and utilize other buyers' carriers when its own are unavailable.
- MIFV has several marketing channels, depending on the product. Fresh yellowfin and bigeye, mostly B grade or lower, can be airfreighted to markets in the United States of America as headed, gilled, gutted or loined tuna, or processed into *saku* blocks and other product forms depending upon the market. Fresh yellowfin and bigeye (B+ and A grade) can be sent gilled and gutted to Japan via Guam as airfreight. Yellowfin and bigeye (C grade) can also be processed into steaks, loins and other product forms, then treated with carbon monoxide and frozen for containerized shipment to the United States of America.
- PPF must ship all its products by container – refrigerated for frozen, cooked loins, and dry containers for fish meal. To a large extent, shipping costs determine the markets that can be accessed. At one time, there was demand from Papua New Guinea for blood meat, the red meat from tuna-loin processing that is used for fish meal. PPF shipped frozen bags there for processing. This was discontinued, however, because high freight costs resulted in a lack of profit and the blood meat was again diverted into fish meal.

The Compact of Free Association between the Marshall Islands and United States of America, as approved by the United States Congress, contains a trade provision relating to tuna. The Compact allows duty free entry to the United States of America of tuna in airtight containers, but not in oil, at quantities up to 10 percent of total United States consumption of tuna during the previous calendar year. An identical provision exists in the Compact between the Federated States of Micronesia and the United States of America, but the quota must be shared between the two countries.

The Outer Islands Fish Market Center (OIFMC) and the Kwajalein Atoll Fish Market Center (KAFMC) provide fresh fish to the Majuro and Ebeye markets. In the case of Ebeye, in addition to fish, local produce from the outer islands is sold, injecting cash into their economies. In 2014, OIFMC purchased 50 tonnes of fish from nine outer atolls, paying local fishermen USD 116 853.13. This fish was transported by OIFMC vessels to Majuro for sale. KAFMC paid outer islands fishermen from five

atolls and islands USD 28 473 for fish, and local residents another USD 3 105.29 for produce that was transported by KAFMC vessels to sell on Ebeye Island. Fish-market staff work with outer-island fishers to enforce quality standards and size limits on the fish purchased (MIMRA, 2015b).

6.5 SOCIO-ECONOMIC CONTRIBUTION OF THE FISHERY SECTOR

A recent study by SPC (Gillett, 2016) attempted to quantify the fishery-related benefits received by the Marshall Islands and other Pacific Island countries. The study gave the available information on the contribution of fishing to GDP, exports, government revenue, employment and nutrition. Unless otherwise noted, the information in this section is from that study.

6.5.1 Role of fisheries in the national economy

The 2014 Marshall Islands Statistical Compendium (including the national accounts) was prepared by the Graduate School USA, Pacific Islands Training Initiative, Honolulu, Hawaii, in collaboration with the Economic Planning, Policy and Statistics Office (EPPSO) of the Marshall Islands. The Statistical Compendium contains the official estimate of the fishing contribution to the GDP of the Marshall Islands. The SPC study examined the official methodology and, using its independent estimate of the value of fisheries production, re-estimated the fishing contribution.

- The official contribution showed a 2014 fisheries contribution to GDP of USD 26.3 million, or 14.1 percent of GDP.
- The contribution of fishing to GDP was re-estimated by the SPC study for the year 2014. It showed a contribution of USD 55.1 million, or 29.5 percent of GDP.
- The major difference between the official and SPC estimates is that the official estimate includes industrial fish processing and excludes most of the operations of the locally based, industrial fishing vessels. The SPC methodology more closely follows the standardized System of National Accounts (SNA, 2009).

The 2014 Annual Report of MIMRA (MIMRA, 2015b) indicates that the Marshall Islands received USD 16 920 802 as access fees for foreign fishing in 2014. Access fees represented about 16.4 percent of government revenue for that year.

6.5.2 Trade

Marshall Islands exports can be considered as essentially fishery products, copra and coconut oil. The official 2014 Marshall Islands Statistical Compendium shows exports from 2008 to 2014 (Table 6.11).

TABLE 6.11
Major exports of Marshall Islands (USD million)

	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014
Copra/ coconut oil	4.4	2.0	2.4	3.6	3.0	3.2	2.7
Fish	0.8	2.8	8.5	19.6	24.8	21.0	14.6
Coconuts and fish	5.2	4.8	10.9	23.2	27.8	24.2	17.3
Fish as % of all major exports	15.4%	58.3%	78.0%	84.5%	89.2%	86.8%	84.4%

Units: tonnes.

The value of fishery exports in Table 6.11 is low compared to the FAO data in Part 1 of this profile. The FAO value for fishery exports for 2014 is USD 96 441 000 (96.4 million). The difference appears to involve the treatment of (a) the catches of Marshall Islands-flagged vessels that are landed in foreign ports, and (b) the large amount of tuna from foreign-flagged vessels that is transhipped in Majuro.

A large amount of non-tuna fishery exports are aquarium products. MIMRA (2015b) states:

Seven Marshall Islands-based companies export marine ornamentals mainly for the aquarium trade overseas. Products exported included live fish, giant clams, frozen fish and various marine invertebrates. In financial year 2014, exports of the giant clam *Tridacna derasa* increased to over 4 000 compared to about 1 500 in FY 2013, while *Tridacna maxima* rose to 3 500 compared to about 1 000 the previous year. Angel fish (Pomacanthidae) exports increased from about 15 000 in FY 2013 to over 50 000 in FY 2014.

For 2014, the FAO data shows USD 5.7 million of fishery imports.

6.5.3 Food security

Although national per capita fish consumption in the Marshall Islands is not high in relation to that of neighbouring countries, fish is important in food security for several reasons. At present, there is an abundant supply of imported food, but this supply is subject to shocks (e.g. changes in levels of payments by the government of the United States of America). The most vulnerable communities in the country are those in the outer islands – and they are highly dependent on fish for daily nutrition. It also should be noted that the Marshall Islands atoll environment is not favourable for raising alternative sources of protein, such as poultry or livestock.

There have been no general nutrition surveys in the last 15 years that included fish consumption. Most information on fish consumption comes from older, general nutrition surveys or new studies focused on the fisheries sector.

With respect to older surveys:

- Preston (2000), using 1995 FAO production, import and export information, indicated that the apparent per capita supply of fish in the Marshall Islands was 38.9 kg per year.
- Gillett and Lightfoot (2001) reviewed the fisheries nutrition literature of the Marshall Islands up to mid-2001 and made two overall observations: (a) there is considerable difference in consumption between the population centres of Majuro and Kwajalein, where 68 percent of the population resided in 1999, and the outer islands, where fish is relatively plentiful; and (b) leakage of fish from the transshipment operations and longline bases in Majuro probably has a substantial effect on the supply of fish on that island.
- McCoy and Hart (2002) showed that per capita consumption of “local marine animals” by the 1 915 people on Ailinlaplap Atoll in 2001 was 1.75 lb per week. This equates to annual per capita consumption of 42.3 kg.
- OFCF and MIMRA (2004) state: “Food supply – That first point is food supply to Majuro people. Total fish catch amount estimated of about 2 million lb in whole Majuro atoll by a year. And those fishes supplied to people of 23 thousand people in Majuro. That mean to 88 lb average fish supply amount to 1 person (*sic*).” (Note: 88 lb equate to 39.9 kg.)
- Echigo (2010) examined fish consumption at four outer islands in 2009. The results showed annual per capita fish consumption at Jaluit (45.3 kg), Likiep (138.2 kg), Namdrik (158.6 kg) and Ailuk (159.0 kg).

If Marshall Islands coastal fisheries production in 2014 of 4 500 tonnes (as estimated by the SPC study) is divided by the 2014 population of 54 550, the result is 82.5 kg of fish per person per year. In terms of fish consumption, this per capita figure does not consider reef fish exports, imports, or domestic consumption of the leakage from tuna transshipment operations.

6.5.4 Employment

The 2011 census (EPPSO, 2013) gives some information on fisheries employment in the country:

The second most popular agricultural activity is fishing. A total of 3 787 households reported fishing – that is 48.9 percent of total households in the country. Again, fishing was primarily used for subsistence purposes; 64.1 percent of the households who went fishing claimed it was only for subsistence purposes, while 34.8 percent claimed that fishing was for both subsistence and income, and 1.1 percent reported it as a means of income.

The Forum Fisheries Agency (FFA) tracks tuna-related employment in Marshall Islands. The total number of people employed in the industry (including “expat personnel and crews”) in 2012 and 2013 is shown in Table 6.12.

TABLE 6.12
Number of people employed in large fisheries companies

	2012	2013
Marshall Islands Fishing Venture (MIFV)	320	288
Koo's Fishing Company (KFC)	220	220
Pan Pacific Fisheries Inc. (PPF)	170	170
Total	710	678

Source: FFA (unpublished data)

6.5.5 Rural development

An important aspect of the government's fishery development programme is to enhance the livelihoods of fishers in the more isolated parts of the country. The main strategy for doing this is through support for the transport and marketing of fish from the outer islands in urban areas. Fish are shipped to the Outer Islands Fish Market Center (Majuro) and Kwajalein Atoll Fish Market Center (Ebeye). Details of the fish shipments are given above.

Aquaculture is also associated with rural development. The document “Policies and Priority Actions for Sustainable Mariculture Development in the Republic of the Marshall Islands” (Anon., 2005) states that outer-island communities have long had an interest in mariculture. Improved communication and transportation, coupled with the clear success of commercial mariculture ventures on the most populated islands where many of the outer-island leaders reside, have increased both interest in, and the probability of, successfully developing outer-island mariculture.

6.6 TRENDS, ISSUES AND DEVELOPMENT

6.6.1 Constraints and opportunities

Some of the major constraints for the fisheries sector are:

- difficulties associated with marketing products from the remote areas where abundance is highest in the urban areas where marketing opportunities are greatest;
- difficulties for small-scale fishers in accessing offshore fishery resources;
- the scarcity of skilled Marshallese labour due to ease of entry into the Untied States of America;
- balancing the benefits from the basing of foreign fishing vessels in Majuro with the environmental and social costs;
- difficulties of competing internationally in tuna processing from a relatively high-wage location;
- expansion of the Marshall Islands-flagged, industrial fishing fleet in such a way that it does not undermine regional efforts to reduce overall fishing effort in the region.

Opportunities for the fisheries sector include:

- value-adding to fishery products, for domestic consumption, sales to the military, and export;
- expansion of the marine aquarium fishery;

- greater use of fish aggregating devices (FADs) to promote offshore fishing by small-scale fishers;
- more use of partnerships (community, government, NGO) in the management of coastal fisheries;
- taking advantage of the relative proximity of the country to tuna markets in Japan and the United States of America;
- taking advantage of the comparatively good infrastructure – a deep-water port, extensive fuel capacity, reliable electricity, air and shipping connections, wholesalers, hotels and engineering facilities;
- the long-term value of the relatively effective government resource management agency.

6.6.2 Government and non-government sector policies and development strategies

The Marshall Islands fisheries policy is based on the interrelated needs to (a) improve economic benefits within sustainable limits; (b) promote responsible, private-sector-led developments; and (c) strengthen institutional capacities within the country for responsible fisheries development and management. The main strategy for fisheries development is based on the interventions of an enhanced fisheries agency. Accordingly, the government approved a policy for the development of fisheries about a decade ago and directed a restructuring of the Marshall Islands Marine Resource Authority into a more autonomous and self-funding authority. The objective was to release MIMRA from the standard civil service restraints that regulate most public services to enable a more corporate and commercial orientation (Stanley, 2005).

MIMRA's current – and continuing – goal is to raise the bar for fisheries management in the Marshall Islands. Key to this are its four areas of focus:

- Fisheries observer programme – MIMRA, in cooperation with SPC and PNA, conducts regular fisheries observer training programmes to bring in new observers. The goal is to increase the number of Marshall Islands fisheries observers to 100, which means the training initiative will be ongoing to expand capacity to provide observers for both purse-seine and longline fishing vessels.
- Collaboration with Sea Patrol – MIMRA continues to partner with the Marshall Islands Sea Patrol by providing fuel and other resources, and working together at the enforcement level, to improve monitoring, control and surveillance of the fishery. Sea Patrol provides essential enforcement capacity and MIMRA will continue the collaboration.
- Participation in the Shiprider Program – The Marshall Islands now has "shiprider" agreements with both the United States Coast Guard and United States Navy that allow Marshall Islands marine enforcement personnel to ride on the United States of America-flagged vessels in the Marshall Islands EEZ to enforce the nation's sovereign fishing rights. This resulted in multiple boardings for compliance verification of vessels fishing in the EEZ during 2014, significantly expanding surveillance activities beyond those that can be accomplished by Sea Patrol's lone patrol vessel. MIMRA aims to expand its participation in the Shiprider Program in future years.
- Participation in regional and international fisheries forums and agreements – MIMRA staff played an active role during 2014 in WCPFC and in annual meetings and various technical committees that oversee fishing on the high seas and stock assessments. Similarly, staff engaged with FFA and PNA, among others, to ensure that the Marshall Islands meets its obligations to regional fisheries conventions and agreements, including the provision of required fishing catch data that scientists need to produce accurate stock assessments. Participation in these regional and international organizations allows MIMRA to engage with the fisheries management programmes and initiatives of other nations, and to ensure

that it is implementing "best practice" policies for managing Marshall Islands fisheries (Source: www.mimra.com).

The Marshall Islands has a Tuna Development Strategy, the objective of which is to maximize economic benefits flowing to the country from the sustainable utilization of its tuna resources, including harvesting and processing. The components of the strategy include:

- an investment strategy that provides a framework on which investors can base their decision making;
- licensing fees – the government should initiate and/or support any move to increase access fees;
- increasing fishing effort in the EEZ to utilise fishing days allocated to the Marshall Islands. The government should promote domestic fisheries operations that propose to fish in its EEZ;
- institutional arrangements – strengthening the capacity of MIMRA, particularly in the area of market access.

OTHER SUPPORT ACTIVITIES

6.6.3 Research

Historical fisheries research in the Marshall Islands (including research in the Japanese era) is included in a bibliography of the Marshall Islands marine resources (Izumi, 1992). Research on specific fisheries resources is summarized by Smith (1992b).

Much of the research on offshore fisheries resources is carried out in cooperation with SPC's Oceanic Fisheries Programme. This has included both national work (e.g. a tuna resource assessment of the Marshall Islands) and work in the Marshall Islands that feeds into regional tuna research (e.g. length frequency sampling of tuna in Majuro).

Research relevant to coastal fisheries that has occurred recently in the Marshall Islands includes:

- climate change and its impacts on coastal fisheries resources
- ciguatera fish poisoning
- growth patterns of six species of popular reef fish
- gathering of the scientific data needed to characterize marine resources and assess the condition of the coral-reef ecosystems of several atolls

6.6.4 Education and training

Education related to fisheries in the Marshall Islands is provided by a variety of institutions:

- Basic education in disciplines related to fisheries is given at the College of Micronesia in Majuro.
- Skills that enable people to work on commercial fishing vessels and as fishery observers are taught at the National Fisheries and Nautical Training Center in Majuro.
- Academic training in biological, economic and other aspects of fisheries is given at the University of the South Pacific in Suva, Fiji.
- Marshallese have received academic training related to fisheries at tertiary institutes in Hawaii, Guam, mainland United States of America and New Zealand.
- Training courses in various fisheries-related subjects are frequently organized by SPC in New Caledonia and FFA in the Solomon Islands.

6.6.5 Foreign aid

The Marshall Islands receives aid in the fisheries sector from a number of bilateral donors, especially Japan. The latest MIMRA annual report (MIMRA, 2015b) gives information on assistance from Japan.

The Marshall Islands has a long-standing partnership with the Japan Overseas Fisheries Cooperation Foundation (OFCF), which began in 1992. Each year, during the annual OFCF Japan/Pacific Island Nations Fisheries Directors Meeting on Fisheries Cooperation, OFCF receives project requests from each country. After conducting field surveys and consultation with each government, the scope of the projects is developed, followed by the signing of an agreement governing implementation. Marshall Islands projects implemented recently have included repair and restoration of the outboard motors of MIMRA community fishing boats; repair and restoration of MIMRA transport boats; repair and restoration of the MIMRA and KAFMC ice plants; and technical guidance for fishing boat operators.

The main multilateral donor to the Marshall Islands in the fisheries sector has been the Asian Development Bank, which has provided USD 6.95 million in assistance to the fisheries sector since 1990, with the most important component being strengthening MIMRA and refining fisheries policies to solidify the sector's initial gains. The World Bank is supporting a pilot project to strengthen the governance and sustainability of MIMRA and its programmes.

The regional organizations serving Pacific Island countries, including FFA, SPC, the Secretariat of the Pacific Regional Environment Programme (SPREP) and the Pacific Islands Forum Secretariat, have been active in supporting the Marshall Islands fisheries sector.

6.7 INSTITUTIONAL FRAMEWORK

The Marshall Islands Marine Resources Authority was established under the MIMRA Act 1988. MIMRA is the primary agency responsible for exploration, exploitation, regulation and management of living and non-living marine resources in the Marshall Islands. From the perspective of fisheries management in more developed countries, MIMRA may be unique in that the law requires it to be responsible for both the conservation and management of marine resources, as well as their sustainable development.

With respect to its responsibilities, the act specifies that MIMRA has the exclusive power and functions to:

- conserve, manage and sustainably develop all resources in the fishery waters and seabed and subsoil thereunder, in accordance with the principles and provisions in the Act and in subregional, regional and international instruments to which the Republic of the Marshall Islands is party;
- establish management plans and programmes to manage the resources in the fishery waters;
- issue licences in accordance with the Act;
- issue licences for the exploration and exploitation of the seabed and subsoil of the fishery waters;
- negotiate and conclude access agreements and fisheries management agreements;
- implement by regulation or otherwise, as appropriate, access agreements or fisheries management agreements to which the Republic of the Marshall Islands is party;
- coordinate and manage fisheries monitoring, control and surveillance and, in consultation with the Attorney General, enforcement of the Act;
- appoint authorized officers and observers in accordance with the Act;
- cooperate in the conservation and management of highly migratory fish stocks as appropriate with other coastal states in the region and states fishing in the region and high seas area and participate in appropriate subregional, regional and international organizations or arrangements relating to fisheries;
- participate in the planning and execution of projects, programmes or other activities.

MIMRA is responsible to a board of directors, which is chaired by the Minister of Resources and Development. In 1997 it was decided that the activities of MIMRA would henceforth be funded from fishing access fee revenues and that the Authority should have more autonomy from the public service structure. The reconstituted board of directors is made up of the:

- Minister of Resources and Development (Chair)
- Attorney General
- Secretary for Foreign Affairs
- Two fisheries sector representatives (appointed by the President)
- Director of MIMRA (*ex officio* and secretary to the board).

The Executive Director of MIMRA is responsible to the board and (according to the latest MIMRA annual report) supervises the operations of the various MIMRA divisions including:

- Oceanic and Industrial Affairs
- Coastal and Community Services (with sections responsible for policy/planning/statistics, aquaculture and repairs/maintenance)
- Corporate Services and Finance
- Fisheries and Nautical Training Center
- Legal Affairs.

Other Marshall Islands institutions with involvement in fisheries include the Office of Environmental Policy and Planning Coordination, Environmental Protection Agency, College of the Marshall Islands and the Marshall Islands Conservation Society.

The main private sector stakeholders in the fishing industry are:

- Pan Pacific Foods – operator of the tuna loining plant
- Marshall Islands Fishing Venture – operator of locally based longliners
- Koo's Fishing Company – operator of Marshall Islands-registered purse seiners
- Numerous small-scale commercial fishers
- Marshalls Billfish Club – comprising game-fishing enthusiasts.

Important internet links related to fisheries in the Marshall Islands include:

- www.mimra.com – information on the Marshall Islands Marine Resources Authority, including annual reports
- <http://www.spc.int/coastfish/en/countries/marshall-islands.html> – information on Marshall Islands fisheries, links to other sites concerning the Marshall Islands and its fisheries, and some SPC reports on Marshall Island fisheries
- www.ffa.int – information on the regional organization primarily involved in the development and management of offshore fisheries
- www.pnatuna.com – information on the subregional, regional organization of eight Pacific Island countries where most of the tuna in the region is harvested
- www.billfishclub.com – information on the Marshalls Billfish Club
- www.paclii.org/databases.html – contains the laws of the Marshall Islands, including those related to fisheries
- www.yokwe.net – general Marshall Islands news, including articles related to fisheries.

6.7.1 Regional and international institutional framework

The major regional institutions involved in fisheries are the Forum Fisheries Agency (FFA), located in Honiara, and the Pacific Community (SPC) in Noumea. Other players are the Parties to the Nauru Agreement (PNA) Office in Majuro, the Secretariat of the Pacific Islands Forum Secretariat (PIFS) in Suva, the Pacific Regional Environment Programme (SPREP) in Apia, and the University of the South Pacific (USP) in Suva. The characteristics of those institutions are given in Table 6.13.

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean entered into force in June 2004,

and established the Western and Central Pacific Fisheries Commission (WCPFC). The Marshall Islands is a member of the commission, along with 26 other countries. WCPFC has its headquarters in Pohnpei, Federated States of Micronesia, and has held 13 annual meetings to date.

6.8 LEGAL FRAMEWORK

The MIMRA Act 1988 was replaced by the Marshall Islands Marine Resources Act 1997. This act deals with MIMRA affairs, fisheries conservation, management and development issues, management and development of local fisheries, trade, foreign/domestic-based fishing, licensing, and monitoring, control and surveillance (MCS). The section on conservation, management and development covers the following topics:

MIMRA's responsibilities with respect to conservation, management and sustainable use of the fishery resource

- Objectives and purposes for fisheries management and development
- Determining total level of fishing and allocations of fishing rights
- Determining participatory rights in fishery
- Designated fisheries – fishery management and development plans
- Conservation and management measures
- Protection of certain species
- Protection and promotion of artisanal fisheries
- The Fisheries Exclusion Zone
- Cooperation on high seas fishing for highly migratory fish stocks
- Consultation on international fisheries management
- Fishing with poisons or explosives
- Limitations on taking turtles
- Control of sponges and of black-lip mother-of-pearl oyster shell
- Prohibition of harvesting trochus except during open season
- Introduction of fish into fishery waters
- Prohibition of removal of fish from nets, traps, etc.
- Protection of fish aggregating devices, artificial reefs, mooring buoys, floats, trays
- Protection of fishing vessels or gear
- Use or possession of prohibited fishing gear
- Prohibition of driftnet fishing activities

There have been only two minor amendments to the act since 1997. The first amendment, which was in 2001, increased the number of board members from five to seven, and the quorum from three to four. The second amendment in 2006 deals with tax exemption (www.mimra.com).

According to MRAG (2011), other legislation relevant to fisheries includes the:

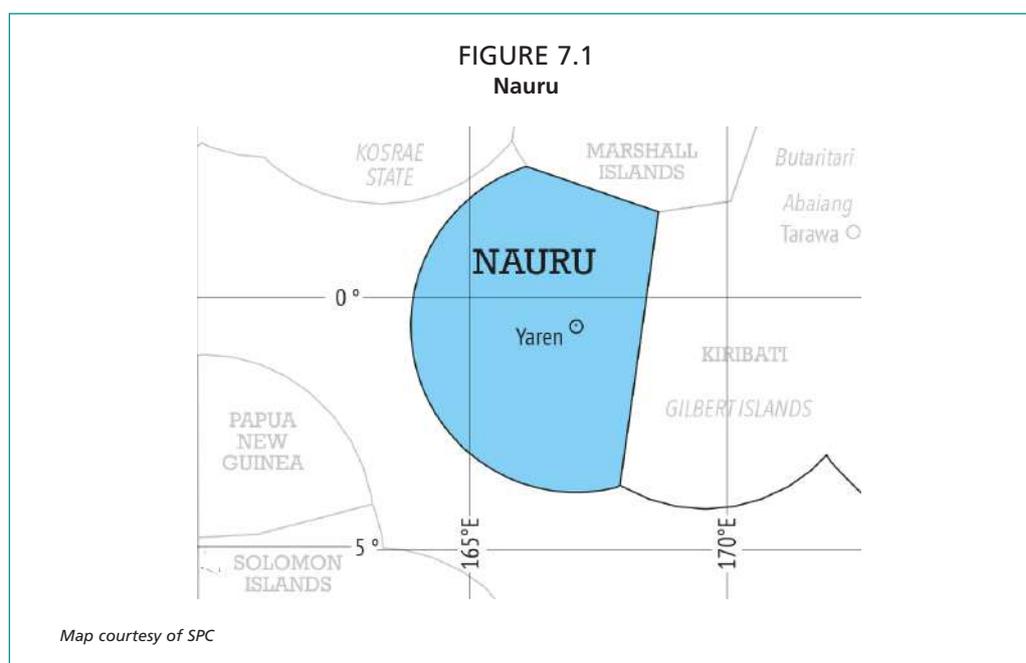
- Fishing Access and Licensing Act, which vests in MIMRA powers to regulate the fishing activities of both foreign and domestic fishing vessels in the fishery waters of the Marshall Islands;
- Fisheries Enforcement Act, which vests responsibility for the enforcement of the fisheries laws of the Marshall Islands in MIMRA;
- Maritime Administrations Act, which provides Marshall Islands with the necessary legal framework to discharge flag state duties;
- Documentation and Identification of Vessels Act, which regulates the registration of vessels;
- Republic of the Marshall Islands Ports Authority Act 2003, which established the Republic of the Marshall Islands Ports Authority;
- Ports of Entry Act, which regulates the entry of vessels into the country.

TABLE 6.13
Pacific Island regional organizations involved in fisheries

	FFA	SPC	Other regional organizations with fishery involvement
Main area of emphasis	Providing management advice on tuna fisheries and increasing benefits to Pacific Island countries from tuna fishing activities.	Most aspects of coastal fisheries and scientific research on tuna. Fisheries are only one aspect of SPC's work programme, which also covers such issues as health, demography and agriculture.	PNA – subregional grouping of countries where most purse seining occurs; SPREP – environmental aspects of fisheries; USP – School of Marine Studies (SMS) involved in a wide range of training; PIFS – major political initiatives, some natural resource economics; leads trade negotiations with EU, which have a major fisheries component
Inter-regional relationships	The FFA/SPC relationship has had ups/downs over the years. It was most difficult in the early 1990s, but tremendous improvement in mid/late 1990s. An annual colloquium has helped the relationship. Staff who have moved between the two organizations have made a noticeable improvement in understanding. Much of the success/benefits achieved by FFA/SPC cooperation depends on the personalities of FFA's Director/Deputy and SPC's Director of the Division of Fisheries, Aquaculture and Marine Ecosystems.		At least in theory, all regional organizations come under the umbrella of PIFS. Their activities are coordinated to some degree by the Council of Regional Organisations in the Pacific (CROP), which has a Marine Sector Working Group that meets at least once per year, but is limited by lack of resources for follow-up. FFA originally provided secretariat services to the PNA, but the PNA broke away from FFA in 2010. Currently, there are some sensitivities in the relationship, but it appears to be improving.
Main strengths	Direct contact with its governing body many times per year results in a high degree of accountability. Mandate of tight focus on tuna eliminates considerable dissipation of effort.	Noumea being a pleasant place to work, there is considerable staff continuity. The Oceanic Fisheries Programme often sets the standard for tuna research in the world. Documentation of work is very good.	Because PIFS is under the national leaders, it is considered the premier regional organization. PNA has achieved considerable success and credibility in such areas as raising access fees, 100 percent observer coverage, eco-certification, high seas closures, and controls on FADs. USP is centrally located in the region and SMS has substantial infrastructure. SPREP has close ties to NGOs active in the marine sector.
Membership	Australia and New Zealand, plus Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu	Includes the major metropolitan countries, all Pacific Island countries, and the French/UK/US territories; the most inclusive of any regional organization.	PNA: the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. USP: Cook Islands, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. SPREP: 21 Pacific Island countries and territories, plus Australia, France, New Zealand and United States of America. PIFS: same as FFA

Source: Adapted from Gillett (2014a).

7. Nauru



REPORTING YEAR

This profile was written in 2017, based on data mostly from 2014.

PART 1. OVERVIEW AND MAIN INDICATORS

7.1 GENERAL GEOGRAPHIC AND ECONOMIC INDICATORS

TABLE 7.1
General geographic and economic indicators - Nauru

Land area ¹	21 km ²
Water area ²	320 000 km ²
Population (2011) ³	10 084
GDP of Nauru (2014) ⁴	USD 116 475 000
Fisheries contribution to GDP (2014) ⁵	USD 2 623 000
Fisheries contribution as a % of GDP (2014) ⁶	2.3

¹ Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

² Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

³ 2011 Nauru National Report on Population and Housing Census.

⁴ Reported in Gillett (2016) from the Nauru Department of Finance and Economic Planning Office.

⁵ Reported in Gillett (2016) from the Nauru Department of Finance and Economic Planning Office.

⁶ Reported in Gillett (2016) from the Nauru Department of Finance and Economic Planning Office.

7.2 FAO FISHERIES STATISTICS

TABLE 7.2

FAO Fisheries statistics on total production, employment and trade – Nauru

2014		
Production (tonnes)	Aquaculture	0
	Capture	530
	Total	530
Employment (thousands)	Aquaculture	N/A
	Capture	N/A
	Total	N/A
Value of trade (USD 1000)	Fisheries exports	N/A
	Fisheries imports	N/A
	Total	N/A

Source: FAO Statistics and Information Branch of the Fisheries and Aquaculture Department. N/A: Data is not available.

PART 2. NARRATIVE

7.3 PRODUCTION SECTOR

7.3.1 Introduction

Nauru is a single, raised coralline island with a land area of only 21 km², but with an exclusive economic zone (EEZ) that extends over more than 431 000 km². The island lies 41 km south of the equator. Nauru was formerly rich in phosphate, but those resources are now depleted and the country needs to develop alternative sources of income to replace mining revenues. With porous soils and uncertain rainfall, Nauru has limited opportunities for agricultural production. Fisheries development is considered to be a major economic prospect for the future.

Although Nauru has only a very shallow lagoon, much of which dries at low tide, and a narrow fringing reef, the food produced by fishing in these inshore areas is very important in the Nauru diet. The harvest of tuna in Nauru waters is substantial, but almost all of the catch is taken by overseas-based industrial fishing vessels. The access fees paid by those vessels form a large proportion of government revenue.

To understand fisheries in Nauru, some knowledge of the recent economic history of the country is required. Box 7.1 summarizes the situation.

Fisheries statistics can be presented in different forms to cater for different purposes. For the Nauru statistics published by FAO in Part 1 of this profile, the presentation follows the international conventions and standards used by FAO and its Member States for reporting catches, which are given by the flag of the catching vessel. Accordingly, the fishery and aquaculture production of Nauru in 2014 published by FAO (as given in Part 1) was 530 tonnes.

In Table 7.3, Nauru fishery production statistics include the catch by Nauru-flagged vessels,⁷ the catch by small boats (which do not carry a flag) and the catch from fishing activities that do not involve a vessel (e.g. reef gleaning). The offshore category in the table is defined as the catch from Nauru-flagged, industrial-scale fishing operations that are carried out anywhere in the western and central Pacific Ocean (i.e. inside or outside Nauru waters).

⁷ There are currently no offshore fishing vessels operating from Nauru. The two longliners formerly owned by the Nauru Fisheries Trading Corporation (12 m and 15 m) have not operated since the mid-2000s.

BOX 7.1

Nauru's recent economic history

In the mid-1970s to the 1980s, Nauru was one of the richest countries in the world per capita due to its export of phosphate. In 2000, the economic crisis altered the living standards of the population. At the time, 95 percent of the workforce were public servants and mainly relied upon phosphate royalties as sources of income. During the peak years of phosphate mining, Nauruans enjoyed a high standard of living where household needs, including food and drinking water, were imported from overseas and distributed through local retail outlets. In 2000, when the large-scale commercial mining of phosphate ceased but residual mining continued, both government revenue and average household income were reduced dramatically. Those families who were once highly privileged in comparison with much of the world's population found it difficult to provide for their day-to-day needs.

A socio-economic assessment report by Australia highlighted a significant deterioration in the humanitarian situation in Nauru since the beginning of 2004. Food security has emerged as a serious issue as a consequence of policy failure and chronic economic decline. This resulted in a total regression of development with people resorting to basic subsistence fishing and farming for survival. Men, women and children forage daily on reefs, there is daily hunting of birds for food, and families resort to extended family systems to barter food for imported food items.

Source: Modified from Debye (2015) and PROCFish (2007).

TABLE 7.3
Nauru fisheries production in 2014 (as per FAO reporting standards)

	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Nauru-flagged offshore
Volume (tonnes)	0	0	163	210	0
Value (USD)	0	0	1 071 275	965 438	0

The amounts of production given in the above table differ from those shown in Part 1. The table gives production estimated from a variety of sources (see SPC study below), whereas the quantities reported in Part 1 are generally those reported to FAO by the Nauru Fisheries and Marine Resources Authority (NFMRA).

A recent study by the Pacific Community (SPC) presented Nauru's fishery statistics in a different way. The SPC study reports the amount of catch in Nauru fishery waters, regardless of vessel flag. The catches are also placed in different categories, which is useful for other purposes, such as administration of the large amount of foreign fishing that occurs in the fishery waters of Nauru. A summary of the fishery production from the SPC study is given in Table 7.4.

Some comment is required to explain the difference between the information in this table and that in Part 1 of this profile:

- Catches can be given by the flag of the catching vessel (as in the FAO statistics given in Part 1), or by the zone where the catch is made (the "offshore foreign-based" and "offshore locally based" columns in the table above). These two different ways of allocating catches each have their purposes. Attribution by flag is important for consistency with international conventions, while attribution by zone is important for determining fishing contributions to GDP and managing revenue from licence fees for foreign fishing in a country's zone.

- There is no fisheries statistical system in Nauru covering the entire categories of aquaculture and coastal subsistence/commercial fishing. The estimates above were made in a 2015 SPC study that examined a large number of fishery and economic studies covering the last two decades. It is likely that the basis of the information for the three categories in the FAO statistics in Part 1 was a more informal conjecture by a nominated person in the Nauru Fisheries and Marine Resources Authority.

TABLE 7.4
Fisheries production in Nauru waters

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Offshore locally based ⁸	Offshore foreign-based ⁹
					Both Nauru- and foreign-flagged vessels	
Volume (tonnes)	0	0	163	210	0	177 315
Value (USD)	0	0	1 071 275	965 438	0	231 229 508

Source: Gillett (2016).

7.3.2 Marine sub-sector

The marine fisheries have two very distinct components, offshore and coastal:

- There is no domestic fleet operating in offshore areas. Offshore fisheries are dominated by purse-seine fishing by foreign-flagged vessels, with a small amount of foreign longlining.
- Coastal fishing is carried out for subsistence purposes and for sale in local markets.

7.3.2.1 Catch profile

Catches of tuna in Nauru waters for recent years are given in Table 7.5.¹⁰ The quantities show that there is much inter-annual variation in the amount of tuna captured in the Nauru EEZ. A climatic event known as El Niño tends to shift the fishery toward the eastern part of the Nauru EEZ.

TABLE 7.5
Tuna catches in the offshore fisheries in Nauru waters (tonnes)

Year	Skipjack	Yellowfin	Bigeye	Total
2011	82 256	17 022	8 399	107 677
2012	42 296	8 751	3 605	54 652
2013	98 610	12 933	1 617	113 160
2014	144 175	24 599	7 505	176 279
2015	53 244	14 550	1 079	68 873

Source: NFMRA (2016)

In the absence of a fisheries statistical system covering all Nauru's coastal fisheries, there have been four substantive attempts to make crude estimates of its coastal fisheries production:

- Dalzell *et al.* (1992) gave the following coastal catch information: subsistence fisheries – 98 tonnes; commercial fisheries – 279 tonnes.

⁸ In the SPC study, “offshore locally based” is the catch by industrial-scale tuna fishing operations that are (a) based at a port in Nauru, and (b) generally harvested more than 12 nautical miles offshore.

⁹ “Offshore foreign-based” is the catch in the Nauru zone from catch from industrial-scale tuna fishing operations that are based at ports outside Nauru. Under the international, standardized System of National Accounts (SNA, 2009), those catches do not contribute to Nauru's GDP.

¹⁰ The difference between the total 2014 catch in the table (176 679 tonnes) and that given in Section 7.3.1 (177 315 tonnes) is due to the inclusion of bycatch in the latter.

- Gillett and Lightfoot (2001) considered the surveys above and other sources of information to produce estimates of 315 tonnes for coastal commercial fisheries production, and 110 tonnes for coastal subsistence production.
- Gillett (2009a) considered the two surveys above and recent changes in Nauru (economy, population) and estimated coastal commercial fisheries production at 200 tonnes and coastal subsistence production at 450 tonnes.
- Gillett (2016) considered the three surveys above and other studies (e.g. a household income and expenditure survey) and estimated coastal commercial fisheries production at 163 tonnes, and coastal subsistence production at 210 tonnes.

7.3.2.2 *Landing sites*

Catches from the offshore fishery are not offloaded in Nauru. Depending on the flag of the vessel, tunas are either transshipped for transport to a cannery (seiners from Taiwan Province of China and the Republic of Korea), delivered directly to Pago Pago (United States of America-flagged vessels), or delivered to a port in Japan (Japanese vessels). Some vessels may make direct deliveries to canneries in the Philippines.

The catch obtained from fishing in shallow inshore waters is landed all around Nauru wherever fishers can swim, wade, or walk ashore. Most of the catch from fishing further offshore from canoes and skiffs is landed at a few artificial channels through the fringing reef. Grabab Channel at the southwest of the island is used during the prevailing easterly winds, while Anibare Bay is used during winds from the northwest.

7.3.2.3 *Fishing practices/ systems*

Box 7.2 gives some highlights of Nauru's involvement in offshore fisheries. Currently, all offshore fishing in Nauru waters is carried out by foreign-flagged, foreign-based vessels.

BOX 7.2

Some history of Nauru offshore fisheries

Nauru does not have a strong history in offshore tuna fishing. Early surveys conducted from 1971 to 1974 by the Japan Marine Fishery Resources Research Centre concluded that domestic pole-and-line fishing was not feasible due to the lack of suitable baitfish around Nauru. However, Japanese distant-water pole-and-line vessels, carrying their own baitfish, took 25 000 tonnes of tuna between 1972 and 1978 in areas that would now be in the Nauru EEZ. Foreign longline fishing activities were also undertaken in the mid-1970s, with annual catches of 948 to 2 799 tonnes. Some exploratory purse-seining was also undertaken in the waters around Nauru in the late 1970s, with 83 tonnes of tuna caught in two sets. In an attempt to enter the tuna fishery, the Nauru Fishing Corporation was established in 1976 by the Nauru Government. The Nauru Fishing Corporation purchased two 948 GRT purse seiners from the Eastern Pacific in 1980. The two vessels were from Peru, with Peruvian skippers, engineers and crew. The vessels proved to be unsuccessful at catching tuna as the nets being used were too shallow. In 1986/87, one of these vessels sunk off Nauru in a storm. The second vessel was moved to the Philippines in 1987/88, where it was chartered to a local company and eventually sold. In 1998, the government established the Nauru Fisheries Corporation (NFC). NFC purchased two longline vessels, one (18.5 m) in 2000, and the other (12 m) in 2002. Both vessels have experienced extensive breakdowns that have restricted fishing activities. In addition, when the vessels were fishing, only low catch rates were achieved and the fishing operations have not been economically viable.

Source: PROCFish (2007).

The 2016 Nauru report to the Western and Central Pacific Fisheries Commission (NFMRA, 2016) commented as follows about the country's offshore fishing:

- Nauru's offshore fishery, as in previous years, is dominated by purse seiners from distant water fishing nations (DWFNs).
- The primary target of the DWFN vessels are skipjack (*Katsuwonus pelamis*) and yellowfin (*Thunnus albacares*), which are intended for foreign canneries.
- Most of the vessels are in the 1001–1500 gross tons size and are licensed either under bilateral access agreements by Nauru, or under a preferential regional arrangement (i.e. the Federated States of Micronesia Arrangement) or the US Treaty.
- One longline vessel was licensed for one trip in the Nauru EEZ in 2015.
- Nauru did not have a commercial fishery of any kind under its flag or by charter arrangements active in the WCPFC convention area in 2015.

TABLE 7.6
Foreign-flagged offshore fishing vessels licensed to fish in Nauru waters in 2015

Flag	Gear	No. of vessels	0–500GRT	501–1000 GRT	1001–1500 GRT	1500+ GRT
China (CN)	PS	12	-	5	4	3
Japan (JP)	LL	1	-	1	-	-
Japan (JP)	PS	32	-	-	27	3
Philippines (PH)	PS	2	-	-	-	-
Republic of Korea (KR)	PS	26	-	12	10	4
Taiwan Province of China (TW)	PS	33	-	9	18	2
UST (US)	PS	35	-	-	17	18
Vanuatu (TV)	PS	1	-	-	-	1
Vanuatu (TW)	PS	3	-	-	-	3
New Zealand (NZ)	PS	2	-	-	-	-
Vessels sponsored under the Federated States of Micronesia arrangement	PS	76	-	8	42	26
Total		223	-	35	118	60

Source: NFMRA (2016).

Notes: PS = purse seiner; LL = longliner.

The nationality and gear type of the vessels licensed to fish in Nauru waters in 2015 are given in Table 7.6. The Annual Report of the Nauru Fisheries and Marine Resources Authority (NFMRA 2015) provides information on coastal fisheries in Nauru (Box 7.3).

BOX 7.3

Coastal fisheries in Nauru

Nauru's artisanal fleet comprises small (less than 6 m) powered skiffs, canoes operated by local fishers. The powered boats are mostly used for trolling and often target pelagics. Other types of fishing include dropline fishing, gillnetting, cast-netting, angling, spearfishing, by freediving or with scuba, and reef gleaning targeting reef fish and invertebrates which are mainly for subsistence. Some commercial fishing activities are practised but mostly on a part-time scale, meaning that fish catches are sold only when there is surplus after meeting subsistence needs. Apart from trolling and deep bottom drop-lining, the coastal fishing activities are generally conducted on the reef flats and the reef slopes.

A report by FFA (2007) gives details of coastal fishing methods (Table 7.7).

TABLE 7.7
Coastal fishing methods in Nauru

Fishing area	Fishing methods	Comment
Reef flat, reef crest and surf zone	Gleaning, seine and cast nets, spearing, traditional trapping, line fishing at high tide, for food and bait	Relatively small area available overall (less than 300 ha). Some traditional association with adjacent communities in districts
Reef front and nearshore slope to 25-30 m	Seining, bottom and water column hand-line fishing from canoes and skiffs, diving and spearing, with or without scuba	100–200 ha. Very limited area under high and increasing pressure, with access from both shore-based and boat-based activities
Reef slope and deep water to 400 m	Drop-line, other bottom fishing methods and mid-water hand-lining, from canoes, skiffs and larger outboard vessels in deeper water	Relatively limited area, requires more expensive gear for fishing in deep water
Nearshore pelagic waters within sight of island, and adjacent to anchored FADs and mooring buoys	Trolling, pole and mini long-lining, drop-stone and similar methods for deeper pelagics; traditionally, netting for flying fish and baitfish	Large mooring buoys off Ewo Cantilevers have provided inshore trolling and line fishing; other offshore and inshore FAD deployment since early 1980s

Source: FFA (2007).

7.3.2.4 Main resources

In the offshore fisheries, the three main species captured are skipjack, yellowfin, and bigeye. In 2015, the catch was about 77 percent skipjack, 21 percent yellowfin and 2 percent bigeye (NFMRA, 2016).

In terms of the status of its fish resources, the above three species of tuna in Nauru mix freely with those of the neighboring countries in the western and central Pacific. Recent information from the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC, 2016) shows that for:

- **skipjack** – the stock is currently only moderately exploited and fishing mortality levels are sustainable;
- **bigeye** – recent analysis indicates that overfishing is occurring for the bigeye tuna stock and that to reduce fishing mortality to that at the maximum sustainable yield, a large reduction in fishing mortality is required;
- **yellowfin** – the current total biomass and spawning biomass are higher than at levels associated with maximum sustainable yields. Therefore, yellowfin tuna is not considered to be in an overfished state.

FFA (2007) summarizes the main coastal species by fishing area (Table 7.8).

PROCFish (2007) described the condition of coastal finfish in Nauru:

TABLE 7.8
Main species captured by coastal fishing in Nauru

Fishing area	Species
Reef flat, reef crest and surf zone	Molluscs, crustaceans, some beche-de-mer, eels, octopus and small fish, mullet, surgeonfish and scarids and other species, netted in surf zone; casting and bait fishing from reef edge
Reef front and nearshore slope to 25–30 m	Wide range of smaller demersal and epibenthic species such as scarids, acanthurids, carangids, shallow-water serranids, lutjanids and lethrinids and ranging reef-associated pelagics
Reef slope and deep water to 400 m;	Deep-water snappers, lutjanids, carangids and some scombrids, deeper-water serranids, balistids, some sharks
Nearshore pelagic waters within sight of island, and adjacent to anchored FADs and mooring buoys	Rainbow runners, some tunas, wahoo, mid-water balistids, barracuda, some sharks

Source: FFA (2007)

“Nauru has a very high population of surgeonfish and triggerfish, but alarmingly low populations of targeted and commercial species of groupers, snappers, emperors and scarids. The semi-pelagic species of trevallies, fusiliers, baitfishes and tunas appear to be in relatively good numbers, perhaps only sustainable for local needs. The relatively high abundance of surgeons and triggers correlates well with the high cover of hard substrate and abundant algae; moreover, such herbivorous fishes are common in an outer reef environment, the only habitat surveyed in Nauru. However, acanthurids and balistids have a high abundance in Nauru, especially when compared to other country average values, which could be related to current ciguatera events. Available stocks of these two fish families far exceed that of the other remaining 11 families. Nonetheless, small-size schooling species of mullets, snappers and goatfishes are still common immediately behind the breaker zone. Preliminary results suggest that the relatively low populations of commercially targeted groupers, snappers and emperors signal that stock sizes are currently at, or already exceed sustainable and optimum levels. Similarly, stock biomass of other less targeted edible species of parrotfish, now targeted by spear fishers (free diving and scuba), appear to be increasingly affected as well. Surgeons are the highest in abundance and therefore suitable candidates for targeting as edible species.”

SPC carried out a survey of the reef invertebrate resources of Nauru, and considered sea cucumbers, bivalves, crustaceans, gastropods, starfish and urchins (Harris *et al.*, 2016). The conclusion of the survey was that coastal fisheries in Nauru have operated for many years with inadequate management. The results of the survey and previous surveys on Nauru provide evidence of significant over-exploitation of Nauru’s coastal invertebrate resources.

7.3.2.5 Management applied to main fisheries

In the early 2000s, a National Tuna Fishery Strategy was prepared, and in 2005, the Nauru National Tuna Management and Development Plan was prepared. Neither document was officially adopted (Gillett, 2009b). Although the strategy and plans cannot be relied on to provide accurate information on national management arrangements, they provide some insight. The plan has two major overall goals: (a) to promote the effective management and conservation of the tuna resources; and (b) to maximize the long-term economic and social benefits for the people of Nauru from the development of tuna resources.

In practical terms, Nauru’s management of its offshore tuna resources follows closely the subregional and regional management arrangements that Nauru has signed (T. Adams, personal communication, March 2017). The latest NFMRA Annual Report states: “Adoption of subregional, regional and international instruments into national laws is a key area to ensure Nauru is conforming to its rights and obligations.”

- On the subregional level, Nauru cooperates with the other countries that are members of the Parties to the Nauru Agreement, which is described below.
- On the regional level, Nauru is a member of the Western and Central Pacific Fisheries Commission (WCPFC) that was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Nauru and the other 26 members of the commission enact tuna management measures at the annual WCPFC meeting. From the Nauru perspective, the most important recent measure is the Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean.

A crucial component of the management of Nauru’s offshore fisheries is the Parties to the Nauru Agreement and its Vessel Day Scheme. The early history of the PNA is given by Tarte (2002):

In February 1982, the Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest was opened for signature. The Nauru Agreement had been negotiated by seven Pacific Island states – the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea and Solomon Islands. This group of countries (later joined by Tuvalu) is known collectively as the Parties to the Nauru Agreement (PNA). The conclusion of the Nauru Agreement marked the beginning of a new era in Pacific Island cooperation in the management of the region’s tuna stocks. It was an important milestone in the exercise of coastal states’ sovereign rights over their 200-mile EEZs. The PNA group accounts for much of the tuna catch in the Pacific Island region. In 1999, it produced 98 percent of the tuna catch taken from the EEZs of Pacific Islands Forum Fisheries Agency (FFA) members; 70 percent came from three PNA members: Papua New Guinea, the Federated States of Micronesia and Kiribati. The group also accounted for 94 percent of the access fees paid to the FFA Pacific Island states. By controlling access to these fishing grounds, the PNA group collectively wields enormous influence and power.

The most important fishery management tool of the PNA is the Vessel Day Scheme (VDS) described in Box 7.4.

There is not much active management of the coastal fisheries in Nauru. Several authors have commented on this situation:

BOX 7.4

PNA Vessel Day Scheme

In 2000, a study suggested that the PNA purse-seine management scheme that was then based on vessel numbers be replaced by a scheme based on purse-seine fishing days. The transition was actually made seven years later. In 2007, the Parties to the Nauru Agreement began implementing the Vessel Day Scheme (VDS), transitioning from permitting a total number of purse-seine vessels in the region (205) to permitting a total allowable effort (TAE) in number of purse-seine fishing days (44 703 days for 2012; 44 890 days for 2016). Given the volume, value and multi-jurisdictional nature of the fishery, it is arguably one of the most complex fishery management arrangements ever put in place. Its key features are as follows:

- System of tradable fishing effort (days) allocated to the eight Parties
- Limit on total effort (the TAE) ~ 45 000 days
- TAE is allocated to Parties based on zonal biomass and historical effort as PAEs (Party Allowable Effort)
- Fishing days are sold to fleets for fishing in each EEZ
- There is a minimum benchmark price for VDS days sold to foreign vessels
- Fishing days monitored by satellite-based Vessel Monitoring System (VMS)
- VMS monitoring supported by observers on board all vessels
- Days are tradable between Parties
- Scheme costs are financed by levies on vessels

Due to the complicated nature of the new VDS system and the various constraints of the government fisheries agencies of the region (e.g. under-funded, under-staffed), it was expected there would be problems in the introduction of the scheme. This is not to say that the VDS has not produced substantial benefits for PNA countries. The system is creating competition for a limited number of days, thereby increasing the value of each day. In practice, the value of a fishing day before the VDS was roughly USD 1 350, but it increased to about USD 5 000 in July 2011 and days were being sold in 2016 for over USD 12 000.

On a different and less tangible level, another benefit is that the VDS moves fisheries management in the region to a desirable rights-based system. That is, fishing rights (such as vessel days) can be defined, allocated and traded. Consistent with this transition to a rights-based approach, a VDS-style arrangement for management of the tropical longline fishery is being implemented by PNA.

Source: Havice (2013); Campling (2013); Gillett (2014a); Clark and Clark (2014).

- Aside from fisheries development efforts, there is little government intervention in the inshore fisheries. This is an important sector and like any other island in the Pacific, coastal fishery commodities often go a long way towards fulfilling the immediate cash needs of the largely subsistence communities in many island nations. Because of the declining state of resources coupled with the increasing overdependence of the population on reef and inshore species, there is an urgent need to strengthen management capabilities (PROCFish, 2007).
- Coastal fisheries in Nauru have operated for many years with inadequate management. Accordingly, as a matter of priority and in the best interest of coastal communities, there is an urgency to develop a legal framework and introduce fisheries management initiatives (including community-based approaches) for the sustainable management of the fishery (Harris *et al.*, 2016).

Recently, there has been some progress in the management of coastal fisheries in Nauru. NFMRA has been holding consultations to help communities design management plans for local fisheries and is currently developing a legal framework for Cabinet consideration. This framework could allow communities to take part in decisions about their own fisheries, or to take part in discussions with other communities to help decide how fisheries that cover more than one district should be managed. The last piece of the puzzle – the government advisory service on reef fishery resources – was reported to be beginning to take shape (Nauru Fisheries and Marine Resources News, 2012).

Management objectives

As mentioned above, although Nauru's National Tuna Fishery Strategy and National Tuna Management and Development Plan were never officially adopted (Gillett, 2009b), they provide some insight into the objectives of Nauru's management of its tuna fisheries. The objectives in the draft plan are:

- strengthening the exercise of sovereign rights by Nauru over the tuna resource;
- increasing the economic gains received by Nauru from the exercise of its rights over the tuna resource;
- ensuring effective participation by Nauru in regional tuna management activities;
- minimizing any adverse impacts of tuna fishing and related activities on non-tuna species and the marine environment;
- eliminating illegal fishing activity in the fisheries waters of Nauru;
- protecting the interests of small-scale tuna fishers, noting their contribution to food security;
- improving the nutritional standards of the Nauruan people through increased availability of fish, including tuna and bycatch species taken during tuna fishing, as a source of food in Nauru.

In terms of the objective of “increasing economic gains”, from a historical perspective, national offshore fishery management efforts have been focused on generating revenue for the Nauru Government through licensing foreign fishing vessels. These efforts have

been quite successful: access fees represented 9 percent of government revenue/grants in financial year 2013 and 13.7 percent in FY 2014 (Gillett, 2016).

Management measures and institutional arrangements

The main management measure applied to the offshore fisheries is the PNA purse-seine vessel day scheme described above. Under this scheme, the PNA allocates Nauru a certain number of fishing days that can be sold to the highest bidder. The number of days are set considering historical fishing and conservation issues. As the number of days is set with a view to creating scarcity, the bidding process has tended to increase the value of a fishing day. This is demonstrated by the change in Nauru's access fees over a six-year period:

- For FY 2007/2008, access fees were USD 5 147 899
- For FY 2013/2014, access fees were USD 15 852 459

With respect to coastal and inshore fisheries management, there is little government intervention in inshore fisheries (CoFish, 2005). This situation is summarized in Box 7.5 below. Because of the declining state of resources, coupled with the increasing overdependence of the population on reef and inshore species, there is an urgent need to strengthen management capabilities. FFA (2007) states that good progress has been made in community consultation and development of draft community fisheries legislation as the basis for community-based management for coastal fisheries.

The NFMRA Corporate Plan 2009–2012 provides an indication of the coastal fisheries management measures that are likely to be used in the future:

BOX 7.5

Lack of inshore fisheries management

At the moment there is no form of fisheries management, although at the district level, people have started to adopt mechanisms that could address the issues, and there are continuing attempts to put in place marine-protected areas. Nauru's open-access tenureship means that everyone is free to fish anywhere on the island. This is very different from other Pacific Island countries. Because of the lack of traditional authority, the protocols seen in other countries are not practised in Nauru. There are no customary regulations, district laws or unwritten understandings on fishing activities, such as size limits, quotas, gear restrictions, use of scuba, or imports.

Source: Vunisea (2007).

Marine-protected areas (MPAs) are not a panacea for all that ails fisheries, but they are a useful tool in the rehabilitation of *heavily-impacted* reef fisheries. Nauru is the only Pacific Island country with no MPAs, and this Corporate Plan envisages the effective promotion of protected areas as one of NFMRA's strategies. Another rapid-acting (and also relatively easily enforced) reef fishery rehabilitation measure might possibly be to ban scuba spearfishing.

NFMRA provides the institutional framework for fisheries management in Nauru. It is a statutory corporation under the Fisheries Act 1997 that has responsibility for overseeing, managing and developing the country's natural marine resources and environment. NFMRA's role is covered in more detail below.

7.3.2.6 Fishing communities

The concept of “fisher communities” has limited applicability to Nauru. CoFish (2005) indicates that 97 percent of sampled households on Nauru were found to be engaged in fishing activities. In some respects, all of Nauru could be considered as one fishing community.

7.3.3 Inland sub-sector

According to NFMRA (2005), there are four depressions on the Nauru plateau, the most significant one forming Buada Lagoon, which is 30 000 m². The other waterbodies, known as ponds, are on the fringing coast or just a few metres from the base of the escarpment. They range from about 40 m² to about 10 000 m², either manufactured or naturally occurring. Anabar pond, at 10 000 m², is the most significant. The ponds have become infested with tilapia, which is not popular as a food item. In many studies of the fisheries of Nauru, any harvesting from these brackish waterbodies is considered to be aquaculture.

7.3.4 Aquaculture sub-sector

NFMRA (2005) discusses the fall and rise of aquaculture in Nauru. Traditionally, juvenile milkfish were collected on the intertidal reef and reared in brackish ponds. The most important areas for farming were Buada Lagoon and, to a lesser extent, the Anabar pond. Farming was divided among families, with walls and fences, and the people maintained an intricate social fabric intertwined with milkfish culture. The Mozambique tilapia (*Oreochromis mossambicus*) was introduced around 1961 with assistance from the South Pacific Commission, but it was not accepted as a food source mainly because of its small size and poor flavour. Tilapia eventually infested all the milkfish ponds and competed for food. The result was that milkfish harvested from infested ponds took longer to grow to an edible size and this caused many farmers to abandon their traditional practice of raising milkfish. In 2000, the Buada Lagoon Owners’ Association introduced 10 000 milkfish fry from Kiribati into Buada Lagoon, reaping 5 000 adult fish some months later.

According to an update from a resident fisheries adviser (B. Yeeting, personal communication, January 2016):

- there are currently 35 pond owners registered with NFMRA. These are family-owned backyard milkfish ponds and some are old swimming pools, in addition to the one-hectare Buada Lagoon;
- over the last few years, milkfish farming has not been active and only a couple of family-owned ponds are known to still have milkfish from the last fry shipment from Tarawa. These remaining milkfish were harvested during pond preparation work and totalled about 150 kg;
- NFMRA is reviving milkfish farming and has almost completed an aquaculture holding facility which will be used to receive, hold and condition milkfish fry from Tarawa on a regular basis before distributing/selling to local pond owners to stock their ponds. There are two extension officers helping people to prepare their ponds and they will provide assistance and advice to pond owners on stocking, feeding and management of the ponds;
- currently there is no aquaculture production in Nauru.

7.3.5 Recreational sub-sector

Chapman (2004) reported that around 50 vessels were capable of game fishing or sport fishing on the island. However, since that time Nauru’s economy has suffered shocks, and recreational activities have been curtailed. Nevertheless, many Nauruans consider subsistence fishing as a pleasurable social activity that has value beyond just food collection.

According to an update from a resident fisheries adviser B. Yeeting (personal communication, January 2016):

- sport diving tours are available on request through the dive instructor at NFMRA for a fee of AUD 150 per diver and AUD 70 for dive gear;
- a charter sport fishing operation is available for hire through a private company at a cost of AUD 400 per day.

7.4 POST-HARVEST SECTOR

7.4.1 Fish utilization

The catch from the various foreign-flagged purse-seine fleets operating in Nauru is almost all for canning, but there is considerable variation in mechanisms for getting the catch to the canneries:

- Japanese purse seiners return to Japanese ports to offload the catch.
- Purse seiners flagged to the United States of America offload their catch at the canneries in Pago Pago, American Samoa, and do not transship often.
- Taiwanese, Korean, and Chinese seiners (or vessels controlled by interests from these countries) usually transship their catch. Because of the lack of a suitable harbour in Nauru, and a ban on transshipping in the zones of Pacific Island countries, this transshipment usually occurs in a port in a neighboring country – often Pohnpei in the Federated States of Micronesia or Majuro in the Marshall Islands.

The production from coastal and inshore fisheries and aquaculture is almost entirely for domestic consumption.

7.4.2 Fish markets

CoFish (2005) states that local marketing of finfish is rare and marketing of invertebrates is non-existent (apart from lobsters). The reliance on marine products for basic food needs, and the lack of transportation and outlets for marketing contribute to this. Almost all finfish catch is consumed or given to relatives, and only a small proportion of catches is reported to be sold. Most of the sales are from informal roadside markets. The Nauru Fisheries Corporation (the commercial arm of NFMRA) has operated a fish market, but it is currently closed.

Resident fisheries adviser, B. Yeeting (personal communication, January 2016) states: “There is no formal processing. There is one fish shop, which has a couple of chest freezers where they store their fish. This is more or less the same set-up as the few fishers who sell from their houses (i.e. have a chest freezer that they use to store fish and sell from).”

7.5 SOCIO-ECONOMIC CONTRIBUTION OF THE FISHERY SECTOR

A recent study by SPC (Gillett, 2016) attempted to quantify the fishery-related benefits received by Nauru and other Pacific Island countries. The study gave the available information on the contribution of fishing to GDP, exports, government revenue, employment and nutrition. Unless otherwise noted, the information in this section is from that study.

7.5.1 Role of fisheries in the national economy

The official GDP of Nauru and the fisheries contribution are estimated by Nauru’s Department of Finance and Economic Planning. For FY 2014, the fishing contribution was estimated to be USD 2.6 million, or 2.3 percent of GDP.

In 2015, in an SPC study (Gillett, 2016), the fishing contribution to GDP was re-estimated using a standard methodology for the fishing sector. For calendar year 2014, it was estimated that the fishing contribution was USD 1.5 million, or 1.3 percent of GDP.

Given the lack of details available on the official methodology, it is difficult to speculate on why the difference is so great. However, if the official estimate used the production approach to estimate the fisheries sector contribution, the volume of production from coastal fisheries in the two estimates must be very different.

7.5.2 Trade

Currently there are no formal exports of fishery products from Nauru. The last formal export shipment of fresh tuna from the domestic longline operation was in 2001, and only seven shipments were ever made. Although the fish was of good quality and received a good price at auction in Japan, the local longline operation was unprofitable for various reasons.

Informal exports of fish are made by passengers travelling on the regular commercial flights. These shipments are often for family and friends in Australia, Fiji and the Marshall Islands. Although the Nauru Quarantine Office issues certificates for fish and other marine products that are being taken out to make sure that the products are in good condition, those certificates do not include the weights of the shipped products.

7.5.3 Food security

An SPC/CoFish study in Nauru in October and November 2005 examined the consumption of fishery products. Per capita consumption of fresh fish was recorded at 46.5 kg/year. Finfish was consumed an average of 3.8 times a week, while invertebrate consumption was much lower with a frequency of about twice a month. Canned fish was also frequently consumed, at an average of 2.4 times a week for most households, with annual per capita consumption reaching about 16 kg, which is considerable though only about one-third of finfish consumption. For many families, canned fish is an affordable substitute that can be cooked in a soup and in many other ways to feed large families. The low consumption of invertebrates may be due to their overharvest. There is very high reliance on fresh fish, with many households interviewed consuming their own catches or being given fish by relatives and neighbors. The results of the CoFish survey of fish consumption are summarized in Table 7.9.

TABLE 7.9
Consumption of fishery products on Nauru according to CoFish survey of households

Aspect (units)	Measure
Quantity fresh fish consumed (kg/capita/year)	46.45 (±2.74)
Frequency fresh fish consumed (time/week)	3.79 (±0.14)
Quantity fresh invertebrate consumed (kg/capita/year)	1.63 (±0.19)
Frequency fresh invertebrate consumed (time/week)	0.53 (±0.04)
Quantity canned fish consumed (kg/capita/year)	15.86 (±1.12)
Frequency canned fish consumed (time/week)	2.42 (±0.12)

Source: CoFish (2005); 245 households were surveyed.

Bell *et al.* (2009b) used information from household income and expenditure surveys (HIES) conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES were designed to enumerate consumption based on both subsistence and cash acquisitions. For the whole of Nauru, the annual per capita fish consumption (whole weight equivalent) was 55.8 kg, of which 96 percent was fresh fish.

FAO data indicates that annual per capita consumption of fish and fishery products was 52.3 kg in 2013.

7.5.4 Employment

CoFish (2005) gives the results of fisheries-focused socio-economic surveys carried out in 11 of the 14 districts in Nauru during October and November 2005:

- The total resident population at the time was estimated at 10 131 people and 1 230 households.
- A total of 245 households were surveyed for income and expenditure, with 97 percent of these found to be engaged in fishing activities.
- A total of 405 finfish fishers (357 men and 48 women) and 283 invertebrate fishers (149 women and 134 men) were interviewed. Survey results indicated an average of 3.7 fishers per household; when this is extrapolated, the total number of fishers in Nauru is 4 513, which includes 2 947 men and 1 566 women.
- The main source of income is from government employment (86 percent), with some people employed in the private sector.
- Fisheries do not play a significant role in household income. For 5 percent, it is their first income and for 17 percent their second income.

The results of the Nauru 2011 census (Anon. 2012) provide some insight into participation in fishing:

- The main source of household income for 85 percent of all households was wages and/or salary; 7 percent of households' main income came from own business activities, 4 percent relied mainly on rent of land and 2 percent on the sale of fish, crops or handicrafts.
- Just over half (51 percent) of all households in Nauru were engaged in fishing activities.
- Participation in fishing activities varied greatly between Nauru's 14 districts. Only 21 percent of the households in Nibok District were involved with fishing compared to 96 percent of the households in Ijuw District.
- Aquaculture was undertaken by only 2 percent of all households in Nauru, and this was entirely for subsistence. It was mainly undertaken by households in Ewa District.

The results of the 2012/2013 HIES (Bureau of Statistics, 2014) provide some information on participation in fishing:

- The total resident Nauru population in 2012 was estimated to be 10 293 in 1 705 private households over the 14 districts of Nauru.
- It was estimated that 26 percent of households were engaged in fishing.
- About 8.94 percent of the Nauruan labour force of 3 952 were involved in one form of fishing or another. This relates to about 353 fishers.
- With regards to full-time fishers, if "full-time" means those who have fishing as their main activity, only 1.26 percent of the Nauruan labour force had fishing as the main activity. This equates to about 50 fishers.
- With regards to part-time commercial fishers, if this is taken as those who have fishing as a secondary activity, about 7.7 percent of the Nauruan labour force were in this category, i.e. about 300 fishers.
- With regards to subsistence fishers, in Nauru all fishers, whether full-time or part-time, also fish for their subsistence (i.e. 353 fishers).

The difference in the results of the 2011 census and 2012/2013 HIES seem quite large. The census indicates that just over half (51 percent) of all households in Nauru were engaged in fishing activities. The HIES estimated that 26 percent of households were engaged in fishing.

7.5.5 Rural development

The concept of "rural development" is hardly applicable to Nauru, where there is little distance between the most and least urban areas of the island.

7.6 TRENDS, ISSUES AND DEVELOPMENT

7.6.1 Constraints and opportunities

Major constraints for the fisheries sector include the following:

- Many of the inshore fishery resources are fully or overexploited, creating problems for an expanding population that is reliant on marine resources for subsistence.
- Introduction of inshore fisheries management is difficult at a time when interest in harvesting inshore fisheries resources has increased considerably.
- There is considerable difficulty in promoting small-scale fishers' access to the large tuna resources.
- Lack of infrastructure (and the difficulties/expense of establishing that infrastructure) places a major limitation on development of the domestic tuna industry.
- NFMRA has considerable difficulty in carrying out its fisheries development functions in a time of financial stringency.
- Several reviews (e.g. FFA, 2007) state that development of small-scale offshore fisheries targeting pelagic species is one of the few avenues for transferring effort from inshore fisheries, but this requires appropriate boats, equipment, gear and fuel, and increased investment in communications and other equipment for safe operation away from the island.

One of the major opportunities in the fisheries sector relates to regional cooperation – that is, solidarity with neighboring Pacific Island countries to take advantage of the fact that these countries control access to most of the tuna resources in the central and western Pacific Ocean. Possible outcomes of using this strategy include: (a) increasing access fees for foreign fishing vessels; (b) leveraging development of the domestic tuna industry; and (c) promoting employment on purse-seine vessels.

Other opportunities include:

- using the relatively frequent airline flights to and from Nauru to facilitate fishery trade;
- taking advantage of the experience of neighbouring countries in community-based fisheries management;
- using the lagoons and ponds for fish culture.

A 2008 FFA study of fishery development aspirations (Gillett, 2008c) summarized the views of Nauru officials:

Fisheries officials aspire to have expanded harbour facilities. A further aspiration is to use these facilities to catalyze the establishment of a locally based longline fishery and an associated fresh tuna export packing facility. Involvement with purse seining is a possibility. Another view (from a former fisheries official) stresses the importance of what he considers as the sole opportunity for the future – artisanal longlining.

7.6.2 Government and non-government sector policies and development strategies

As stated in NFMRA's 2014/2015 Annual Report, its goal is to enhance development and sustainable management of marine and fisheries resources to provide sustainable economic returns. To do this, there are eight strategies, each with milestones:

1. Strengthen institutional capacity
 - Corporate Plan 2009–2012 implemented
 - Fisheries Act updated
 - NFMRA effectively providing leadership, guidance and assistance on developing and managing fisheries resources
 - NFMRA infrastructure improved and consolidated in one site
2. Maximize sustainable economic returns

- Foreign licensing revenue per fishing day increased in real terms by 2012 from 2008 levels
- Maximized sustainable economic yield from marine and fisheries resources
- 3. Promote private-sector led development of commercial fisheries
 - Potential niche, small-scale, high-quality fishing and processing export enterprises identified
 - Recreational use of marine resources (e.g. game fishing) investigated
 - Business profiles for establishing commercial fishing enterprises developed, and potential joint-venture partnerships with investors explored
- 4. Promote development of aquaculture
 - Current 5-year national aquaculture plan reviewed and implemented
 - Legislative and regulatory framework for aquaculture development scoped and developed
 - Legislative and regulatory framework for aquaculture development adopted and implemented
- 5. Sustainably utilize marine resources to increase food security and alternative livelihoods
 - Feasibility study conducted on new fisheries and fishing techniques, including traditional fishing methods
 - Business profiles/plans for development of new fisheries and fishing techniques completed and implementation started
- 6. Ensure sustainable practices are implemented to safeguard marine biodiversity and ecosystems
 - Design, through participatory consultation, development of marine-protected-area (MPA) networks
 - Capacity development and training on use of ecosystem approach and other conservation planning tools conducted
 - Develop legal and regulatory framework to support MPA
 - Implement ecosystem approach to coastal fisheries management
- 7. Minimize illegal, unregulated and unreported (IUU) fishing
 - Implement national plan of action for combating IUU fishing
 - Implement national observer programme
 - Substantial reduction in IUU
 - At least 20 observer trips conducted per annum
- 8. Develop sound scientific information on coastal marine resources
 - Research capacity of NFMRA strengthened through partnerships with regional and international research institutions
 - Research plans for resources assessment capacity developed and training conducted for NFMRA

7.6.3 Research

NFMRA's 2014/2015 Annual Report includes a section on "Research and Statistics," which states: "The Authority's principal concern is the ongoing advancement of personnel skills to the necessary levels through participation in regional capacity building workshops and training. Like the rest of the region, the Authority has embraced the regional database systems (i.e. TUFMAN and TUFART), which were developed by SPC's Oceanic Fisheries Programme. Relentless refining of these systems to meet the Authority's requirements is constant."

Currently, NFMRA has limited capacity to carry out substantial fisheries research. Consequently, most research projects have involved the government cooperating with outside researchers and agencies.

Past research topics (and agencies) include:

- tuna stock assessment (SPC)

- baseline information on the status of reef fisheries (SPC)
- tilapia eradication (FAO)
- underwater bathymetry (SOPAC – now SPC’s Geoscience Division)
- milkfish growth trials (Taiwan Province of China PC)
- ciguatera fish poisoning (University of the South Pacific)

7.6.4 Education and training

Education related to fisheries in Nauru is undertaken in a variety of institutions:

- Academic training in biological, economic and other aspects of fisheries is provided at the University of the South Pacific, Suva.
- Training courses, workshops and attachments are frequently organized by regional organizations: SPC in New Caledonia and FFA in the Solomon Islands. Subject matter has included such diverse topics as fish-quality grading, stock assessment, fisheries surveillance and on-vessel observing.
- Courses and workshops are also given by NGOs and bilateral donors.

7.6.5 Foreign aid

Historically, Nauru has not sought direct fisheries development assistance from bilateral or multilateral donors, although some assistance of this type has been channelled through FFA, SPC and other regional organizations of which Nauru is a member. However, the economic downturn that began in the early 2000s has resulted in Nauru actively seeking development assistance, including for the fisheries sector.

At present, the main donor activity in the fisheries sector is Australia’s support for the Fisheries Management Institutional Strengthening Project. For several years, the project has been assisting NFMRA to improve its management of the industrial tuna fishery, in particular to consolidate the crucial foreign exchange revenue that foreign fishing on Nauru’s tuna resources generates for the national economy.

SPC and FFA provide regular fisheries-related assistance to Nauru, including for inshore and offshore fisheries resource assessment, aquaculture, and monitoring, control and surveillance.

7.7 INSTITUTIONAL FRAMEWORK

In 1997, the Nauru Fisheries and Marine Resources Authority Act established NFMRA as an entity with the powers and functions to regulate and develop activities relating to Nauru’s fisheries and marine resources. It is responsible for the management of offshore fisheries, coastal fisheries and aquaculture, and also owns the Nauru Fisheries Corporation, which acts as the Authority’s commercial arm (FFA, 2007).

The 2014/2015 NFMRA Annual Report, presents the objectives and functions of the NFMRA:

Objectives:

- To manage, develop, conserve and protect the fisheries and marine resources of Nauru in such a way as to conserve and replenish them as a sustainable asset for future generations.
- To promote the sustainable utilization of the fisheries and marine resources of Nauru to achieve economic growth, improved social standards, improved nutritional standards, human resource development, increased employment and a sound ecological balance.
- To pursue effective strategies for managing the fisheries and marine resources of Nauru so as to maintain the integrity of marine ecosystems, to preserve biodiversity, to avoid adverse impacts on the marine environment and to minimize the risk of long-term or irreversible effects of resource extraction operations.

- To enhance the administrative, legal, surveillance and enforcement capacities of the Republic for the management, development, conservation and protection of the fisheries and marine resources of Nauru.

Functions:

The NFMRA is required by the Nauru Fisheries and Marine Resources Authority Act 1997 to:

- carry out and give effect to any policy directions of the Minister and the Cabinet on the utilization, management, development, conservation and protection of fisheries and marine resources;
- make recommendations and give advice to the Minister on matters connected with the Authority's objectives;
- administer and enforce the NFMRA 1997 and any other law relating to fisheries or marine resources, to the extent required or permitted by that law and any related policy approved by Cabinet;
- advise and make recommendations to the Minister on the operation of the NFMRA Act 1997 and any other law which relates to its objectives and on changes and amendments the Authority considers necessary or desirable to be made to any law in order to promote and further the Authority's objectives;
- to the greatest extent possible, consistent with the performance of the Authority's functions under the NFMRA Act 1997 or any other law, consult and cooperate with other government departments, branches and agencies, with non-governmental bodies and with international, regional and subregional organizations on matters connected with the Authority's objectives;
- secure, authorize and provide attendance and representation of the Republic at international, regional and sub-regional meetings, conferences, workshops and similar gatherings concerned with the development, management, conservation and protection of fisheries or marine resources;
- to the extent provided by the NFMRA Act 1997 and any other law, and with the approval of the Minister, represent the Republic in the conduct of negotiations in respect of any international convention, treaty, agreement or similar arrangement, or any agreement with a foreign state or body representative of the interests of a foreign state, relating to fisheries or marine resources;
- establish, initiate, maintain and engage in such other activities pertaining to the Authority's objectives as are determined by the Board from time to time, in accordance with any policy directions of the Minister; and
- carry out such other functions as are necessary to achieve the Authority's objectives, or as given to it under the NFMRA Act 1997 or any other law.

In terms of day-to-day activities, the NFMRA provides various goods and services to the local communities. According to the latest NFMRA Annual Report, these include 1) ice sales; 2) outboard motor, boat and trailer repair and maintenance; 3) rigging, deployment, repair and maintenance of anchored FADs; 4) search and rescue operations; 5) technical assistance to aquaculturists, either directly or through the Nauru Aquaculture Association; 6) technical assistance to district communities on the community-based ecosystem approach to fisheries management; 7) technical assistance to artisanal fishers, either directly or through the Nauru Fishers Association; and 8) collection of data from communities, fishers and aquaculturists to keep abreast of the situation on the ground and to intervene when required.

NFMRA is governed by the NFMRA Board of Directors, who are responsible to the Minister of Fisheries. Under the board is a Chief Executive Officer who oversees the work of the three functional units of NFMRA: Oceanic, Coastal, and Support.

In 2015/2015, NFMRA had 44 staff: the CEO, 5 oceanic staff, 25 coastal staff, and 13 support staff (plus 19 vacant positions).

Non-government agencies involved in Nauru fisheries include the Nauru Fishers Association, the Nauru Aquaculture Association (established to assist fish farmers on an individual basis), and the Buada Land Owners' Association (supports communal aquaculture efforts).

Important internet links related to fisheries in Nauru include:

- <https://sites.google.com/site/naurufisheries/home/information> – the NFMRA website, which has sections on news, legislation, regional laws, licence lists, coastal reports, corporate documents and contacts
- <http://www.spc.int/coastfish/en/countries/nauru.html> – SPC reports on Nauru's fisheries
- <http://www.sprep.org/library-information-resource-center/collection> – a virtual environmental library that includes information on Nauru
- <http://www.paclii.org/countries/nr.html> – information on the laws of Nauru
- www.ffa.int – information on the regional organization primarily involved in the development and management of offshore fisheries
- www.pnatuna.com – information on the regional organization of eight Pacific Island countries where most of the tuna in the region is harvested

7.7.1 Regional and international institutional framework

The major regional institutions involved in fisheries are the Forum Fisheries Agency (FFA), located in Honiara, and the Pacific Community (SPC) in Noumea. Other players are the Parties to the Nauru Agreement (PNA) Office in Majuro, the Pacific Islands Forum Secretariat (PIFS) in Suva, the Secretariat of the Pacific Regional Environment Programme (SPREP) in Apia, and the University of the South Pacific (USP) in Suva. The characteristics of these institutions are given in Table 7.10.

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean entered into force in June 2004 and established the Western and Central Pacific Fisheries Commission (WCPFC). Nauru is a member of the commission, along with 26 other countries. The WCPFC has its headquarters in Pohnpei, Federated States of Micronesia, and has held 13 annual meetings to date.

7.8 LEGAL FRAMEWORK

The most important laws relating to fisheries in Nauru are the Nauru Fisheries and Marine Resources Authority Act 1997 and the Fisheries Act 1997.

The NFMRA Act describes the Authority's objects and functions:

- Objects of NFMRA
 - to manage, develop, conserve and protect the fisheries and marine resources of Nauru in such a way as to conserve and replenish them as a sustainable asset for future generations;
 - to promote the sustainable utilisation of the fisheries and marine resources of Nauru to achieve economic growth, improved social standards, improved nutritional standards, human resource development, increased employment and a sound ecological balance;
 - to pursue effective strategies for managing the fisheries and marine resources of Nauru so as to maintain the integrity of marine ecosystems, to preserve biodiversity, to avoid adverse impacts on the marine environment, and to minimize the risk of long-term or irreversible effects of resource extraction operations; and
 - to enhance the administrative, legal, surveillance and enforcement capacities of the Republic for the management, development, conservation and protection

TABLE 7.10
Pacific Island regional organizations involved in fisheries

	FFA	SPC	Other regional organizations with fishery involvement
Main area of emphasis	Providing management advice on tuna fisheries and increasing benefits to Pacific Island countries from tuna fishing activities.	Most aspects of coastal fisheries and scientific research on tuna. Fisheries are only one aspect of SPC's work programme, which also covers such issues as health, demography and agriculture.	PNA – subregional grouping of countries where most purse seining occurs; SPREP – environmental aspects of fisheries; USP – School of Marine Studies (SMS) involved in a wide range of training; PIFS – major political initiatives, some natural resource economics; leads trade negotiations with EU, which have a major fisheries component
Inter-regional relationships	The FFA/SPC relationship has had ups/downs over the years. It was most difficult in the early 1990s, but tremendous improvement in mid/late 1990s. An annual colloquium has helped the relationship. Staff who have moved between the two organizations have made a noticeable improvement in understanding. Much of the success/benefits achieved by FFA/SPC cooperation depends on the personalities of FFA's Director/Deputy and SPC's Director of the Division of Fisheries, Aquaculture and Marine Ecosystems.		At least in theory, all regional organizations come under the umbrella of PIFS. Their activities are coordinated to some degree by the Council of Regional Organisations in the Pacific (CROP), which has a Marine Sector Working Group that meets at least once per year, but is limited by lack of resources for follow-up. FFA originally provided secretariat services to the PNA, but the PNA broke away from FFA in 2010. Currently, there are some sensitivities in the relationship, but it appears to be improving.
Main strengths	Direct contact with its governing body many times per year results in a high degree of accountability. Mandate of tight focus on tuna eliminates considerable dissipation of effort.	Noumea being a pleasant place to work, there is considerable staff continuity. The Oceanic Fisheries Programme often sets the standard for tuna research in the world. Documentation of work is very good.	Because PIFS is under the national leaders, it is considered the premier regional organization. PNA has achieved considerable success and credibility in such areas as raising access fees, 100 percent observer coverage, eco-certification, high seas closures, and controls on FADs. USP is centrally located in the region and SMS has substantial infrastructure. SPREP has close ties to NGOs active in the marine sector.
Membership	Australia and New Zealand, plus Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu	Includes the major metropolitan countries, all Pacific Island countries, and the French/UK/US territories; the most inclusive of any regional organization.	PNA: the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. USP: Cook Islands, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. SPREP: 21 Pacific Island countries and territories, plus Australia, France, New Zealand and United States of America. PIFS: same as FFA

Source: Adapted from Gillett (2014a).

of the fisheries and marine resources of Nauru, in accordance with any law relating to fisheries or marine resources.

- Functions of NFMRA
 - to carry out and give effect to any policy directions of the Minister and the Cabinet on the utilisation, management, development, conservation and protection of fisheries and marine resources;
 - to make recommendations and give advice to the Minister on matters connected with its objects;
 - to administer and enforce this Act and any other law relating to fisheries or

marine resources, to the extent required or permitted by that law, and any related policy approved by the Cabinet; and

- to advise and make recommendations to the Minister on the operation of the Act and of any other law which relates to its objects, and on needed changes and amendments.

The NFMRA Act also includes provisions for a board of directors, funds and powers of the Authority, limitations on its powers, liability of directors, and exercise of the powers of the board.

The Fisheries Act 1997 is concerned with the management, development, protection and conservation of the fisheries and living marine resources of Nauru. The act has provisions to:

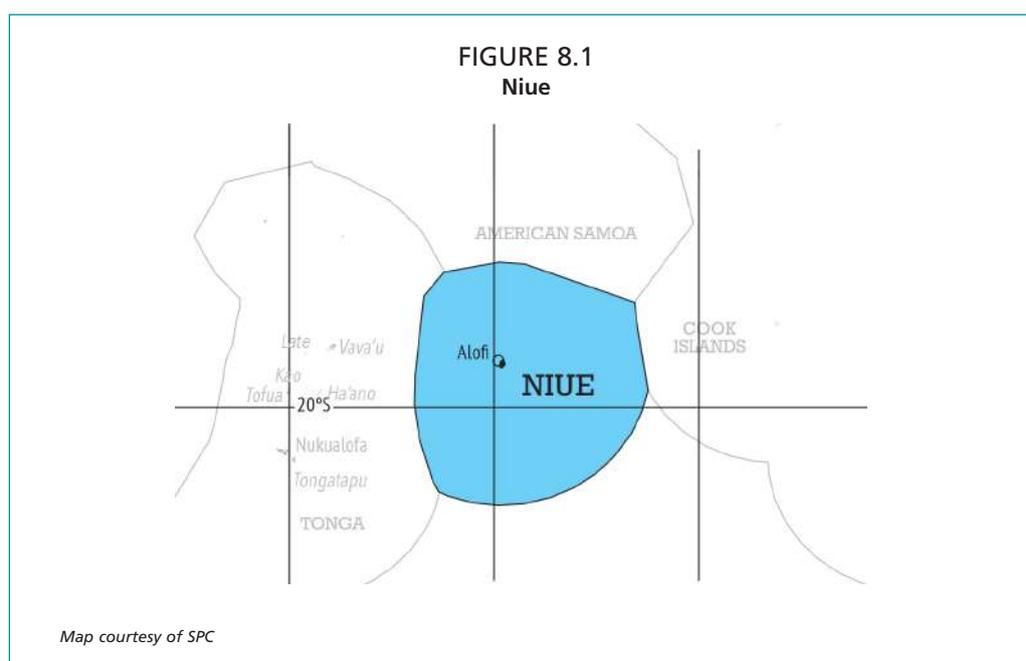
- exercise the sovereign rights of the Republic to explore, exploit, conserve and manage those resources within the fisheries waters of Nauru in accordance with the relevant rules of international law;
- utilise, manage, develop, protect and conserve those resources in such a way as to conserve and replenish them as a sustainable asset for future generations, and to achieve economic growth, improved social standards, improved nutritional standards, human resource development, increased employment and a sound ecological balance;
- pursue effective strategies for managing the fisheries and marine resources of Nauru, including the registration of fishing boats and the licensing of fishing and fishing activities; and
- repeal the Marine Resources Act 1978.

Other laws and regulations important to Nauru fisheries are:

- NFMRA Amendment Act 2004 – transfers the receipt of NFMRA revenue from NFMRA to the Treasury.
- Fisheries Regulations 1998 – describe requirements for vessel registration and licensing, and specific measures for protection of certain resources.
- Nauru Fisheries (PNA Third Implementing Arrangement) Regulations 2009 – give legal expression in Nauru waters to the Third Implementing Arrangement of the Nauru Agreement.
- Sea Boundaries Act 1997 – sets out the scope of Nauru’s marine jurisdiction.
- Sea Boundaries Proclamation 1997 – declares the coordinates of the Nauru EEZ.

According to a Nauru fisheries advisor (B. Yeeting, personal communication, March 2017), Nauru is in the process of reviewing the Nauru Fisheries Act, with the oceanic component of the review being done by FFA and the coastal and aquaculture component being undertaken by an independent legal consulting firm.

8. Niue



REPORTING YEAR

This profile was written in 2017, based on data mostly from 2014.

PART 1. OVERVIEW AND MAIN INDICATORS

8.1 GENERAL GEOGRAPHIC AND ECONOMIC INDICATORS

TABLE 8.1

General geographic and economic indicators - Niue

Land area ¹	259 km ²
Water area ²	390 000 km ²
Population (2011) ³	1 611
GDP of Niue (2014) ⁴	USD 24 432 000
Fisheries contribution to GDP (2014) ⁵	USD 1 045 000
Fisheries contribution as a % of GDP (2014) ⁶	4.3

¹ Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

² Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

³ 2011 Niue Census of Population and Households.

⁴ Reported in Gillett (2016) from the Niue Statistics and Immigration Division (unpublished data).

⁵ Reported in Gillett (2016) from the Niue Statistics and Immigration Division (unpublished data).

⁶ Reported in Gillett (2016) from the Niue Statistics and Immigration Division (unpublished data).

8.2 FAO FISHERIES STATISTICS

TABLE 8.2
FAO Fisheries statistics on total production, employment and trade – Niue

2014		
Production (tonnes)	Aquaculture	0
	Capture	38
	Total	38
Employment (thousands)	Aquaculture	N/A
	Capture	N/A
	Total	N/A
Value of trade (USD 1000)	Fisheries exports	N/A
	Fisheries imports	N/A
	Total	N/A

Source: FAO Statistics and Information Branch of the Fisheries and Aquaculture Department. N/A: Data is not available.

PART 2. NARRATIVE

8.3 PRODUCTION SECTOR

8.3.1 Introduction

Niue is an uplifted coralline island with the greater part of its coast consisting of an ancient, raised reef platform forming cliffs that rise to around 60 m above sea level. Niue has no lagoon and the outer reef slope descends precipitously to 1 000 m within 5 km of the shore. Cliffs predominate along much of the coastline and there are relatively few locations for ocean access. The reef area has been estimated by researchers from the Pacific Community (SPC) to be about 620 hectares.

Although the island's land area is only 259 km², Niue's exclusive economic zone (EEZ) is 390 000 km² in area.⁷ Located in this zone, about 125 nautical miles south-east of Niue Island, is the semi-exposed Beveridge Reef. At 19 degrees south latitude, Niue experiences greater annual temperature variation than most of its Pacific Island neighbors.

There are 14 coastal villages in Niue. The population of Niue continues to drop – from 5 200 in 1966 to about 1 499 in mid-2014.

A study by SPC (Kronen *et al.*, 2008) states that the orientation to a western lifestyle, which includes high living costs, frequent travel and a high education level, suggests the existence of alternative income opportunities and thus a low dependency on reef fisheries for income and nutrition. Nevertheless, reef fishing is part of the Niuean lifestyle, underpinning the strong bond between the native Polynesian people and the sea. People in Niue go fishing not to catch as many fish as possible, nor to make money, but for pleasure and well-being. The frequent exchange of seafood on a non-monetary basis further supports the argument that reef fishing in Niue has a traditional value.

Most fishing and invertebrate collecting occurs on the side of the island that is protected from the prevailing south-east trade winds. The natural inaccessibility of the eastern coast means that this area plays an important role in marine conservation (Fisk, 2007).

Fisheries statistics can be presented in different forms to cater for different purposes. In the statistics published by FAO (Part 1 of this profile), the presentation follows the international conventions and standards used by FAO and its Member States for reporting catches, which are given by the flag of the catching vessel. Accordingly, the fishery and aquaculture production of Niue in 2014 published by FAO (as given in Part 1) was 38 tonnes.

⁷ Some sources cite 450 000 km² as the size of the Niue zone.

In Table 8.3 below, the Niue fishery production statistics include catch by any Niue-flagged vessels⁸ (as reported to FAO), catch by canoes and skiffs in Niue (which do not carry a flag) and catch from fishing activities in Niue that do not involve a vessel (e.g. reef gleaning). The offshore category in the table is defined as the catch from Niue-flagged, industrial-scale fishing operations that are carried out anywhere (i.e. inside or outside the Niue zone).

TABLE 8.3
Niue fisheries production in 2014 (as per FAO reporting standards)

	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Niue-flagged offshore
Volume (tonnes)	0	0	11	154	0
Value (USD)	0	0	116 016	1 136 953	0

The amounts of production given in the above table differ slightly from those shown in Part 1. Table 8.3 consists of production estimated from a variety of sources (see SPC study below), whereas the quantities reported in Part 1 are estimates by the Niue Department of Agriculture, Forestry and Fisheries (DAFF) reported to FAO.

The fishery statistics of Niue are presented in a different way in a recent study by SPC. The SPC study (Gillett, 2016) reports on the amount of catch in Niue fisheries waters, regardless of vessel flag. In the study, the catches are placed in different categories, which is useful for other purposes, such as administration of the foreign fishing that occurs in the waters of Niue. A summary of the fishery production from the SPC study is given in Table 8.4 below.

TABLE 8.4
Fisheries production in Niue waters

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Offshore locally based ⁹	Offshore foreign-based ¹⁰
					Both Niue- and foreign-flagged vessels	
Volume (tonnes)	0	0	11	154	0	547
Value (USD)	0	0	116 016	1 136 953	0	1 519 487

Source: Gillett (2016).

Some comment is required to explain the difference between the information in this table and that in Part 1 of this profile:

- Catches can be given by the flag of the catching vessel (as in the FAO statistics given in Part 1), or by the zone where the catch is made (the “offshore foreign-based” and “offshore locally based” columns above). These two different ways of allocating catch each have their purposes. Attribution by flag is important for consistency with international conventions, while attribution by zone is important for determining fishing contributions to GDP, and managing revenue from licence fees for foreign fishing in a country’s zone.
- There is no fisheries statistical system in Niue covering the categories of coastal commercial and coastal subsistence fishing. The estimates above were made by a

⁸ There are no such vessels at present. The 2016 Niue report to the WCPFC (Fisheries Division, 2016) states: “Niue is not a flag state”.

⁹ In the SPC study, “offshore locally based” is the catch in Niue waters from industrial-scale tuna fishing operations that are (a) based at a port in Niue, and (b) generally harvested more than 12 nautical miles offshore.

¹⁰ “Offshore foreign-based” is the catch in Niue fisheries waters from catch from industrial-scale tuna fishing operations that are based at ports outside Niue. Under the international standardized System of National Accounts (SNA, 2009), those catches do not contribute to the GDP of Niue.

study carried out by SPC in 2015 which examined a large number of fishery and economic studies covering the last two decades. It is likely that the basis of the information in the FAO statistics given in Part 1 was a more informal conjecture by a nominated person in the Niue Department of Agriculture, Forestry and Fisheries.

8.3.2 Marine sub-sector

8.3.2.1 Catch profile

Fisheries in the waters of Niue are primarily oriented to subsistence, but there is some small-scale commercial fishing and sporadic, offshore industrial-scale fishing.

For the offshore industrial fishing, the Fisheries Division (2015) states:

A total of five out of eight vessels that were licensed to fish in 2014 engaged in fishing. These vessels were flagged to Fiji, Cook Islands, United States and Taiwan Province of China. As expected, albacore made up the majority of the catches, followed by yellowfin and bigeye. The effort is slightly lower in 2014 compared to 2013 and it was concentrated on the north-western part of the island.

There has been no locally based offshore fishing in Niue since 2007. The one small “alia” catamaran longliner operating since 2013 is, for the purpose of the present study, considered to be part of the coastal fleet.

Estimates of the volumes and values of catches of the four main commercial species of tuna in the area of the Western and Central Pacific Fisheries Commission (WCPFC) have been made by the Forum Fisheries Agency (FFA) using data sourced from SPC’s Oceanic Fisheries Programme. The volumes and values of the catches can be determined using the FFA data (FFA, 2015a). Table 8.5 below takes those volumes and adjusts for bycatch. The values on the table are adjusted (a) to account for the value of the bycatch, and (b) to be in-zone values (i.e. overseas market prices, less transport charges to those markets).

TABLE 8.5
Offshore catches in the Niue zone

	2010	2011	2012	2013	2014
Adjusted catch volume (tonnes)	322	0	0	597	547
Adjusted catch value (USD)	718 540	0	0	1 306 626	1 519 487

Source: Modified from FFA (2015a).

Catch estimates for coastal fishing around Niue involved more speculation. As mentioned above, there is no fisheries statistical system in Niue covering the categories of coastal commercial and coastal subsistence fishing – so catches must be estimated indirectly. Using previous survey work on Niue, discussions with Niue fisheries officials, and changes in recent years that could affect fisheries production, the SPC study (Gillett, 2016) made an estimate of the 2014 Niue coastal fisheries production. The important considerations of that study were as follows:

- The SPC PROCFish program surveyed Niue in June 2005. As part of that work, estimates were made of the annual production in various categories of fishing. The report of the survey (Kronen *et al.*, 2008) states: (a) the survey data suggests a total annual reef finfish catch of 53.4 tonnes; (b) there is an estimated production of 76.2 tonnes/year from mid-water and trolling fishing; and (c) applying sample data to the total number of possible invertebrate fishers in Niue, the total annual impact in biomass (wet weight) removed amounts to 35.3 tonnes/year. This equates to a total annual harvest of 164.9 tonnes.
- Gillett (2009a) considered many studies (except the above PROCFish work as the results were not available), recent information on factors that could affect coastal

fishery production, recent surveys, and current prices of fish. Coastal fisheries production in 2007 was estimated to be 150 tonnes, made up of commercial production of 10 tonnes (worth NZD 80 000 to the fisher) and subsistence production of 140 tonnes (worth NZD 840 000).

- According to Niue fisheries officials, estimates of total fisheries production for coastal fisheries have not been made in Niue since 2008. In examining the above studies, it appears that the PROCFish work was the most methodical in the way that coastal fisheries production was estimated. Accordingly, if it is assumed that the PROCFish estimate is reasonably accurate, it could be adjusted by factors that are likely to have affected production in the period since that estimate was made.
- In recent years there have been a few changes that could have conceivably affected coastal fisheries production. According to an individual knowledgeable about Niue fisheries (J. Tamate, personal communication, December 2015), these changes include the following: (a) The locally based longliners ceased operations in late 2007. When those vessels operated from Niue (2005–2007), there was an increase in the supply of fish (i.e. sales of longline bycatch) resulting in a lower price for coastal fish. When the operations ceased in late 2007, the price increased. (b) To compensate coastal fishers for the lower prices for coastal fish due to the longlining, the government introduced a fuel subsidy in 2006 to ensure local fishers would remain in the fishery. The subsidy was removed in late 2015. (c) In the period 2007–2014, the population of Niue dropped from 1 587 to 1 499, a reduction of 5.9 percent. (d) Major cyclones have had substantial negative impacts on coastal fisheries (the last serious cyclone to hit Niue was Heta in 2004). (e) The number of fish aggregation devices (FADs) has been relatively constant in the last decade. (f) An international fishing competition was started in 2010. (g) There was an increase in the number of canoes and fishing activities from 2010, e.g. in 2014, one village launched 40 new canoes. (h) Average prices paid to fishers increased from NZD 7.00 to 9.00 per kg in 2007, to NZD 12.00– 15.00 in 2014. An inspection of the above list of factors suggests there are influences that would tend to both increase and decrease coastal fisheries production, with no remarkable net affect. This is consistent with the views of Niue fisheries officials, who believe that production has not changed much since the 2005 PROCFish work.

Selectively using the above information, it is estimated that the coastal fisheries production in Niue in 2014 was 165 tonnes, made up of 11 tonnes of commercial catch (worth USD 116 016 to the fishers) and 154 tonnes of subsistence catch (worth USD 1 136 953 to the fishers).

8.3.2.2 *Landing sites*

The only wharf in Niue is at Alofi, the main urban area. This part of Niue is sheltered from the prevailing south-easterly trade winds but is vulnerable to wind and swell from the west. This is because, unlike most ports in Pacific Island countries, there is no barrier reef protecting the wharf area. In major storms that have occurred (e.g. Cyclone Heta in January 2004), much of the exposed wharf equipment was damaged.

When the large longliners operated out of Niue in the mid-2000s, their catch was landed at the Alofi wharf. The single small longliner also offloaded its catch at this wharf, as did many other smaller boats.

At two other sites, some improvements have been made to facilitate the landing of canoes and small boats. Fishing craft also land catches at many unimproved landings around Niue.

The catch by offshore foreign-based vessels is not sold in Niue. This catch is offloaded at various locations, including Pago Pago, American Samoa, and Suva, Fiji.

8.3.2.3 Fishing practices/systems

The history of offshore fishing in the Niue zone is presented in Box 8.1.

BOX 8.1

Past offshore fishing in the Niue zone

Some fishing by Japanese, Taiwanese and Korean longliners was reported before the establishment of the Niue EEZ. Pole-and-line operations for skipjack tuna were conducted in Niuean waters in early 1980 through the Skipjack Survey and Assessment Programme of SPC. Tuna longline operations were conducted in Niuean waters from 1993 to 1997 by two to six Taiwanese vessels fishing under an access agreement. Over the five-year period, 790 000 hooks were set for a catch of 306 tonnes of albacore tuna and 13 tonnes of yellowfin tuna. In 2002 there were 21 licensed vessels from Taiwan Province of China and American Samoa fishing in the Niue EEZ, with an approximate catch of 50–100 tonnes. Locally based offshore longlining commenced in May 2005, with four small vessels landing 33 tonnes over a three-month period. The number of licensed vessels increased to 13 by the end of 2005, with a total recorded catch of 122.8 tonnes. These vessels fished under a charter arrangement and landed their fish to the government joint-venture fish-processing facility, Niue Fish Processors Ltd. During 2006 and 2007, the number of vessels fishing in Niuean waters and landing their catch to the processing facility fluctuated, resulting in the closing of the facility due to the limited amount of fish available for processing, which made the operation uneconomic.

Source: Kronen *et al.* (2008).

Currently, all offshore fishing in the Niue zone is carried out by longliners. According to the Fisheries Division (2015), a total of five out of eight vessels that were licensed to fish in 2014 engaged in fishing. These vessels were flagged to Fiji, Cook Islands, the United States and Taiwan Province of China. In 2015, the number of longline vessels licensed to fish in Niue decreased from five to three (Fisheries Division, 2016a) and the effort and total weight for the year decreased significantly compared to the previous two years. Niue licensed two purse-seine vessels in 2015. However, no catch was reported by these vessels.

With respect to coastal fishing, fishing techniques can be partitioned into three categories:

- Shore-based fishing techniques include hook and line, occasional gillnetting, reef gleaning, diving and spearfishing.
- Fishing from boats close to the island includes shallow-water handlining and the traditional catching of *Decapтерus*, called *ulihēga* in Niue (Box 8.2).

Further offshore, fishing activity consists mainly of trolling or vertical longlining, with a few other types of hook gear. Fishing effort is predominantly focused around anchored FADs, which are located within 3 nautical miles of the island.

In addition to the capture of *Decapтерus*, another culturally important fishery in Niue is that for the coconut crab (*Birgus latro*). Helagi *et al.* (2015) state that the coconut crab is an iconic species in Niue and a local delicacy, eaten regularly and used in celebrations. It is hunted for domestic sale and for export to Niueans living abroad, and supports a growing eco-tourism sector, where visitors take guided tours to view crabs in natural habitats. To catch coconut crabs, hunters set baits of coconuts split in half, or a whole coconut with a small wedge cut out. This bait is fastened to a tree root or limestone coral. Half coconuts are generally used when crabs are needed at short notice. Whole coconuts with a small wedge removed are set and revisited regularly for

BOX 8.2

Fishing for *Decapterus* in Niue

Fish of the genus *Decapterus* are commonly referred to as scads, round scads and mackerel scads. In Niue, they are called “ulihega”. These fish are caught in Niue by traditional techniques and are valued for both food and bait. Using single-man canoes, groups of fishermen bait small hooks with bits of coconut meat to catch the fish relatively close to shore, usually around sunset. The fishing season appears to correspond to the period of highest sea surface temperature, October to April. Although the annual catch of scads in Niue is probably much less than 5 tonnes, it is likely that scads account for a higher proportion of the total fish catch in Niue than in any other Pacific Island country.

Source: Gillett (1987a).

up to three weeks. Hunters revisit baits at various times of the night, using torches or head lamps. Crabs are also dug directly from burrows, although locating crabs underground requires considerable experience. Hunters may use dogs to assist them in searching for crabs, and vehicles are now also being used to search for crabs at night on and alongside roads.

For nearshore pelagic fishing, fishers on Niue often make use of FADs. Some background on FADs in Niue is given in Box 8.3.

BOX 8.3

History of FADs in Niue

FADs were first introduced to Niue in the early 1980s, with materials funded by the United Nations Development Programme, and SPC providing a master fisher to rig and deploy the FADs while training local fisheries staff in these techniques. Four FADs were deployed in 1982 along the west coast in 220–780 m depths and at a distance of 1–3.75 km from the island. With the successful development of a FAD programme in Niue, the Fisheries Department regularly maintained the FADs. Several FADs were deployed in the mid-1980s, followed by another six in 1989/90. The fisheries staff continued to maintain and replace FADs during the 1990s, with seven FADs on station in 1991 and eight FADs on station in 1999. In 2001, a joint project was initiated between SPC and the fisheries departments of Niue and Cook Islands. The project was to develop a more cost-effective FAD mooring design, collect catch and effort data from fishers (with a focus on FAD fishing), conduct a cost-benefit analysis of the FADs, and produce a manual on the most effective FAD mooring designs. Over a three-year period, 11 FADs were deployed off Niue and a data collection system initiated. The results clearly showed the value of FADs to the small-scale tuna and coastal pelagic fishery off Niue.

In 2012, Niue had the most extensive FAD network in the Pacific region. In that year, there were nine FADs in place, including three offshore and six nearshore FADs. The National Tourism Office had plans to deploy three more FADs specifically for visiting spearfishers – a first in the region.

Source: Kronen *et al.* (2008); Blanc (2012).

8.3.2.4 Main resources

The main offshore fishery resources are the tunas and tuna-like species. The Fisheries Division (2015) states that albacore is the dominant species, making up over 70 percent of the total weight, followed by yellowfin then bigeye.

In terms of the status of these offshore resources, recent information from the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC, 2016) shows that for:

- **South Pacific albacore** – there is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries. It should be noted that longline catch rates are declining, and catches over the last 10 years have been at historically high levels and are increasing;
- **yellowfin** – the current total biomass and spawning biomass are higher than at levels associated with maximum sustainable yields. Therefore, yellowfin tuna is not considered to be in an overfished state.
- **bigeye** – recent analysis indicates that overfishing is occurring for the bigeye tuna stock and that to reduce fishing mortality to that at maximum sustainable yield, a large reduction in fishing mortality is required.

As for the coastal fishery resources, Fishbase (www.fishbase.org) lists 212 finfish species that are found on Niue. Fisk (2007) studied the coastal environment of Niue and noted the relatively low diversity of animal and plant species. He attributed the few species to:

- Niue's isolation from other landmasses, which limits the number of species reaching the island;
- Niue being relatively young geologically. The upper terrace formed during interglacial periods that occurred prior to 500 000 to 900 000 years ago – the animals and plants arriving in Niue have thus had limited time to evolve;
- Niue's relatively small size, which provides a restricted range of habitats (e.g. it lacks a reef lagoon) and limits species numbers and degree of endemism (the only known endemic marine organism is a sea snake).

Invertebrates are quite important in Niue relative to neighboring countries. Lambeth and Fay-Sauni (2001) carried out research on invertebrates and seaweeds in Niue and recorded Niuean names for a total of 63 Niuean invertebrates and 3 seaweeds, with 41 of these collected for food. They give the most important invertebrates and seaweeds as: the spiny lobster (*Panulirus* sp.), slipper lobster (*Parribacus* sp.), red reef crab (*Etisus splendidus*), three-spot reef crab (*Carpilius maculatus*), giant clam (*Tridacna squamosa* and *T. maxima*), green snail (*Turbo setosus*), and caulerpa seaweeds or seagrapes (*Caulerpa racemosa*, and *C. cupressoides*).

There is limited information on the status of Niue's coastal fishery resources:

- Dalzell *et al.* (1990) estimated the total fisheries production of Niue to be about 115 tonnes per year, based on nutritional data and population census data. A further 4.9 tonnes per year was estimated to be exported to New Zealand during periods of direct air connections. The questionnaire survey indicates that about half of Niue's fish production comes from the coral reef areas. This amounts to a total annual reef yield for the 6.2 km² of shallow reef of 9.3 tonnes/km². According to Kronen *et al.* (2008), this harvest level suggests that "Niue's reef resources are reasonably heavily exploited".
- The report of an SPC study in 2005 (Kronen *et al.*, 2008) states: "The finfish resource assessment indicates that the quality of finfish resources in Niue is quite poor. Preliminary results suggest that this scarcity of finfish may be natural rather than induced by fishing, possibly due to the lack of a lagoon and the remoteness and small size of the island...The quality and quantity of reef finfish resources in Niue will only allow limited subsistence use; expansion of the fishery is not possible without causing overfishing."

- Fisk (2007) states that many community members share the perception that coastal marine resources are being depleted. A review of the status of coastal marine resources in Niue based on previous studies showed that prior information is scarce and often in a form that does not assist in assessing long-term trends in resource availability. A lack of data frustrates efforts to validate possible causes of resource depletion from land-based activities. Inconsistency in survey methodology in previous studies also hindered the assessment of long-term trends in resources. It is probable that a major contributor to resource depletions is the limited natural carrying capacity of coastal habitats, which are under constant pressure from high harvest levels. When coupled with natural disturbances (cyclones, storms, bleaching) and large variations in species replenishment (due to the isolation of Niue from other similar reef systems), it is clear that the result will be wide fluctuations in resource availability and abundance, on both spatial and temporal scales. It is possible to hypothesize that the perceived depletion of stocks could be attributed to interference with recovery processes following major natural perturbations, through a combination of localised pollution effects and widespread overharvesting.

As stated in section 8.3.2.3 above, the fishery for coconut crab is culturally important in Niue. It is probably the best-studied fishery resource in Niue, and nowhere else in the Pacific Islands region has more effort gone into coconut crab research and management.

- Kronen *et al.* (2008) cited a previous SPC study (Friedman and Pakoa, 2007) that involved a desk review on the coconut crab in Niue at the request of the Niue Fisheries Department. The review noted that, in the early 1990s, stocks of coconut crab were already depleted and stock abundance had continued to fall. Management measures that had previously been recommended to halt declines were only partially adopted and proved insufficient to stem declines in the populations. However, even highly depleted fisheries have managed to recover, as long as spawning stock (the number of females of spawning size) is not decimated. The review recommended that only strong controls on harvest could protect the remaining stock of coconut crabs on Niue.
- The most recent study (Helagi *et al.*, 2015) found that there was a greater abundance of coconut crabs in 2014 compared to previous studies. The size structure of the coconut crab population has remained reasonably stable over the past two decades, but with small average and maximum sizes for female and male coconut crabs. Seventeen percent of crabs recorded (both male and female) were larger than the current minimum harvest size limit, but only two percent of females recorded were above the minimum harvest size. There was a slight decrease in the average size of male and female crabs recorded in this study compared to 1990. Small average sizes and the lack of large crabs in a population are consistent with heavy harvesting pressure.

8.3.2.5 Management applied to main fisheries

Niue's offshore fishery is managed on regional and national levels:

- On the regional level, Niue is a member of the Western and Central Pacific Fisheries Commission (WCPFC) that was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Niue and the other 26 members of the commission enact tuna management measures at the annual WCPFC meeting. From Niue's perspective, the two most important measures are: (1) the Conservation and Management Measure for South Pacific Albacore, and (2) the Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean.

- On the national level, the tuna fisheries are managed by the National Pelagic Management and Development Plan. According to the Fisheries Division (2016a), that plan (a) sets limits on the main tuna species targeted, based on the best catch rates and those neighbouring countries' catches that are similar in size; (b) contains the provision that sharks caught in Niue's waters must be discarded; and (c) specifies the requirements for research involving offshore target and non-target species.

As for coastal fisheries management in Niue, it is important to consider the historical context. Pasisi (1995) states: "Given that fishing pressure, due to Niue's relatively low population, has been proportionately low and predominately on a subsistence scale, the issues of management, conservation and sustainability have been somewhat ignored. Reflecting this is the current almost non-existence of inshore fishery strategies/plans."

There is a coastal fisheries management plan, but as of April 2017 that plan is still in draft form (B. Pasisi, personal communication, April 2017). An earlier national management plan for coastal fisheries was developed to "produce baseline information, promote existing and introduce appropriate new management and co-management mechanisms, and assess the effectiveness of these mechanisms with respect to fishery production and social systems" (Kronen *et al.*, 2008).

Much of the current coastal fisheries management measures are given in the Domestic Fishing Act 1995 (below).

According to the DAFF Corporate Plan 2015–2019, the core fisheries management functions of the department in the near future will be as follows:

- Fisheries Management Advisory Committee (FMAC) is established and functioning by June 2017.
- Management Committee provides recommendations to the Minister and cabinet on key fisheries management and development matters. At least two meetings of the FMAC annually from 2017 onwards.
- Niue Pelagic Fisheries Management and Development Plan is reviewed in 2018.
- Coastal Fisheries Management Plan endorsed by cabinet by December 2016.
- At least two village community-based fisheries management plans are completed annually from 2017 onwards.
- Marine spatial plan is completed by 2019 including zoning for key fisheries-related activities.

Management objectives

At a high level, an indication of fisheries management objectives is given in the National Strategic Plan 2009–2013. According to that plan's environment pillar, the goal is to maximize benefits from Niue's resources in a sustainable manner focusing on private sector development, targeting tourism, agriculture and fisheries supported by safe, reliable, affordable, healthy infrastructure.

For offshore fisheries, the objectives of management are given in the National Pelagic Management and Development Plan:

- Ensure that the utilization of the tuna, billfish and wahoo stocks in the waters of Niue is consistent with the sustainable utilization of these stocks in their entirety.
- Eliminate illegal fishing activity in the waters of Niue.
- Maximize benefits to Niue, including economic and social, from the long-term sustainable utilization of its tuna and billfish resources.
- Minimize any adverse interactions between fisheries, in particular, between the large-scale commercial industry and the small-scale commercial, subsistence, charter or recreational fishers.
- Minimize the impact of target fishing on both the marine environment and bycatch species.

- Identify and secure funding to support the development and implementation of management measures to pursue the objectives of the Plan.
- Assist to fulfill regional and international obligations regarding the conservation and management of highly migratory fish stocks in Niue's waters.
- Ensure that all activities undertaken as part of this Tuna and Billfish Fishery Plan are implemented and administered efficiently and cost-effectively.

With respect to coastal fisheries, the latest available Niuean National Management Plan for the Coastal Fishery states the goal is to maintain the productivity, and maximize the overall sustainable benefit to Niue of coastal fisheries in all areas permitted to fishing. The objectives of the Plan are to:

- ensure that the utilisation of coastal fishery resources is consistent with obtaining the maximum long-term benefit for the people of Niue, according to social development goals defined by the Government and/or Village Councils from time to time;
- ensure that the utilization of coastal fishery resources is consistent with maintaining the integrity of coastal marine ecosystems, particularly coral reef ecosystems, taking into account seasonal, annual, decadal, and other natural environmental cycles;
- effectively integrate national and village coastal fisheries governance systems;
- ensure that there is a balance in perceived equity in the right to use or enjoy coastal fishery resources by all relevant groups and stakeholders, in each Village Council area across the nation as a whole;
- provide early warnings for potential or actual crises in coastal fisheries and their supporting ecosystems;
- contribute to minimizing the impact of non-fishing human impacts on coastal fishery resources;
- assist in fulfilling any regional and international obligations of Niue regarding the identification, conservation and management of coastal fishery species and their habitats;
- ensure that all activities undertaken as part of this plan are implemented and administered efficiently and cost effectively;
- ensure that Niue has sufficient capacity to implement the plan; and
- review the progress of this Plan against objectives 1 to 7 after a period not exceeding five years from each implementation, and make any amendments necessary to better achieve the overarching goal of the plan or of its parent legislation.

Management measures and institutional arrangements

According to the Fisheries Division (2016a), the main management measure for the offshore fishery is a limit on the catches of the main tuna species. There is also a prohibition on the discarding of sharks caught in Niue waters.

Much of the current coastal fisheries management measures are given in the Domestic Fishing Act 1995, which prohibits:

- use of certain fishing means (e.g. explosives, fish poisons, small mesh nets)
- fishing in marine reserves
- bait fishing in certain areas
- taking of certain species
- exporting certain species
- fishing on Sundays
- using an unlicensed vessel for fishing.

The main institution involved with fisheries management in Niue is the Department of Agriculture, Forestry and Fisheries. This agency is discussed in Section 8.7 below.

8.3.2.6 Fishing communities

The concept of “fishing communities” has limited applicability to Niue. Most households in the villages of Niue are involved in fishing activities. It could therefore be stated that all villages in Niue are “fishing communities”.

8.3.3 Inland sub-sector

There are no freshwater fisheries in Niue. Unlike most Pacific Island countries, neither tilapia nor freshwater shrimps (*Macrobrachium*) are caught on Niue.

8.3.4 Aquaculture sub-sector

There is currently no aquaculture activity on Niue.

8.3.5 Recreational sub-sector

In Niue there are two categories of activities that could be considered recreational fishing:

- Reef fishing is part of the Niuean lifestyle, as noted in the introduction to this profile (Kronen *et al.* 2008).
- Many of the tourists that come to Niue are involved with fishing. There are a few local businesses that take visitors out fishing and occasionally game-fishing tournaments are organized.

8.4 POST-HARVEST SECTOR

8.4.1 Fish utilization

Most of the catch by offshore longliners is delivered to a cannery in the region (e.g. Levuka, Fiji, and Pago Pago, American Samoa) or transshipped at a port in a nearby country, often Pago Pago or Suva, Fiji.

No discussion of post-harvest aspects of fisheries in Niue would be complete without mention of the tuna processing plant (Box 8.4). Although that facility is not currently operating (it closed in late 2007), it is noteworthy due to several features, including the possibility it may re-open in the future.

With respect to coastal fisheries, most of the fisheries production is consumed at home. Some, however, is sold both to Niue residents and to the establishments that cater to tourists.

BOX 8.4

Locally based foreign processing companies in Niue

Niue has an interesting, if not totally traditional, form of second-generation access arrangement to encourage the development of domestic industry in its micro economy. In lieu of access agreements, the key development for Niue’s fishing industry is the negotiation of a new joint venture between the government of Niue and the private company Reef Group. Reef is a New Zealand firm that focuses on ocean-going sea freight; it holds a monopoly on freight services to Niue and feeds several other Pacific Island countries.

The creation of Niue Fish Processors Ltd (NFP) has had several important effects on local development and on resource use. All foreign commercial tuna vessels fishing in Niue’s zone are required to offload all of their catches to the NFP plant. Only vessels that agree to these terms will be licensed. NFP currently employs six Niuean staff and three expatriates.

In addition to its role as a packing plant, NFP has also recently purchased two large longliners that will be used to supply the plant. The vessels are owned by Reef Group and are registered in the Cook Islands. The original intention was that the factory would simply

process and export fish on a contract basis for independent fishing boats, but due to the lack of supply it became necessary for the factory to have company boats to supply it.

The wharf appears to be one of the biggest shortcomings of the venture as it is very small, shallow, and subject to surge, and several boats have been damaged on the surrounding reef trying to access it. Generally, services and logistics are proving very difficult – airport services and tele-communications do not perform reliably.

Summarizing, Niue is an interesting example of how fisheries access to the resource can be used to induce domestic development in even the most isolated of locations. Niue is the smallest, remotest and one of the least well-served Pacific Island countries in terms of infrastructure and yet it has succeeded in attracting foreign investment in a major tuna processing facility.

Source: Campling et al. (2007).

8.4.2 Fish markets

The catch from offshore longlining is not brought ashore. The catch from coastal fishing is mainly for consumption by the family of the person making the catch. It is only when there is a surplus that seafood is sold either raw or cooked at the Alofi market on Tuesdays and Fridays. A few women also sell from home, or to restaurants, hotels and shops.

8.5 SOCIO-ECONOMIC CONTRIBUTION OF THE FISHERY SECTOR

A recent study by SPC (Gillett, 2016) attempted to quantify the fishery-related benefits received by Niue and other Pacific Island countries. The study gave the available information on the contribution of fishing/fisheries to GDP, exports, government revenue, employment and nutrition. Unless otherwise noted, the information in this section is from that study.

8.5.1 Role of fisheries in the national economy

The Niue GDP for recent years is given by the Statistics and Immigration Division (2015). Unpublished data from the Statistics and Immigration Division gives the fisheries component of the GDP (Table 8.6).

The SPC study examined the official methodology and, using its independent estimate of the value of fisheries production, re-estimated the fishing contribution. The re-estimated fishing contribution to the Niue GDP in 2014 was USD 1 045 000, which is also (rounding off) 4.3 percent of GDP.

In 2014, the total access fees for all foreign fishing in the Niue zone was USD 635 815. This represented about 3.3 percent of the government's recurrent expenditure for the year.

TABLE 8.6
Fisheries contribution to Niue GDP (USD (000))

	2013	2014
Fisheries contribution to GDP	1 074	1 045
Niue GDP (current prices)	24 902	24 432
Fisheries as a % of GDP	4.3%	4.3%

Source: Statistics and Immigration Division (2015; and unpublished data)

8.5.2 Trade

Since Niue Fish Processors and the associated longlining ceased activities in late 2007 there have been no formal exports of fishery products from Niue. Informal fish exports occur as passenger baggage on flights to Auckland, but these are not monitored.

If there were 75 flights in 2014, and each flight carried 100 kg of fish, that would equate to an informal export of 7.5 tonnes of fish during the year. In 2014, the value of all exports was NZD 15 085 000 (<http://wits.worldbank.org>), so at NZD 11.71/kg, this hypothetical fish export would be about 0.6 percent of all exports in 2014.

One of the most significant items in Niue's informal fishery exports is the coconut crab. The report of the SPC/DAFF study of the status of coconut crab in Niue (Helagi *et al.*, 2015) states that departing aircraft passengers and their baggage/cargos were monitored for some flights between March 2014 to January 2015. From this monitoring, it was estimated that around 9 350–9 850 crabs were sent abroad over the sampling period.

8.5.3 Food security

The SPC PROCFish programme conducted fieldwork around Niue in May and June 2005. With respect to fish consumption, that survey interviewed about half of the households and made estimates of fish consumption (Table 8.7).

TABLE 8.7
Seafood consumption on Niue

Item	Consumption (kg)
Quantity fresh fish consumed (kg/capita/year)	31.03 (± 2.28)
Quantity fresh invertebrate consumed (kg/capita/year)	2.53 (± 0.33)
Quantity canned fish consumed (kg/capita/year)	17.17 (± 1.26)

Source: Kronen *et al.* (2008); M. Kronen (personal communication, March 2009).

Bell *et al.* (2009b) used information from household income and expenditure surveys (HIES) conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES were designed to enumerate consumption based on both

subsistence and cash acquisitions. For Niue, the annual per capita fish consumption (whole weight equivalent) was 79.3 kg, some of which was imported.

In the 2015 SPC study (Gillett, 2016), the production of coastal commercial and subsistence fisheries is estimated to have been 165 tonnes in 2014. The population of Niue was 1 499 in 2014. That equates to 110 kg per capita per year – without considering informal fish exports and canned fish imports.

8.5.4 Employment

The 2009 agriculture census of Niue (Statistics Niue, 2010) contains fisheries participation information:

- Most of the households were engaged in inshore fishing (62 percent) – 31 percent were involved in both inshore and offshore fishing, with the remaining 7 percent being involved in offshore fishing only. This showed that fishing in Niue is still more of a subsistence activity as opposed to commercial fishing.
- Household participation in fishing activity was very high across the country, with only one village (Lakepa) having less than a 50 percent participation rate. Toi had the highest participation rate of 89 percent, with 8 out of 9 households involved in fishing in the last 10 months.
- The main purpose of household fishing activity was for home consumption, accounting for 82 percent of fishing households, with 16 percent selling some of their catches and the remaining 2 percent of households fishing mainly for sale.
- Of the 564 people who engaged in fishing the week before the census night, 201 were females and 363 were males.

To some degree in Niue, the change in the number of boats reflects the change in participation in fishing. A comparison of the number of vessels in the 2006 census (Anon., 2007) and that in 2011 (Vaha, 2012) is given in Table 8.8. It can be seen from the table that between 2006 and 2011, while Niue's population decreased by 14 people (0.9 percent), the population of small craft increased by 57 (26 percent).

A Niue-based fisheries economist believes there are about 10 people who spend at least 50 percent of their time in fishing, and who could be considered the core of commercial fishing in Niue (J. Tamate, personal communication, December 2015). Those 10 people represent about 1.4 percent of Niue's 737-person workforce.

TABLE 8.8
Change in the number of small craft 2006–2011

	Canoe	Aluminium Dinghy	Inflatable Dinghy	Boat	Other	Total
2006	122	66	5	23	0	216
2011	142			115	16	273

Source: Anon. (2007); Vaha (2012).

8.5.5 Rural development

The concept of “rural development” is not very relevant to a tiny country such as Niue, with a population of around 1 300 in 14 coastal villages, all in close proximity. In the Niue context, rural development in the fisheries sector equates to fisheries sector development.

8.6 TRENDS, ISSUES AND DEVELOPMENT

8.6.1 Constraints and opportunities

Some of the major constraints for the fisheries sector are:

- the limited reef area
- the high cost of operating longline vessels from such a remote location
- scarce and expensive labour
- infrequent and costly air cargo
- inadequate wharf infrastructure
- the highly destructive cyclones that occasionally batter the island, especially, the exposed fishery infrastructure.

Opportunities in the fisheries sector include:

- commercial sport fishing, if the air service to Niue is enhanced;
- building on the model of using fishing access to leverage domestic tuna industry development;
- increased cooperation and solidarity with neighboring Pacific Island countries to increase the value of the tuna resources.

Although the fishery resources of Niue’s Beveridge Reef are sometimes cited as a development opportunity, the distance of the reef from Niue Island, the cost of travel, and the large vessel required to make the trip severely constrain the current fisheries value of the reef.

8.6.2 Government sector policies and development strategies

Niue has a National Strategic Plan (NNSP). The Department of Agriculture, Forestry and Fisheries has the “DAFF Corporate Plan 2015–2019”, which lists its activities supporting the NNSP. The corporate plan:

- gives the fisheries and marine objective as: “To actively facilitate the utilization of Niue’s marine resources through sustainable and environmentally sound fisheries development strategies at all levels aimed at increasing economic development opportunities and enhancing food security”;
- specifies the major activities: “All FADs replaced following cyclone losses, offshore fisheries licensing revenue secure, fishery limits utilized, and coastal fisheries managed at community level”;
- states that fisheries work will focus on the implementation of the pelagic and coastal fisheries management and development plans;
- indicates that the public-private sector partnership project, Niue Ocean Wide (NOW), will resource and drive key fisheries management and planning.

8.6.3 Research

Fisheries research in Niue is the responsibility of the Fisheries Division. The division does not have a strong research capability, so it normally collaborates with regional fisheries organizations. SPC has carried out many research projects in Niue in the past decade, including assessment of tuna stocks and the status of coconut crab. Most of FFA research in Niue has been oriented to economics. FAO has sponsored studies on *Decapterus*, coconut crab and development potential.

The DAFF Corporate Plan 2015–2019 lists its planned research and development activities, which are to:

- develop key areas in fisheries, allowing for resource sustainability and economic opportunities via research;
- complete the Beveridge Reef assessment survey and clam genetic profiling;
- have Niue's pelagic tuna fishery limits fully recognized and under a rights-based management scheme by 2020;
- deploy four to five FADs lost during the 2015–2016 cyclones.
- deploy an additional two FADs in 2017 in support of tourism charter operations, along with two shallow-water FADs for spearfishing in strategic locations.
- keep records of catches around FADs to monitor the success of the FAD, with an annual report on local catches.

8.6.4 Education and training

Education related to fisheries in Niue is undertaken in a variety of institutions:

- Academic training in biological, economic and other aspects of fisheries is given at the University of the South Pacific (USP) in Suva, and to a lesser extent at universities in New Zealand and elsewhere.
- The USP Extension Centre in Niue offers courses, including those from the Marine Studies Programme.
- Training courses, workshops and attachments are frequently organized by the regional organizations: SPC in New Caledonia and FFA in the Solomon Islands. The subject matter has included such diverse topics as fish-quality grading, stock assessment, seaweed culture, fisheries surveillance, and on-vessel observing.
- Courses and workshop are also given by NGOs and bilateral donors.

8.6.5 Foreign aid

New Zealand is the largest donor of development assistance to Niue. Funding for the fisheries sector has also flowed from other sources, including Australia, FAO, UNDP, the Global Environment Facility and regional agencies. A significant amount of assistance is related to rehabilitation of infrastructure after cyclones.

The country has enjoyed substantial development assistance from the major regional agencies involved in fisheries, SPC and FFA. SPC has contributed to a variety of fishery efforts, including inshore/offshore surveys, tuna stock assessment, data processing, FAD fishing skills, production and marketing of shell craft, setting up a marine reserve, setting up a household fishing and consumer survey, and establishing a port sampling programme. FFA has been especially active in support for establishing a domestic tuna industry and improving the benefits from Niue's tuna resources.

8.7 INSTITUTIONAL FRAMEWORK

Responsibility for fisheries and marine resource matters is vested in the Department of Agriculture, Forests and Fisheries (DAFF). DAFF is one of three components of the Ministry of Natural Resources, the other two being the Department of Environment and Meteorological Services.

Table 8.9 shows DAFF's organizational structure.

TABLE 8.9
Department of Agriculture, Forests and Fisheries' organizational structure

Administration	Quarantine & Plant Protection	Agriculture		Forestry	Fisheries
		Crop Research	Animal Health		
Management	Quarantine	Crop research and development.	Livestock production	Forestry management	Fisheries management
Corporate Services and Finance	Border control (MCS)	Sustainable land management & soils	Animal health	Research and development	Research & development
Policy development & advice	Import/Export standards/protocol	Crop extension	Feral pig control		Monitoring, control & surveillance
Databases	Plant protection				Compliance
Information and awareness	Invasive species control				Licensing & data collection
Marketing					Database management
Mechanical & maintenance					

Source: DAFF Corporate Plan 2015–2019.

According to the DAFF Corporate Plan 2015–2019, the core functions of DAFF are grouped into five categories:

- **Management:** to implement the Fisheries Management Plans that ensure sustainability and ecosystems are managed well, and enable Niue to sustainably develop marine resources and provide food security from healthy stocks.
- **Research and Development:** to develop key areas in fisheries, allowing for resource sustainability and economic opportunities via research.
- **Monitoring, Control and Surveillance and Compliance:** to monitor, control and police measures adopted and ensure illegal activities are reduced.
- **Licensing:** to produce competitive licences that will maximize returns to Niue.
- **Data Collection and Data Management:** to maintain a comprehensive fisheries database that will aide in informing decision makers of management options.

The DAFF Corporate Plan 2015–2019 lists “challenges and risks” for the Department:

- Limited technical expertise and capacity (human resources). Calibre of current staff complement is limited.
- Transformation process requiring changes midstream to planned activities, increasing administrative workload.
- Four-day week will continue to challenge the work of larger departments and projects.
- Project funds are not received on time, and experience delays.
- Timely planning and coordination of execution of project activities under co-financing arrangements remain challenging.
- Uncoordinated planning of inter-governmental agency cross-sectoral support, causes real distractions on many occasions (e.g. workshops, consultations, etc.), all competing for time and personnel.
- Regional and international obligations and integrated activities of national interest, e.g. WCPFC and fisheries management and development.
- Vehicles, machinery, and plant are old and maintenance is limited by affordability, but also by the lack of expertise and capacity on the island to service machinery on a timely basis.
- Staff turnover.
- Competing community and family obligations, exacerbated by the four-day week, including staff with young babies and children.
- Natural hazards.

Important internet links related to fisheries in Niue include:

- www.spc.int/coastfish/en/countries/niue.html – contains information on legislation, management plans, applications for licences, publications and contact details for key fisheries officials.
- <http://catalogue.nla.gov.au/Record/1329462> – report of a fisheries resources survey of the island of Niue by SPC.
- www.niueisland.com/fishing – information on fishing and spearfishing in Niue for tourists.

8.7.1 Regional and international institutional framework

The major regional institutions involved with fisheries are the Forum Fisheries Agency (FFA), located in Honiara and the Pacific Community (SPC) in Noumea. Other players are the Parties to the Nauru Agreement (PNA) in Majuro, the Pacific Islands Forum Secretariat (PIFS) in Suva, the Secretariat of the Pacific Regional Environment Programme (SPREP) in Apia, and the University of the South Pacific (USP) in Suva. The characteristics of those institutions are given in Table 8.10.

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean entered into force in June 2004 and established the Western and Central Pacific Fisheries Commission (WCPFC). Niue is a member of the commission, along with 26 other countries. The WCPFC has its headquarters in Pohnpei, Federated States of Micronesia, and has held 13 annual meetings to date.

Niue is also a participant in a subregional fisheries grouping known as the Te Vaka Moana Arrangement. This is a cooperation arrangement between the Ministry of Marine Resources of the Cook Islands, the Ministry of Fisheries of New Zealand, the Department of Agriculture, Forestry and Fisheries of Niue, the Ministry of Agriculture and Fisheries of Samoa, the Ministry of Agriculture and Food, Forestry and Fisheries of Tonga, and the Department of Economic Development, Natural Resources and Environment of Tokelau. Information on the Te Vaka Moana Arrangement is given in Box 8.5.

8.8 LEGAL FRAMEWORK

The domestic fisheries legislation of Niue was reviewed in 1995, which resulted in the combining of the Niue Island Fish-Protection Act 1991, the Sunday Fishing Prohibition Act 1980, the Niue Island Fish-Protection Ordinances 1965, and the Safety at Sea Act 1980, into the Domestic Fishing Act 1995 (DAFF, 1999).

The Domestic Fishing Act 1995 covers three main areas:

- Protection of fish: marine reserves, restriction on taking of certain species, prohibited use of illegal fishing means, prohibited exports, and catch/size limits.
- Sunday fishing ban: Sunday fishing prohibited between certain hours.
- Safety at sea: all vessels, including fishing vessels propelled by oars or otherwise, but excluding canoes, must be licensed by the fisheries officer and must carry certain safety equipment.

Cabinet is empowered to make regulations for the purpose of giving full effect to the provisions of the act and has done so through the Domestic Fishing Regulations 1996.

The Domestic Fishing Regulations 1996 give specifics on prohibited fish exports, fish size limits, fish quota limits, destructive organisms, protected fish species, vessel safety equipment, annual licence fee for vessels, requirements for vessels fishing inside Niue's territorial sea zone, requirements for vessels fishing outside Niue's territorial sea zone, and measurement of crustaceans for size limits.

The Territorial Sea and Exclusive Economic Zone Act 1996 establishes a territorial sea of 12 nautical miles and a 200-nautical mile EEZ of approximately 390,000 km² in size. In addition, the act covers fisheries management and development (designated fisheries, management/development plans), unauthorized fishing, prohibited fishing methods, access agreements and licensing.

TABLE 8.10
Pacific Island regional organizations involved in fisheries

	FFA	SPC	Other regional organizations with fishery involvement
Main area of emphasis	Providing management advice on tuna fisheries and increasing benefits to Pacific Island countries from tuna fishing activities.	Most aspects of coastal fisheries and scientific research on tuna. Fisheries are only one aspect of SPC's work programme, which also covers such issues as health, demography and agriculture.	PNA – subregional grouping of countries where most purse seining occurs; SPREP – environmental aspects of fisheries; USP – School of Marine Studies (SMS) involved in a wide range of training; PIFS – major political initiatives, some natural resource economics; leads trade negotiations with EU, which have a major fisheries component
Inter-regional relationships	The FFA/SPC relationship has had ups/downs over the years. It was most difficult in the early 1990s, but tremendous improvement in mid/late 1990s. An annual colloquium has helped the relationship. Staff who have moved between the two organizations have made a noticeable improvement in understanding. Much of the success/benefits achieved by FFA/SPC cooperation depends on the personalities of FFA's Director/Deputy and SPC's Director of the Division of Fisheries, Aquaculture and Marine Ecosystems.		At least in theory, all regional organizations come under the umbrella of PIFS. Their activities are coordinated to some degree by the Council of Regional Organisations in the Pacific (CROP), which has a Marine Sector Working Group that meets at least once per year, but is limited by lack of resources for follow-up. FFA originally provided secretariat services to the PNA, but the PNA broke away from FFA in 2010. Currently, there are some sensitivities in the relationship, but it appears to be improving.
Main strengths	Direct contact with its governing body many times per year results in a high degree of accountability. Mandate of tight focus on tuna eliminates considerable dissipation of effort.	Noumea being a pleasant place to work, there is considerable staff continuity. The Oceanic Fisheries Programme often sets the standard for tuna research in the world. Documentation of work is very good.	Because PIFS is under the national leaders, it is considered the premier regional organization. PNA has achieved considerable success and credibility in such areas as raising access fees, 100 percent observer coverage, eco-certification, high seas closures, and controls on FADs. USP is centrally located in the region and SMS has substantial infrastructure. SPREP has close ties to NGOs active in the marine sector.
Membership	Australia and New Zealand, plus Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu	Includes the major metropolitan countries, all Pacific Island countries, and the French/UK/US territories; the most inclusive of any regional organization.	PNA: the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. USP: Cook Islands, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. SPREP: 21 Pacific Island countries and territories, plus Australia, France, New Zealand and Untied States of America. PIFS: same as FFA

Source: Adapted from Gillett (2014a).

BOX 8.5

Te Vaka Moana Arrangement

The overarching goal of the Te Vaka Moana Arrangement (TVMA) is “to secure, protect and enhance associated long-term economic benefits able to be derived from fisheries and protect the important contribution fisheries make to the food security of the communities”. TVMA participants have endorsed several high-level objectives to achieve this goal. They are:

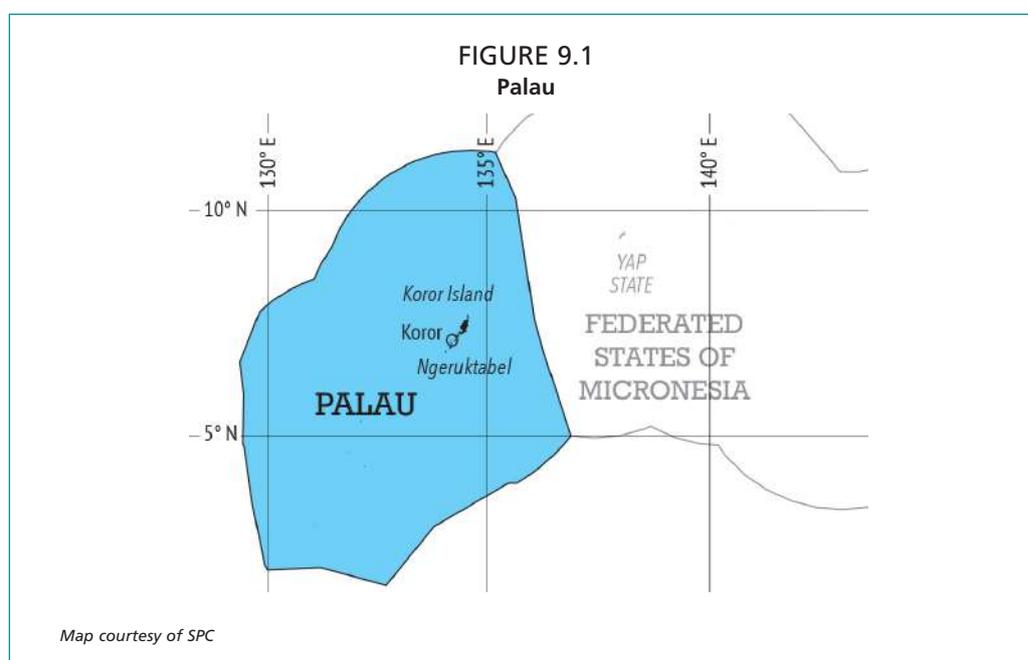
- Healthy and sustainable fisheries resources that provide maximum benefit to TVMA participants (economic benefits and food security), through the development and implementation of robust fisheries governance frameworks, systems and processes, over high seas and in-zone fisheries
- A reduction in cases of IUU fishing, and protection of fisheries management frameworks, through strengthened levels of co-operation between TVMA participants
- A profitable and sustainable fishing industry sector, through creating stability and certainty through governance and enabling environment arrangements
- Greater co-operation, engagement and collaboration with industry stakeholders including through fisheries industry stakeholder groups at national and sub-regional levels
- Te Vaka Moana is an effective and efficient grouping for addressing subregional issues successfully.

There are three key elements to the governance and management structure for TVMA:

- A Governing Committee comprising the Heads of the Fisheries Administrations of TVMA participating countries, or their representatives. The Governing Committee takes decisions for the TVMA Work Programme
- Technical Networks to look at specific issues or complete specific tasks from the Governing Council. Not necessarily meeting based, the networks also provide an opportunity for peer-to-peer support, sharing of ideas and mentoring
- TVMA Programme Coordinator. The role of the Coordinator is to undertake all co-ordination and management-related tasks as directed by the Governing Committee to implement the TVMA work plan. The coordinator is also the primary point of contact for TVMA with partners.
- The TVMA Manager and Coordinator has been authorized by TVMA Participants to attend meetings to represent the interests of and speak for TVMA Participants, as well as being able seek the views of others. The Manager and Coordinator will attend meetings in which TVMA Participants have an interest, as a member of any TVMA Participant delegation. TVM Participants will, of course, continue to engage with partners on matters that affect them individually.

Source: Te Vaka Moana website (www.tevakamoana.org).

9. Palau



REPORTING YEAR

This profile was written in 2017, based on data mostly from 2014.

PART 1. OVERVIEW AND MAIN INDICATORS

9.1 GENERAL GEOGRAPHIC AND ECONOMIC INDICATORS

TABLE 9.1

General geographic and economic indicators - Palau

Land area ¹	488 km ²
Water area ²	629 000 km ²
Population (2015) ³	17 661
GDP of Palau (2014) ⁴	USD 249 082 000
Fisheries contribution to GDP (2014) ⁵	USD 5 460 000
Fisheries contribution as a % of GDP (2014) ⁶	2.2

¹ Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

² Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

³ 2015 Census of Population Housing and Agriculture for the Republic of Palau.

⁴ Reported in Gillett (2016) from the Palau Bureau of Budget and Planning (unpublished data).

⁵ Reported in Gillett (2016) from the Palau Bureau of Budget and Planning (unpublished data). Excludes foreign-owned locally-based fishing vessels, but includes shore-based services of companies operating those vessels.

⁶ Reported in Gillett (2016) from the Palau Bureau of Budget and Planning (unpublished data).

9.2 FAO FISHERIES STATISTICS

TABLE 9.2
FAO Fisheries statistics on total production, employment and trade – Palau

2014		
Production (tonnes)	Aquaculture	26
	Capture	900
	Total	926
Employment (thousands)	Aquaculture	0.013
	Capture	0.042
	Total	0.055
Value of trade (USD 1000)	Fisheries exports	622
	Fisheries imports	2 115
	Total	2 737

Source: FAO Statistics and Information Branch of the Fisheries and Aquaculture Department

PART 2. NARRATIVE

9.3 PRODUCTION SECTOR

9.3.1 Introduction

The geography of Palau exerts a large influence on fishing in the country. The 343 islands of the Republic of Palau are diverse in geological origin and include volcanic, low platform, high platform and atoll types. The Republic includes the islands of Koror (the administrative centre and capital), Babelthuap (the largest island in terms of land mass, making up 78 percent of Palau's land area), Angaur, Peleliu and several coral outer islands including Sonsorol, Tobi, Pulu Anna, Helen's Reef and Merir to the southwest, and Kayangel to the north. More than 70 percent of the population resides in Koror.

Marine life in Palau is abundant and diverse with over 1 300 species of tropical fish and over 700 different species of hard and soft corals in the lagoons and reefs. Most coastal habitats and topographical features found anywhere in the Pacific Islands can be found in Palau. The most distinguishing features of the coastal area of Palau, as compared to that of most other Pacific Island countries, are the large amounts of mangroves, and coastal tourism.

Much of the coastal fishing activity is geared to producing for domestic urban markets, while the offshore fishing consists largely of tuna longlining by foreign fleets for the export market.

The major marine habitats of Palau and their approximate sizes are:

- Mangroves – 45 km²
- Inner reef – 187 km²
- Outer reef – 265 km²
- Lagoon – 1 034 km²

Fisheries statistics can be presented in different forms, to cater for different purposes. In the Palau statistics published by FAO (Part 1 of this profile), the presentation follows the international conventions and standards used by FAO and its Member States for reporting catches, which are given by the flag of the catching vessel. Accordingly, the fishery and aquaculture production of Palau in 2014 published by FAO (as given in Part 1) was 926 tonnes.

In Table 9.3, the Palau fishery production statistics include the catch by Palau-flagged vessels, the catch by small boats (which do not carry a flag) and the catch from fishing activities that do not involve a vessel (e.g. reef gleaning). The offshore category in the table is defined as the catch from Palau-flagged, industrial-scale fishing operations that are carried out anywhere in the western and central Pacific Ocean (i.e. inside or outside Palau waters).

TABLE 9.3
Palau fisheries production in 2014 (as per FAO reporting standards)

	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Palau-flagged offshore
Volume (tonnes)	22 tonnes and 343 800 pcs	1	865	1 250	100
Value (USD)	285 000	10 000	3 200 000	3 300 000	375 000

Units: tonnes unless otherwise stated.

The amounts of production given in the above table differ from those shown in Part 1. The table consists of the production estimated from a variety of sources (see SPC study below), whereas the quantities reported in Part 1 are generally what is reported to FAO by the Palau government. The major difference between the above table and Part 1 appears to originate from estimates of coastal fisheries production.

The fishery statistics of Palau are presented in a different way in a recent study by the Pacific Community (SPC). The SPC study reports the amount of catch in Palau fishery waters, regardless of vessel flag. In the study, the catches are placed in different categories, which is useful for other purposes, such as administration of the foreign fishing that occurs in the fishery waters of Palau. A summary of the fishery production from the SPC study is given in Table 9.4.

TABLE 9.4
Fisheries production in Palau waters

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Offshore locally based ⁷	Offshore foreign-based ⁸
					Both Palau- and foreign-flagged vessels	
Volume (tonnes)	22 tonnes and 343 800 pcs	1	865	1 250	3 987	4 017
Value (USD)	285 000	10 000	3 200 000	3 300 000	31 471 000	18 555 070

Source: Gillett (2016).

Some comment is required to explain the difference between the information in this table and that in Part 1 of this profile:

- Catches can be given by the flag of the catching vessel (as in the FAO statistics given in Part 1), or by the zone where the catch is made (the “offshore foreign-based” and “offshore locally based” columns in the table above). These two different ways of allocating catches each have their purposes. Attribution by flag is important for consistency with international conventions, while attribution by zone is important for determining fishing contributions to GDP, and managing revenue from licence fees for foreign fishing in a country’s zone.
- In Palau, there is no fisheries statistical system covering the categories of aquaculture and coastal subsistence/commercial fishing. The estimates above were made by a study carried out by SPC in 2015 that examined a large number of fishery and economic studies covering the last two decades. It is likely that the basis of the information for the three categories in the FAO statistics given in Part 1 was a more informal conjecture by a nominated person in Palau’s Ministry of Natural Resources, Environment and Tourism.
- Aquaculture production in Palau includes non-food items, such as coral and giant clams for the aquarium trade.

⁷ In the SPC study, “offshore locally based” is the catch by industrial-scale tuna fishing operations that are (a) based at a port in Palau, and (b) generally harvested more than 12 nautical miles offshore.

⁸ “Offshore foreign-based” is the catch in the Palau zone from catch from industrial-scale tuna fishing operations that are based at ports outside Palau. Under the international standardized System of National Accounts (SNA, 2009), those catches do not contribute to the GDP of Palau.

9.3.2 Marine sub-sector

The marine fisheries have two very distinct components, offshore and coastal:

- Offshore fisheries are undertaken on an industrial scale by locally based and foreign-based foreign-flagged vessels and sporadically by one locally based, Palau-flagged pole-and-line vessel.
- Coastal fishing is primarily carried out for subsistence purposes and for sale of production in local markets. In addition, there are some coastal fisheries that are export oriented: trochus and aquarium fish.

9.3.2.1 Catch profile

In the offshore fisheries, most fish is caught by longline gear. Table 9.5 gives, for recent years, the longline catches in Palau waters by species, by gear type and by nationality.

TABLE 9.5
Longline catches in Palau waters

Flag	Year	Catch (tonnes)			
		Albacore	Bigeye	Yellowfin	Total
Belize	2011	n/a	n/a	n/a	n/a
	2012	0	6	1	7
	2013	0	217	20	237
	2014	14	217	21	252
	2015				
Japan	2011	4	693	237	934
	2012	11	890	133	1,034
	2013	73	796	152	1,022
	2014	1	497	153	651
	2015	11	212	84	307
Taiwan Province of China	2011	3	1,061	903	1,966
	2012	1	1,239	883	2,124
	2013	0	1,232	614	1,846
	2014	7	1,031	502	1,540
	2015	0	414	496	910
Total	2011	7	1,754	1,140	2,900
	2012	12	2,136	1,016	3,165
	2013	73	2,245	786	3,104
	2014	22	1,745	675	2,442
	2015	11	626	580	1,217

Source: Modified from BOFM (2016).

The Bureau of Oceanic Fishery Management (BOFM, 2016) gives features of the longline catch in recent years:

- The total longline catch has been relatively stable ever since its peak of 5 000 tonnes in 2006.
- The catch per unit of effort (CPUE) for the longline fleet of Japan in Palau waters has been gradually increasing after dropping in 2004.
- The Taiwan Province of China longline fleet has been stable ever since its high in the 1990s.

Purse-seine fishing in the Palau exclusive economic zone (EEZ) was minimal during 2015 and was mainly in the extreme south of the zone. The area of highest purse-seine effort does not generally overlap the areas of highest longline effort, suggesting the spatial interaction between the longline and purse-seine fleets is relatively low.

The purse-seine fleet of Japan has been the dominant operator in the Palau EEZ, with the fleet of the United States of America and vessels associated with Pacific Island countries active in some years (BOFM, 2016). The Palau zone is located to the west

of where most tuna purse seining in the Pacific Islands region occurs. FFA (2016) indicates that only 185 tonnes of tuna were captured by purse-seine gear in Palau's waters in 2015.

Palau has been a leader in the Pacific Island region in the development of industrial offshore fisheries. Box 9.1 provides some of the history.

BOX 9.1

History of industrial offshore fishing in Palau

Industrial tuna fishing in the waters of Palau has been an important activity for over 80 years - although Palauans have not been very involved during this time. The Japanese were the pioneers, with pole-and-line activities for skipjack tuna across the Micronesian region, which started in the late 1920s. Early production peaked in the Micronesian areas at 33 000 tonnes in 1937, with 75 percent of this coming from Palau and Chuuk. Industrial fishing, however, ceased during World War II and did not resume in Palauan waters until the Van Camp Seafood Company (United States of America) transshipment base was established in 1964 in Koror, supported by up to 15 locally based pole-and-line vessels. Landings peaked from 1978 to 1981, when an average of 6 600 tonnes of skipjack were caught annually. The pole-and-line activity was later replaced by the more cost-effective and competitive purse-seining method of tuna fishing, forcing the Van Camp operation to close down in 1982. Japanese distant-water tuna longlining activity also started in the waters around Palau in the 1960s, although effort was sporadic during the 1970s and 1980s. The initial target species was the larger yellowfin tuna. This changed over time with vessels setting their gear deeper to target the high-value bigeye tuna. The 1980s also saw Republic of Korea and Taiwan Province of China develop their distant-water longline fleets to supply fish to the Japanese market. Changes in Japanese consumer preference for fresh tuna over frozen tuna in the 1980s led to changes in the longline fleets, with smaller vessels making shorter trips and using ice, refrigerated sea water or brine for chilling the catch. The fish was landed to shore facilities for airfreight to Japan. Two companies established themselves in Palau: Palau International Traders Incorporated (PITI) in the late 1980s, and Palau Marine Industries Corporation (PMIC) in the early 1990s. Both companies commenced their fishing operations by bringing in foreign vessels, mainly from the Peoples Republic of China (PRC). A third company, Kuniyoshi Fishing Company (KFC), was established in the mid-1990s, and mainly brought in Taiwanese or PRC vessels to supply them with fish.

Source: Friedman et al. (2009).

Coastal fishing in Palau is carried out, using various types of vessels and gear, on a commercial and subsistence basis. Techniques used include simple hand collection, hook-and-line fishing, underwater spearfishing, net fishing and trolling, most of which are conducted almost exclusively by men.

Although there have been numerous attempts to estimate the production in Palau from coastal fisheries (commercial and subsistence), there remains considerable uncertainty as to the annual harvest level. An SPC study in 2015 (Gillett, 2016) reviewed the information available to make estimates of Palau coastal fisheries production and concluded that "the information available to the present study is inadequate for updating the historical estimates of coastal fisheries production in the country". The coastal fisheries production was assumed by the study to be 2 115 tonnes, of which 60 percent was for subsistence consumption.

The SPC study noted some of the factors that have affected coastal fisheries in recent years:

- Tourism has expanded substantially. The number of visitors to Palau increased from 87 141 in 2007 to 125 417 in 2014 (Graduate School, 2015b).
- In the past five years, there have been periodic bans on the capture of certain fish species, such as groupers (N. Idechong, personal communication, September 2015).
- Because of the Helen Reef Management Project, there is much less fish arriving in Koror from the Southwest Islands (A. Kitalong, personal communication, September 2015).
- Two typhoons were especially destructive – Bopha in December 2012 and Haiyan in November 2013.
- There has been a general decrease in abundance in the commonly targeted coastal fishery resources. This has been shown by a number of recent studies (Prince, 2013; Gleason *et al.*, 2014; and Moore *et al.*, 2015).
- The last trochus harvest was in 2013 when 350 tonnes were harvested (BBP, 2014).

9.3.2.2 Landing sites

The locally based, offshore fishing vessels generally offload their catch at the industrial port that services the Koror urban area. There are reports that some longliners occasionally deliver their catch to Davao in the Philippines. The catch from Japanese longlining in Palau waters is offloaded in Japan.

The catch from small-scale commercial fishing is offloaded mainly at Koror. Some is landed at other locations (i.e. at several places on Babelthuap) where it is delivered by truck to markets, mainly in Koror.

Subsistence fishery landings occur at coastal villages and hamlets throughout the country, roughly in proportion to the distribution of the population.

9.3.2.3 Fishing practices/systems

Table 9.6 gives the number of offshore fishing vessels operating in Palau waters by size, nationality, gear type and year. The Taiwanese longliners form the largest fleet.

TABLE 9.6
Offshore fleets

Year	Flag	Gear	No. of	0–500	501–1000	1001–1500	1500+
2013	Belize	Longliner	1	1	0	0	0
	Japan	Longliner	28	28	0	0	0
	Japan	Purse seiner	5	5	0	0	0
	Taiwan Province of China	Longliner	54	54	0	0	0
2014	Belize	Longliner	1	1	0	0	0
	Japan	Longliner	28	28	0	0	0
	Japan	Purse seiner	21	21	0	0	0
	Taiwan Province of China	Longliner	41	41	0	0	0
	Vanuatu	Longliner	1	1	0	0	0
2015	Japan	Longliner	19	19	0	0	0
	Japan	Purse seiner	27	1	0	26	0
	Taiwan Province of China	Longliner	31	31	0	0	0
	Vanuatu	Longliner	2	2	0	0	0

Source: BOFM (2016); vessel size in gross registered tonnes.

From the mid-1960s to the early 1980s, there was a fleet of pole-and-line vessels based in Palau. Locally based pole-and-line fleets also existed in Papua New Guinea, Solomon Islands and Fiji, with the total number of vessels being about 100 to 120. For various reasons, those fleets have declined. Today, one of the few pole-and-line vessels in the entire region is the single vessel operating out of Koror. Box 9.2 describes the history and present operation of that vessel.

BOX 9.2

Palau's last pole-and-line vessel

The Kuniyoshi Fishing Company has operated a pole-and-line fishing vessel in Palau for several years. According to the company's operation's manager, the fibreglass pole-and-line vessel "Marine Star" is 24 GRT and 15 m in length. Kuniyoshi has been operating the vessel since the 1990s. The "Marine Star" is the last of a fleet of Palau-based pole-and-line vessels that was at a maximum in the early 1980s.

Live bait is obtained at night by using bouki-ami gear in the area of the Rock Islands. The vessel attempts to fish for tuna 5 days per week. Currently, the crew consists of seven Palauans and three Filipinos. A few years ago, the percentage of foreign crew was greater.

The vessel's managers indicate tuna catches have averaged 20 000 pounds per month (i.e. 108 metric tonnes per year) in the last few years. The SPC yearbook estimates that catches by the Palau vessel were 100 tonnes per year in the period 1992-2000. An average of 1 300 gallons (4 921 litres) of diesel is used per month and the current price paid is USD 4.06 per gallon.

The catch is disposed of in the company's retail store adjacent to the office and residence of the owners. Some catch is sold on the roadside. Purchases at the retail shop are mostly for home consumption, but some are for restaurants and institutions. Current prices are USD 1.00 per pound for both skipjack and yellowfin, regardless of quantity.

The vessel management indicates that after the surge in fuel costs a few years ago the operation of the vessel is no longer profitable. They are not likely to continue operating a pole-and-line vessel after the present vessel is retired, unless they can charter a vessel from the government on concessionary terms, as was the case for the company's first vessel. Knowledgeable Palauans from outside the company indicate that current operations are unlikely to be profitable, but continue because the vessel supplies the company's retail store with fish and provides employment associated with social obligations. Vessel operations will probably cease when the elderly owner passes away.

Source: Gillett (2011b).

For coastal fishing, most of the boat-based activities involve the use of small fishing craft, typically from 4.8 to 7.6 m in length and powered by outboard motors. At least 25 percent of households in Palau own fishing boats and through the extended family system, most fishers have access to a powered craft of this type. The completion of the road around the island of Babelthuap several years ago caused considerable change in the marketing of catch and made boat-owners shift landing places for their craft.

Coastal fishing in Palau is carried out on a commercial and subsistence basis, using various types of vessels and gear. Friedman *et al.* (2009) state that traditional fishing methods included throwing spears, the use of sea cucumber skin, which emits a nerve toxin when rubbed (used to poison fish in shallow pools), a leaf sweep (rope or vine with leaves used to herd and capture fish), noose fishing for sharks, a gorge (piece of wood sharpened at both ends and attached to a line in the middle), and stone and wooden fish weirs built on the reef flats.

In September 2015, SPC carried out a creel survey in southern Palau (Moore *et al.* 2015). That survey gave information on four types of coastal fishing (Table 9.7). In summary, during the study, night-time spearfishing was responsible for 48 percent of the total catch by abundance and 38 percent of the total catch by weight, while handlining was responsible for 28 percent of the total catch by abundance and 26 percent of the total catch by weight.

TABLE 9.7
Data summary for the Palau creel survey

	Gillnetting	Hand-lining	Daytime spearfishing	Night-time spearfishing
No. of landings where method encountered	3	14	3	9
Total number of fishers surveyed	13	24	9	18
Mean time spent fishing (hours)	4.7 ±0.9	4.0 ±0.2	8.5 ±0.3	3.7 ±0.3
Mean no. of fishers per trip	4.3 ±1.5	1.7 ±0.2	3.0 ±0.6	2.0 ±0.2
Average catch (number of fish) per trip	117 ±41	40 ±9	49 ±15	109 ±22
Average catch (kg) per trip	55 ±8	24 ±4	93 ±30	54 ±11
Average CPUE _N by abundance (individuals fisher ⁻¹ hour fishing ⁻¹)	9.0 ±4.1	5.2 ±0.8	4.2 ±0.5	14.8 ±2.1
Average CPUE _W by weight (kg fisher ⁻¹ hour fishing ⁻¹)	3.7 ±1.3	3.2 ±0.4	7.8 ±0.8	7.4 ±1.1

Source: Modified from Moore *et al.* (2015).

9.3.2.4 Main resources

The composition of the catch of Palau's longline fishery is given in Table 9.8.

TABLE 9.8
Composition of Palau's tuna catch

	Albacore (% in catch)	Bigeye (% in catch)	Yellowfin (% in catch)	Total tuna catch (tonnes)
2011	0.2%	60.5%	39.3%	2 900
2012	0.4%	67.5%	32.1%	3 165
2013	2.4%	72.3%	25.3%	3 104
2014	0.9%	71.5%	27.6%	2 442
2015	0.9%	51.4%	47.7%	1 217

Source: Modified from BOFM (2016).

The bycatch from the longline fishery includes sharks/rays, billfish, mahimahi and barracuda.

FFA (2016) indicates that only 185 tonnes of tuna were captured by purse-seine gear in Palau's waters in 2015. All of that was reported to be skipjack.

The four major species of tuna in Palau mix freely with those of the neighboring countries in the western and central Pacific. Recent information from the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC, 2016) shows that for:

- **skipjack** – the stock is currently only moderately exploited and fishing mortality levels are sustainable.
- **bigeye** – recent analysis indicates that overfishing is occurring for the bigeye tuna stock and that to reduce fishing mortality to that at maximum sustainable yield, a large reduction in fishing mortality is required.
- **yellowfin** – the current total biomass and spawning biomass are higher than at levels associated with maximum sustainable yields. Therefore, yellowfin tuna is not considered to be in an overfished state.
- **albacore** – there is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries. It should be noted that longline catch rates are declining, and catches over the last 10 years have been at historically high levels and are increasing.

The Palau Conservation Society (PCS, 2000) gives the important species in Palau's coastal fisheries:

TABLE 9.9
Important species in Palau's coastal fisheries

Category	Species
Local pelagic fish	Carangidae: <i>Selar crumenophthalmus</i> (bigeye scad/terekrik)
	<i>Elagatis bipinnulatus</i> (rainbow runner/desui)
	Sphyraenidae: (barracudas/ai/mordubech/lolou)
	Scombridae: <i>Rastrelliger kanagurta</i> (striped mackerel/smach)
	<i>Scomberomorus commerson</i> (Spanish mackerel/ngelnga)
	<i>Euthynnus affinis</i> (kawakawa/soda)
	<i>Acanthocybium solandri</i> (wahoo/keskas)
Mangrove crab	<i>Scylla serrata</i> (mangrove crab/chemang)
Lobster	<i>Panulirus longipes</i> (melech)
	<i>P. penicillatus</i> (raiklius)
Trochus	<i>P. versicolor</i> (bleyached)
	<i>Trochus niloticus</i> ⁹ (semum)
Giant clam	all Tridacnidae, including:
	<i>Tridacna crocea</i> (oruer)
	<i>T. derasa</i> (kism)
	<i>T. gigas</i> (oktang)
	<i>T. maxima</i> (melibes)
	<i>T. squamosa</i> (ribkungel)
	<i>Hippopus hippopus</i> (duadeb)
Sea cucumber	<i>H. porcellanus</i> (duadeb)
	all Holothuriidae, including:
	<i>Actinopyga mauritiana</i> (badelchelid)
	<i>A. miliaris</i> (cheremrum)
	<i>Holothuria fuscogilva</i> (bakelungal cherou)
	<i>H. nobilis</i> (bakelungal)
	<i>H. scabra</i> (molech)
Other invertebrates	<i>Stichopus variegatus</i> (ngims)
	<i>Thelenota ananas</i> (temetamel)
	<i>Birgus latro</i> (coconut crab/ketat)
	<i>Cardisoma</i> spp. (land crabs/rekung el beab)
	<i>Anodontia philippiana</i> (mangrove clam/ngduul)
	<i>Gafrarium</i> spp. (nut clam/delebeka)
	<i>Octopus</i> spp. (octopus/bukitang)
	<i>Tripneustes gratilla</i> (sea urchin/ibuchel)
	<i>Loligo</i> spp. (squid/luut)
	<i>Sepia</i> spp. (cuttlefish/milengoll)
<i>Nautilus</i> spp. (nautilus/kedarm)	

Source: PCS (2000).

In general, it can be stated that those coastal fish and invertebrate species that are sought after and are located in areas readily accessible to many fishers tend to be heavily exploited or overexploited. More recent information on the status of specific coastal fisheries resources includes:

- Moore *et al.* (2015) – Results from this baseline assessment suggest that the coastal finfish fisheries of Palau appear to be moderately healthy, at least when compared to elsewhere in the region. Overall catch rates and maximum ages of key species were generally comparable to, or higher than, those reported elsewhere in Micronesia, while mortality rates were generally lower;

⁹ Also known as *Tectus niloticus*.

- CCIF (2013b) – Resources are in reasonably good health, and spawning aggregations are still present in many areas. For example, the bumphead parrotfish (*Bolbometapon muricatum*) recovery (during a five-year harvest ban) has shown stocks have recovered to the point where a limited harvest may in theory be viable;
- Rhodes *et al.* (2011) – Citing several sources, the study indicates that recent examinations show that Palau's fisheries are fully exploited and there is no evidence to suggest that current levels of fishing are sustainable.

Rhodes *et al.* (2011) examined nearshore fisheries management across Micronesia, including Palau. The study showed that for Micronesia in general, a number of key socio-economic drivers were found to contribute to marine resource declines: (1) the change from a subsistence to a cash economy; (2) an erosion of customary marine tenure; (3) a lack of political will for protecting marine resources; (4) an absence of effective, responsive fisheries management; (5) increasing population pressures and demand for reef resources, including for export; (6) undervalued reef and pelagic resources; (7) high external commodity costs; (8) unsustainable use of modernized fishing gear; (9) an erosion of traditional fishing ethics and practices; and (10) a paucity of educational and alternative employment opportunities.

9.3.2.5 Management applied to main fisheries

The offshore fisheries in Palau are managed on national, subregional, and regional levels:

- On the national level, the management measures for the offshore fisheries of Palau are in the Palau National Tuna Fisheries Management Plan (described below).
- On the subregional level, Palau cooperates with the other countries that are members of the Parties to the Nauru Agreement (described below).
- On the regional level, Palau is a member of the Western and Central Pacific Fisheries Commission (WCPFC) that was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Palau and the other 26 members of the commission enact tuna management measures at the annual WCPFC meeting. From the Palau perspective, the most important recent measure is the Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean.

A crucial aspect of the management of the offshore fisheries in Palau is the Parties to the Nauru Agreement and its Vessel Day Scheme. The early history of the PNA is given by Tarte (2002):

In February 1982 the Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest was opened for signature. The Nauru Agreement had been negotiated by seven Pacific Island states – Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea and Solomon Islands. This group of countries (later joined by Tuvalu) is known collectively as the Parties to the Nauru Agreement (PNA). The conclusion of the Nauru Agreement marked the beginning of a new era in Pacific Island cooperation in the management of the region's tuna stocks. It was an important milestone in the exercise of coastal state sovereign rights over their 200-mile EEZs. The PNA group accounts for much of the tuna catch in the Pacific island region. In 1999, it produced 98 percent of the tuna catch taken from the EEZs of Pacific Island Forum Fisheries Agency members; 70 percent came from three PNA members: Papua New Guinea, the Federated States of Micronesia and Kiribati. The group also accounted for 94 percent of the access fees paid to the FFA Pacific Island states. By controlling access to these fishing grounds, the PNA group collectively wields enormous influence and power.

The most important fishery management tool of the PNA is the Vessel Day Scheme (VDS) described in Box 9.3.

BOX 9.3 PNA Vessel Day Scheme

In 2000, a study suggested that the PNA purse-seine management scheme that was then based on vessel numbers be replaced by a scheme based on purse-seine fishing days. The transition was actually made seven years later. In 2007, the Parties to the Nauru Agreement began implementing the Vessel Day Scheme (VDS), transitioning from permitting a total number of purse-seine vessels in the region (205) to permitting a total allowable effort (TAE) in number of purse-seine fishing days (44 703 for 2012; 44 890 days for 2016). Given the volume, value and multi-jurisdictional nature of the fishery, it is arguably one of the most complex fishery management arrangement ever put in place. Some of the key features are as follows:

- System of tradable fishing effort (days) allocated to the 8 Parties
- Limit on total effort (TAE) ~ 45,000 days
- TAE is allocated to Parties based on zonal biomass and historical effort as PAEs (Party Allowable Effort)
- Fishing days are sold to fleets for fishing in each EEZ
- There is a minimum benchmark price for VDS days sold to foreign vessels
- Fishing days are monitored by a satellite-based Vessel Monitoring System (VMS)
- VMS monitoring is supported by observers on board all vessels
- Days are tradable between Parties
- Scheme costs are financed by levies on vessels

Due to the complicated nature of the new VDS system and the various constraints of the government fisheries agencies of the region (e.g. under-funded, under-staffed), it was expected there would be problems in the introduction of the scheme. This is not to say that the VDS has not produced substantial benefits for PNA countries. The system is creating competition for a limited number of days, thereby increasing the value of each day. In practice, the value of a fishing day before the VDS was roughly USD 1 350 but it increased to about USD 5 000 in July 2011 and days were being sold in 2016 for over USD 12 000.

On a different and less tangible level, another benefit is that the VDS moves fisheries management in the region to a desirable rights-based system. That is, fishing rights (such as vessel days) can be defined, allocated and traded. Consistent with this transition to a rights-based approach, a VDS-style arrangement for management of the tropical longline fishery is being implemented by PNA.

Source: Havice (2013); Campling (2013); Gillett (2014a); Clark and Clark (2014).

The most recent, formally adopted tuna management plan is the Palau National Tuna Fisheries Management Plan 2001. This is a 39-page document, with the first 18 pages dedicated to descriptions of the fisheries and resources, and the legal regime. The substantive elements consist of the aims of the plan, its scope and seven main objectives. A major feature of the plan is the establishment of the Palau Fisheries Policy Advisory Committee with responsibility for the formation, coordination and implementation of the plan.

A major change in the management of Palau's offshore fisheries occurred in October 2015 when the Palau Congress approved the Palau National Marine Sanctuary Act, establishing a large marine protected area (MPA). The legislation creating the sanctuary designates 80 percent of Palau's territory as a fully protected marine reserve in which no extractive activities, such as fishing or mining, can take place. At 500 000 km², the sanctuary becomes the sixth-largest, fully protected marine area in the world. About

20 percent of Palau's waters will become a domestic fishing zone reserved for local fishers and small-scale commercial fisheries with limited exports. This transformation of Palau's EEZ will take place over a five-year period, during which the number of licences sold to foreign commercial vessels will be decreased annually (www.pewtrusts.org).

The background of coastal fisheries management is given in Box 9.4.

BOX 9.4

Background on coastal fisheries management in Palau

The transition to a cash-based economy was initiated in about the 1940s in Palau, and resulted in rapid localized overfishing and the erosion of long-standing traditional customary marine tenure (CMT) systems. With the expansion of export markets and import of modern fishing gear and practices, including motorized boats and improved fishing nets, increased pressure on reef resources began. Erosion of traditional fishing mores and ethics also became a problem, with fishers electing to catch fish for sale rather than for subsistence use. With this fundamental economic transition, fishers became subject to external market forces, including the export market. Foreign exporters began looking to Palau and other Micronesian jurisdictions that in the 1980s resulted in the rapid overfishing of fish spawning aggregations to supply the Southeast Asia-based live reef fish food trade. During the same period, when the price of fuel or imports rose, both competition and the need to increase volumes ensued. By the 1980s, fishing for cash to purchase imported goods and cover rising occupational costs was a key driver of overfishing of near-shore reefs and lagoons in Palau. Moreover, as in other locales, gears and fishing methods became further modernized in the 1980s and 1990s, including the increasing use of night-time spearfishing that led to overexploited stocks, particularly in Koror State.

Unlike many other Micronesian jurisdictions, Palau had several characteristics working in its favor to initiate and sustain conservation practices: (1) an eroded, but still functional traditional management system, (2) available funds to initiate and develop monitoring and enforcement activities, particularly within Koror State, (3) interest and drive among locally respected individuals who could champion conservation ideas and actions, (4) world-class reefs and natural resources that, while impacted from past natural disasters (e.g. 1998 El Niño), remain among the best in the region to lure tourists, (5) a direct air link to Asia and other destinations rich in potential tourists, (6) clear ownership rights of terrestrial and marine resources, (7) a large reef area often difficult to access and, (8) a relatively low population density. These and the pursuit of long-term conservation and development goals by Palau's national and state governments allowed the initiation and growth of revenues for continued improvements to natural resource management.

Source: Modified from Rhodes *et al.* (2011).

In practice, the management applied to coastal fisheries is shaped by the Palau constitution, various laws covering fisheries activities, the staff of the Ministry of Natural Resources, Environment and Tourism, NGOs and communities. The constitution gives the power to manage coastal fisheries in the zone up to 12 nautical miles offshore to the 16 states that make up the country. A salient issue that has considerable impact on the fisheries management strategy in Palau is the balancing of the nutritional, tourism-related and export benefits of coastal resources. This sentiment has been expressed by an advisor to Palau: "First we eat them; second we play with them; third we let visitors eat and play with them, and fourth, we export

them. In other words, give first priority to fish consumption by Palauans resident in Palau; second priority to sport fisheries and recreation by Palauans; third priority to meeting the food and recreational needs of tourists; and finally fourth (only if the resource reserves permit) do we export them” (P. Callaghan).

CCIF (2013b) reviews the strong and weak points of coastal fisheries management in Palau:

While a number of environmental champions have advanced specific efforts to conserve and manage nearshore fisheries and coastal marine resources, actual capacity and focus of national level entities is lacking. The Bureau of Marine Resources (BMR) has given priority to aquaculture livelihood development rather than fisheries management or conservation. This is partially due to its limited staffing: according to the current organization chart, 23 positions out of 56 (40 percent) are vacant. The lack of national-level government support has led to the proliferation of non-governmental organization support for state-level efforts as well as for the provision of public services in lieu of the state. At the state level, there is increasing recognition of the need to manage natural resources through a “ridge-to-reef” approach, and the capacity for enforcement is generally improving, as NGOs are increasingly developing the capacity of Conservation Officers. The outlook for the national and state government’s capacity to assume stronger control of natural resource management is positive, but issues will need to be overcome, such as the lack of available data regarding fishing pressure and activities, as well as fish stock and health. The continued use of MPAs as the primary tool for management will not necessarily ensure that larger fisheries management goals are achieved – especially as the MPAs are located very close to shore and represent only a small portion of overall State waters.

Management objectives

Palau’s Medium Term Development Strategy states that the goal for aquaculture and fisheries is to achieve sustainable economic development and management of the marine and coastal resources of Palau. The expected outcomes of the Aquaculture and Fisheries Action Plan are:

- development of marine resource income opportunities in a sustainable manner;
- a greater role for the private sector in aquaculture;
- improved returns from offshore fishing;
- increased opportunities from the use of marine resources for tourism.

For the offshore fisheries, the latest, formally adopted tuna management plan has the following objectives:

- Conserve fishery resources by controlling harvesting within international and regional recognized sustainable limits.
- Establish an efficient government framework to harmonize application of fisheries management policies and practices.
- Minimize detrimental impacts of fishing on coastal and inshore environment.
- Attain an optimum balance in relation to access to the resource between all stakeholders.
- Enhance the overall economic balance between: the necessity for government to generate revenue, financial expectations of the commercial tuna fishery interests, and the interests of other users of the resource.
- Promote Palauans in professional, administrative, research and development positions in the fishery and related industries and government agencies.
- Adhere to Palau’s regional and international marine resources agreements.

The management objectives of coastal fisheries are less formalized. In general, the objectives of much management are to assure the sustainability of fishery resources for domestic food, for recreation for Palauans, and for viewing by tourists.

Management measures and institutional arrangements

The main management measure for the offshore fisheries (as stipulated in the Palau National Tuna Fisheries Management Plan) is a requirement for a fishing licence and conditions associated with that licence (i.e. payment of fees, pollution controls). These measures are supplemented by a number of regional measures, such as the PNA Purse-Seine Vessel Day Scheme (Box 9.3), and FFA's Vessel Monitoring System.

Another management measure for offshore fisheries was introduced when the Palau Congress approved the Palau National Marine Sanctuary Act. The actual management measure is the exclusion of extractive activities (including fishing) in 80 percent of Palau's waters.

According to Moore *et al.* (2015), the management measures for coastal finfish fisheries in Palau are a mix of input and output controls, regulated under the Marine Protection Act of 1994. They include:

- a closed season on the possession and sale of five grouper species (*Epinephelus fuscoguttatus*, *E. polyphkadion*, *Plectropomus areolatus*, *P. laevis* and *P. leopardus*) from April to October to protect these species during their spawning aggregation periods;
- a ban on the possession (including harvest, sale and export) of bumphead parrotfish, *Bolbometopon muricatum*, and humphead wrasse, *Chelinus undulatus*;
- a ban on the harvest, sale and purchase of rabbitfish from February to March;
- a ban on using any form of underwater breathing apparatus other than a snorkel for fishing;
- a minimum legal mesh size of three inches (measured diagonally) for gillnets and surround nets;
- a prohibition on fishing with a kesokes net¹⁰ with no bag portion or with the bag portion having a mesh size of less than three inches measured diagonally;
- a prohibition on the retention or abandonment of a kesokes net having a mesh size of less than three inches measured diagonally.

There is a rich heritage of traditional fisheries management in Palau. Table 9.10 gives a list of the various management measures that have been used in the past.

The institutional arrangements for management are discussed in section 9.7 below.

9.3.2.6 Fishing communities

The concept of “fishing communities” has limited applicability to Palau. Nearly all households in the country are involved in coastal fishing activities. It could therefore be stated that all villages in Palau are “fishing communities”.

9.3.3 Inland sub-sector

There are no major freshwater fisheries, but the larger islands of Palau (especially Babeldaob) have freshwater bodies that support small amounts of edible freshwater fish and invertebrates. Eels and shrimp are likely to be the most abundant of the edible freshwater animals. The capture of eels is not large due to cultural attitudes. Small amounts of freshwater shrimp are taken and consumed.

There is no management dedicated to the tiny inland fisheries.

9.3.4 Aquaculture sub-sector

During four decades, the culture in Palau of a large number of aquatic organisms has been attempted, both by the government and in independent efforts. Aquaculture production in Palau is currently confined to milkfish, giant clams, and to a much lesser extent, coral, mangrove crab, groupers and rabbitfish.

¹⁰ This is the Palauan name for a V-shaped, stationary barrier net.

TABLE 9.10
Some traditional management measures used in Palau

Measure	Exists in 2011?
Traditional reef tenure: fishing rights are controlled by chiefs for the benefit of villages, which exercise the right to limit access to fishing grounds to their outer boundary	Yes. All but Koror municipality
Power of chiefs to enforce traditional CMT laws	Variable
Closures and bans	
- Area closure (stocks): moratorium (<i>bul</i>) to manageresources	Yes
- Season (stocks)	Yes
- Custom (funeral)	Yes
Punishment (e.g. for poaching)	Yes
- Chief of poacher's village fined by Palau's traditional high chiefs	
- Clan of fisher poaching pay cash fine	
- Boat/gear confiscation as punishment	
Outsider access	
- Temporary fishing permits	No
- Outsiders (neighbors) allowed to fish for subsistence purposes, if ask permission	
- Outsiders allowed to fish commercially, if ask permission and pay portion of catch	No
- Outright gift of fishing grounds to other villages	No
- Fishing grounds shared by two villages	No
Ethics to avoid waste (take only what will be consumed)	No
Restrictions on fishing on spawning aggregation	Yes
- Close areas w/aggregations	Yes
- Ban on harvesting of certain species	
- Allow fish to spawn for ≥ 1 day before catch	
- Stranded jacks returned to water during cod running	

Source: Modified from Rhodes *et al.* (2011).

With regards to milkfish culture, Palau has three farms: the Ngatpang State Milkfish Farm, the Shallum Etpison Palau Aquaculture Project, and the Melwert Tmetuchel Airai Fish Farm. These farms import fry from hatcheries in Taiwan Province of China or the Philippines for grow-out to supply both fresh fish to the public and baitfish for the tuna longline fishery (Pickering *et al.*, 2013). According to staff of the Bureau of Marine Resources, two of those farms sell about 225 kg about every two weeks at USD 6.00 per pound. The other milkfish farm is dedicated to producing bait. The latter sold 327 800 individual baitfish in 2014 (M. Tmetuchl, personal communication, September 2015).

With regards to giant clam culture, there are about five to ten small companies that produce four different species. According to staff of the Bureau of Marine Resources, 8–10 cm clams are worth USD 5.00 to 6.00 apiece, and larger sizes are sold to local restaurants for USD 6.00 to 10.00 apiece. According to the CITES database, a total of 19 173 live giant clams were exported from Palau in 2013. In 2014, one of the producers experienced difficulty in obtaining small clams for growing out (T. Watson, personal communication, September 2015).

The current aquaculture production of coral, mangrove crab, groupers and rabbitfish appears to be very small, or non-existent.

An SPC study (Gillett, 2016) attempted to use the above aquaculture information to estimate Palau's 2014 production. It ventured an estimate of (a) 22 tonnes of milkfish plus 327 800 pieces worth about USD 200 000 at the farm gate, and (b) 16 000 pieces of giant clams (for both the aquarium and restaurant trade), worth USD 85 000 at the farm gate – or a total 2014 production of 22 tonnes and 343 800 pieces, worth USD 285 000.

No discussion of aquaculture in Palau would be complete without mention of the Micronesian Mariculture Demonstration Center (Box 9.5).

BOX 9.5

Palau Mariculture Demonstration Center

The Micronesian Mariculture Demonstration Centre (MMDC) was established in 1973 to serve the US-affiliated Pacific Islands by developing and demonstrating mariculture technology. MMDC later became the Palau Mariculture Demonstration Center (PMDC), and was used for mariculture training in the region as well as a marine science research laboratory. Trochus and soft corals were cultured for reseeding research but also giant clams and soft corals were sold to the aquarium market. The facility also supported a handful of giant clam grow-out sites around Palau in the 1990s. The hawksbill turtle hatchery and ranching project that started in the early 1980s was terminated in the early 1990s and replaced with turtle research and a public education programme.

Source: Modified from Friedman *et al.* (2009).

The main aquaculture management measure is the requirement for an aquaculture permit for all facilities.

9.3.5 Recreational sub-sector

In Palau there is recreational fishing for both Palau residents and for tourists. Residents participate in fishing as a casual leisure activity. In addition, there is an active game-fishing association. One major fishing derby and a few small fishing derbies are held each year in Palau.

There are about 10 vessels that occasionally participate in commercial sport fishing for tourists, but only a few vessels are employed primarily in this business. Most commercial sport fishing for tourists involves pelagic trolling outside the reef, but there has been promotion of inshore catch-and-release sport fishing by the Palau Conservation Society.

9.4 POST-HARVEST SECTOR**9.4.1 Fish utilization**

In general, offshore fishing is export oriented. The high-quality, fresh bigeye and yellowfin is typically exported for sashimi, with the albacore going to canneries. Much of the longline bycatch is for domestic use.

With respect to the disposal of the catch from coastal fisheries, because subsistence fishing remains a major activity (about 60 percent of the coastal catch by volume), much is utilized by the household that makes the catch. The remainder of the coastal catch is used for local retail markets, the hotel/restaurant trade in Palau, and for export. The latter category is largely exported as baggage taken by travellers to family and friends in Guam and Honolulu.

The distribution channel for trochus is quite different, with the meat being utilized locally and the shell for the manufacture of mother-of-pearl buttons. Most of the giant clam exports are for the ornamental aquarium trade.

9.4.2 Fish markets

In Palau, all fresh chilled, sashimi-grade tuna, once offloaded and packed, is air-freighted within 24 hours to sashimi markets in Japan (95 percent), the United States of America mainland and Taiwan Province of China. The albacore for canning goes mostly to Asian canneries (mainly in Thailand), but occasionally it is canned in American Samoa.

Although subsistence fishing remains a major activity, the economic growth of Koror, tourism development, the increasing availability of non-fisheries-related employment and a large foreign labour force have together resulted in the establishment of a cash market for fresh fish and other seafoods. These markets are located mainly in the Koror urban area, but some small markets exist in the main residential areas of the states.

Trochus button manufacturing occurs in Asia and Europe, with the specific destination dependent on price. Marine ornamentals (aquarium fish, juvenile giant clams) are for markets in the United States of America.

9.5 SOCIO-ECONOMIC CONTRIBUTION OF THE FISHERY SECTOR

A recent study by SPC (Gillett, 2016) attempted to quantify the fishery-related benefits received by Palau and other Pacific Island countries. The study gave the available information on the contribution of fishing to GDP, exports, government revenue, employment and nutrition. Unless otherwise noted, the information in this section is from that study.

9.5.1 Role of fisheries in the national economy

The FY 2014 Palau Statistical Compendium (including the national accounts) was prepared by the Graduate School USA, Pacific Islands Training Initiative, Honolulu, Hawaii, in collaboration with the Office of Planning and Statistics, Ministry of Finance, Republic of Palau. The Statistical Compendium contains the official estimate of the fishing contribution to the GDP of Palau. The SPC study examined the official methodology and, using its independent estimate of the value of fisheries production, re-estimated the fishing contribution.

- The official contribution showed a FY 2014 fisheries contribution to GDP of USD 5.5 million, or 2.2 percent of GDP.
- The contribution of fishing to GDP was re-estimated by the SPC study for the year 2014. It showed a contribution of USD 11.5 million, or 4.6 percent of GDP.
- The major difference between the official and SPC estimates is that the official estimate includes industrial fish processing and excludes the operations of the locally based, foreign-flagged industrial fishing vessels. The SPC methodology follows more closely the conventions of the International Monetary Fund and the standardized System of National Accounts (SNA, 2009).

Unpublished data from Palau's Bureau of Oceanic Fisheries Management indicates that in 2014, USD 3.6 million was received by the Palau government as access fees for foreign fishing in Palau waters. This represents about 3.3 percent of all government revenue.

9.5.2 Trade

The official statistics on exports from Palau are given in the Republic of Palau FY 2014 statistical appendices (Graduate School, 2015b). A summary of the export items of relevance to fisheries are given in Table 9.11.

From the information in Table 9.11, it appears that the overseas shipment of the catch of locally based, foreign-flagged offshore vessels is not considered an export of the country in the official statistics, but rather the fish processing of that fish is considered an export of a service. The value of the service in the table (USD 1.2 million) appears to be about 11 percent of the FOB value of the fish exported (as estimated below). The exports of "other goods" on the table is not disaggregated to the point of being able to determine reef fish exports, and it is unclear whether fish exports as passenger baggage are part of the official exports.

Alternatively, FAO data on Palau's imports/exports of fishery products for 2013 indicate that Palau imported USD 1.8 million of fishery products and exported

TABLE 9.11
Palau exports (USD millions)

	FY2011	FY2012	FY2013	FY2014
Exports of goods	12.8	15.0	14.4	19.1
Re-exports	11.2	12.8	13.1	17.8
Fuel	10.2	11.7	10.2	11.5
Other, mostly capital goods	1.0	1.1	3.0	6.3
Other exports	1.6	2.3	1.3	1.3
Exports of services	102.8	104.0	125.7	142.4
Fish processing	1.1	1.5	1.5	1.2

Source: Graduate School (2015b).

products worth USD 0.4 million. It is likely that those exports consisted only of the officially documented exports (e.g. aquarium products and trochus).¹¹ As shown in Part 1 of this profile for 2014, FAO reported the value of USD 0.6 million for fisheries exports and USD 2.1 million for fisheries imports.

9.5.3 Food security

Fish is an important element of food security in Palau. Although Palau has a high GDP per capita relative to other countries in the region, implying considerable ability to purchase food, much of the national prosperity is based on payments from the United States of America – income that will not continue in perpetuity. This fact, in conjunction with a high per capita consumption of fish, attests to the large importance of fish in national food security.

Bell *et al.* (2009b) used information from household income and expenditure surveys (HIES) conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES were designed to enumerate consumption based on both subsistence and cash acquisitions. For the whole of Palau, the annual per capita fish consumption (whole weight equivalent) was 33.4 kg, of which 78 percent was fresh fish. For rural areas the per capita consumption of fish was 43.3 kg, and for urban areas, 27.8 kg.

The SPC PROCFish programme surveyed four locations in Palau that were representative of the country in terms of fisheries conditions (Friedman *et al.*, 2009). In terms of fish consumption (fresh fish, invertebrates and canned fish), the annual per capita results were as follows: Ngarchelong 73.1 kg, Ngatpang 72.0 kg, Airai 81.7 kg, and Koror 86.8 kg, or an average of 78.4 kg across the four sites.

In terms of consumption of pelagic fish in Palau, the locally based, offshore fishing operations sell fish locally and donate some fish for various activities in Palau. During the most recent five-year period, a total of 68.3 tonnes was donated and 349.6 tonnes were sold from the longline companies (Bureau of Oceanic Fishery Management, unpublished data). The single pole-and-line vessel had recent average annual catches of about 100 tonnes (Gillett, 2015b). This equates to 518 tonnes of fish entering the Palau food supply each year from locally-based offshore fishing.

9.5.4 Employment

The statistical appendices for FY 2014 (Graduate School, 2015b) have information on employment in Palau obtained through Social Security and tax records, which therefore relates to formal wage-paying jobs. Table 9.12 summarizes the fisheries-relevant information in the appendices.

¹¹ According to the CITES database, a total of 19 173 live giant clams were exported from Palau in 2013. At USD 5.50 per clam, that represents an FOB value of about USD 105 451. The last Palau trochus harvest was in 2013 when products with an FOB value of USD 350 000 were exported (BBP, 2014).

TABLE 9.12
Information relating to formal jobs in the fishing sector

	FY2010	FY2011	FY2012	FY2013	FY2014
Number of fishing workers	92	87	85	81	83
Total number of workers in Palau	10 044	9 931	9 973	10 108	10 386
Fishing workers as a % of all workers	0.9%	0.9%	0.9%	0.8%	0.8%
Fishing workers that are Palau citizens	22	19	19	15	17
Palau citizen fishing workers as a % of all fishing workers	23.9%	21.8%	22.4%	18.5%	20.5%
Fishing average wages (USD)	4 434	4 589	4 856	4 983	5 459
All workers average wages (USD)	8 541	8 898	9 188	9 265	9 950
Fishing wages as a % of average wages	51.9%	51.6%	52.9%	53.8%	54.9%

Source: Graduate School (2015b).

Note: number of workers includes both full-time and part-time workers

From the table, it can be seen that in Palau, formal employment in the fishing sector is characterized by the small proportion of people formally employed – most are not Palau citizens – and relatively low wages, which are about half the average wage in the country. It should be noted, however, that informal employment in fisheries (i.e. work not registered with Social Security) is likely to be substantial.

FFA (2015b) has information on the employment of Palauans in the tuna industry (Table 9.13). A total of 36 Palauans were employed in the tuna industry in 2014. Across the Pacific, a total of 17 663 people were employed as crew on tuna vessels or in tuna processing. Tuna industry employment in Palau represents 0.2 percent of regional tuna industry employment.

TABLE 9.13
Employment of Palauans in the tuna industry

	2009	2010	2011	2012	2013	2014
Local crew on vessels	3	0	0	0	0	0
Processing and ancillary	8	7	84	70	36	36
Total	11	7	84	70	36	36

Source: FFA (2015b).

Although formal employment in the fishing sector is small in Palau, many people have non-formal fishing jobs and there is much involvement in subsistence fishing. The SPC PROCFish programme surveyed four locations in Palau that were representative of the country in terms of fisheries conditions (Friedman *et al.*, 2009). The survey showed that in Koror 62.7 percent of households were involved with reef fisheries, in Ngarchelong 62.7 percent, in Ngatpang 88 percent, and in Airai 77.8 percent. The PROCFish work in Palau also showed that 68 percent of fishers were men and 32 percent were women.

9.5.5 Rural development

The Bureau of Marine Resources of the Ministry of Natural Resources, Environment and Tourism has several activities relevant to rural development, including placement of two or three FADs per year, conducting training in fishing around FADs, promotion of ice plants in rural areas, and promotion of clam farming.

The Palau Conservation Society (PCS) carried out the Inshore Sport Fishery Development Project, in cooperation with the United States of America Government, The Nature Conservancy and the Palau Government. The aim of the project was to conserve and make the best use of the diversity and abundance of Palau's reef fishes by developing a community-based sport-fishing industry, primarily in the non-urban areas of Palau.

9.6 TRENDS, ISSUES AND DEVELOPMENT

9.6.1 Constraints and opportunities

Some of the major constraints for the fisheries sector are as follows:

- Expansion of the fisheries sector (for both coastal and offshore fisheries) is often constrained by real and imagined interaction with the tourism sector.
- Although there is considerable employment in the tuna industry, few Palauans are willing to accept those types of jobs.
- Given the proximity of the country to Asia, the demand for coastal fishery products by affluent overseas consumers could easily deplete resources to the detriment of domestic fish consumption and tourism.
- Considering the substantial support given to aquaculture over the last four decades, the lack of economic activities in this field is disappointing.

The constraints can also be viewed from a national planning perspective. Palau's Medium Term Development Strategy states that the main problems in the marine resource sector in Palau relate to: i) completion and adoption of various policies and legislation that are well advanced; ii) effective enforcement of legislation and regulations; iii) development and implementation of a nation-wide quarantine plan; iv) confirmation and implementation of offshore fisheries policy, with emphasis on ensuring that the offshore sector optimizes its contribution to the economy of Palau; v) the overstretched capacity of the Bureau of Marine Resources (BMR) and its role in commercial activities; vi) the need to privatize the giant clam programme operated by the Palau Mariculture Demonstration Center under the BMR; and vii) ensuring the environmental sustainability of inshore fisheries.

Opportunities in the fisheries sector include:

- enhancing the input of the private sector into the functioning of the Bureau of Marine Resources;
- enhancing linkages between the fisheries and tourism sectors, including sport fishing and provision of value-added fishery products to the tourism industry;
- improving access by small-scale fishers to the tuna resources;
- improving fish handling/processing in coastal fisheries.

9.6.2 Government and non-government sector policies and development strategies

Palau's Medium Term Development Strategy comments on the government's fishery policies:

The most important action required to be addressed for inshore fisheries is to develop and implement a policy that provides a sustainable framework that balances the needs of all users. The policy needs to consider the sustainable development of all fishery activities (subsistence, artisanal and commercial) while also ensuring the sustainable management and conservation of these resources. Palau has made considerable advances in developing policies and a legal institutional framework to protect, manage and use its inshore natural resources. These policies need to be further developed through stakeholder participation to reflect the conservation, management and economic use of these resources to achieve the nation's aspirations for this sector.

To some degree, the objectives of Palau's tuna management plan can be considered indicative of government policy for the offshore fisheries. These objectives are as follows:

- Conserve fishery resources by controlling harvesting within international and regional recognized sustainable limits.
- Establish an efficient government framework to harmonize application of fisheries management policies and practices.
- Minimize detrimental impacts of fishing on the coastal and inshore environment.

- Attain an optimum balance in relation to access to the resource between all stakeholders.
- Enhance the overall economic balance between the necessity for government to generate revenue, financial expectations of the commercial tuna fishery interests, and the interests of other users of the resource.
- Promote Palauans in professional, administrative, research and development positions in the fishery and related industries and government agencies.
- Adherence to Palau's regional and international marine resource agreements.

The above policy indications will change considerably with the phased implementation of the Palau National Marine Sanctuary Act establishing a large MPA. The legislation creating the sanctuary designates 80 percent of Palau's territory as a fully protected marine reserve in which no extractive activities, such as fishing or mining, can take place. This represents a major shift in Palau's fishery policies. The President of Palau, in announcing the signing of the Act, stated:

"...Our future lies in tourism, not tuna. Science has shown, over and over again, that our global ocean resources are declining and if we do not take drastic action to protect these resources, they will be gone – if not in our generation, then in our children's. As Palauans, we depend on the Ocean for our identity, our culture, our food and our economy. Shifting our way of thinking from merely allowing foreign interests to continue to harvest our limited resources, to protecting them for the future is a step we must take. Science has also shown that by creating marine protected areas and allowing marine life in those areas to regenerate, the "spill over" also promotes the health of surrounding areas. Declaring 80 percent of our EEZ as a no-take zone will allow the marine life in that area to rebound and spill over into the 20 percent domestic fishing area where our local fishermen can harvest them. This will alleviate some of the fishing pressure on our near-shore reefs as well as create a healthy marine environment for our growing diving and sport-fishing industry."

The most active Palauan NGO that deals with marine resources is the Palau Conservation Society (PCS). The Palau Conservation Society Strategic Plan 2010–2015 shows some of their core policies:

PCS's mission highlights our commitment to the environment and to Palauan communities. We believe strongly in maintaining and perpetuating the Palauan conservation ethic to existing generations and beyond. We respect the Palauan culture and the science of conservation. We rely on partnerships. We are a community-based organization that implements conservation activities through partnerships. Palau has a good enabling environment. There are national frameworks that support community-based conservation, such as the Protected Areas Network. PCS's strategies capitalize on this enabling environment. However, there are critical threats, particularly from habitat loss and degradation from unsustainable development and overharvesting of critical species. PCS's strategies focus on these priority threats. In 2010–2015, PCS will focus on the conservation targets of coral reef ecosystems, forested ecosystems, mangroves and seagrass.

9.6.3 Research

A very large number of fisheries research projects have been carried out in Palau. Most areas of Palau and most types of fisheries resources have been covered by various research endeavors. The older research is listed in a bibliography of Palau marine resources (Izumi, 1988). The results of many of the research projects are summarized by resource in profiles of the Palau fisheries (Nichols, 1991).

Friedman *et al.* (2009) reviewed aspects of research in Palau relevant to fisheries. They indicated that Palau's reefs and resources are relatively well studied compared

to those of other island countries in the region. A comprehensive ecological survey (Maragos *et al.*, 1994) documented the status of Palau's reef resources (fish and invertebrates). A more recent assessment of the resource status of Helen Reef by Birkeland *et al.* (2000) documents the status of resources in the area. A review of the results of modern biological surveys of different reef resources, the environment and fisheries production in Palau is provided by Fitzpatrick and Donaldson (2007). Sea cucumbers and echinoderms are documented by Maragos *et al.* (1994) and the invertebrates of Airai State were surveyed by Kitalong (2003). Many research activities in Palau are conducted by the Palau Conservation Society with funding from its corporate partners. Research in the aquaculture sector, especially for clams and trochus, has been supported by the Center for Tropical and Subtropical Aquaculture, including technical support and capacity building. The Palau Community College is involved in research on various types of aquaculture.

Current fisheries research in Palau by the Bureau of Marine Resources and other government agencies includes research on tuna, bycatch, the marine biology of the Northern Reefs, the efficacy of several MPAs, subsistence fishing, coral disease, vulnerable marine species (crocodiles, dugongs and sea turtles), and spawning/culture techniques (giant clams, groupers and rabbitfish).

Major issues in fisheries research are translating research needs into research activities, analysis of data collected by research projects, and funding for research.

Under Palau's Regulations on the Collection of Marine Resources for Aquaria and Research there is a requirement for a research permit: "In order to monitor and encourage appropriate marine-related research, a Marine Research Permit system has been put in place. Anyone wanting to engage in any marine-resource-related research, such as scientific, maricultural or medical research, must apply for a Marine Research Permit and comply with any other applicable national or state law or regulation".

9.6.4 Education and training

Education related to fisheries and marine resources in Palau is provided by a variety of institutions:

- Basic aspects of fisheries science are taught in the Palau Community College's (PCC) Environment and Marine Sciences Program. Courses include marine biology and oceanography.
- PCC also has practical courses of study related to fisheries, such as the Small Engine and Outboard Marine Technology Programme.
- Academic training in biological, economic and other aspects of fisheries is given to Palau students at the University of Guam and the University of the South Pacific in Suva.
- Training courses are frequently organized by the major regional organizations involved in fisheries: SPC in New Caledonia and FFA in the Solomon Islands.
- Courses and workshops are also given by NGOs and bilateral donors, such as those by Japan.
- Many government fisheries officers and other professionals have received advanced degrees in fishery-related subjects at overseas universities, especially in Guam, Hawaii and mainland United States of America.

9.6.5 Foreign aid

Palau has enjoyed fisheries sector assistance from a range of multilateral and bilateral donors. Support has included the funding of expatriate staff positions within the Bureau of Marine Resources, construction of aquaculture facilities, fisheries infrastructure (docks, refrigeration facilities), equipment costs, the provision of vessels, collaborative research, sector planning studies, travel costs for training and attendance at meetings, and hardware and training related to fisheries surveillance.

Important donors have included the U.S. Department of the Interior (through Sea Grant), the U.S. Department of Commerce (Saltonstall-Kennedy allocations), the Peace Corps, the Japanese Government (through the Japan International Cooperation Agency and Overseas Fishery Cooperation Foundation) and the Pacific Aquaculture Association. Other donors have included UNDP, New Zealand and Canada. Australia has been especially generous in providing fisheries surveillance assistance to Palau (Box 9.6).

BOX 9.6

Australian support for fisheries surveillance

Under the Defence Cooperation and Pacific Patrol Boat Programs, Australia provides a wide variety of assistance to Palau and other Pacific Island countries to help them protect their EEZs and promote regional security. Specifically, Australia provided Palau with the patrol vessel *Remeliik* in 1996. Australia also constructed the current Division of Marine Law Enforcement (DMLE) headquarters in 2001 and constructed the patrol boat wharf in 2002. Australia provides two full-time advisors to Palau: a Maritime Surveillance Advisor and a Technical Advisor. They provide advice to the Chief of DMLE and the Director of the Bureau of Public Safety on the maintenance, operation, and employment of *Remeliik*, administer Australian support to DMLE, and advise the Chief of DMLE on the conduct of surveillance operations. Australia also provides ongoing support, including: (1) annual fuel funding for all FFA operations and some national operations; (2) funding for approved projects requested by DMLE in support of *Remeliik*, for example, additional kit/equipment, warehouse construction, building renovations, and United States Coast Guard training; (3) training of DMLE personnel at the Australian Maritime College via a continuum of progressive courses specific to Pacific class patrol boats on subjects such as mechanical engineering, electrical engineering, seamanship, cooking and hygiene, navigation, bridge watch-keeping, general management, and fisheries boardings; and (4) availability of broader courses.

Source: Pew (2015).

Much of the fisheries sector assistance in the past has been channelled through the Bureau of Marine Resources. Recently the Palau Conservation Society has obtained an increasing amount of marine-related overseas aid.

Private foundations are making significant contributions to marine conservation projects in Palau. They include the MacArthur Foundation, Packard Foundation and Wallis Foundation, which are based in the United States, and the Keidanren Foundation, Nippon Foundation and Sasakawa Peace Foundation based in Japan.

9.7 INSTITUTIONAL FRAMEWORK

Following the dissolution of the 1980 Palau Fishing Authority in 1997, the main responsibility for coastal fisheries development and management has been vested in the Bureau of Marine Resources (BMR). The BMR is currently administratively under the Ministry of Natural Resources, Environment and Tourism.

The BMR's work programme covers a range of different activities in the field of fisheries and marine conservation. The Bureau is headed by a Director and has a staff of about 35 people. It currently has three divisions:

- Division of Oceanic Fishery Management
- Division of Information and Data Management
- Division of Marine Resources Development

As to actual functions, the BMR implements national-level fisheries management measures. The 16 state governments control all resources from the shoreline up to 12 nautical miles offshore (except for the tuna resources). The Ministry has the duties, functions and authority to: (a) adopt regulations for the conservation, management and exploitation of all living resources in the contiguous zone and EEZ of the Republic of Palau; (b) negotiate and conclude foreign fishing agreements; (c) issue foreign fishing permits; and (d) perform such other duties and functions as may be necessary. BMR determines the annual total allowable level of foreign fishing permitted with respect to specific fisheries. The regulations establish the total allowable level of foreign fishing, catch limits, and allocation so as to ensure the long-term sustainability and health of fish stocks, populations of living resources and reef fish, and submerged reefs within the territorial sea, internal waters, contiguous zone, and Palau's EEZ. The Bureau generates fisheries data through a robust data collection and verification system. These data come from required information submitted for licensing, fishing conditions, catch and landing data, and the Observer Programme in the form of logsheets, port sampling forms, unloading forms, port visit logs, telex reports and observer reports. Data collection enables Palau to meet its reporting obligations to national and regional fisheries management organizations (Pew, 2015).

Other agencies with involvement in the fisheries sector of Palau include the following:

- The Division of Marine Law Enforcement is the primary enforcement authority for Palau's foreign fishing laws. The division enforces all laws and regulations related to fishing, environmental protection and illicit narcotic trafficking, and is responsible for surveillance of territorial waters and the 200-mile EEZ, including enforcement of national laws and international treaties (Pew, 2015).
- Law-enforcement and compliance with the coastal fisheries legislation is the responsibility of the Division of Fisheries and Wildlife and state government patrol officers.
- Community outreach and environmental awareness are carried out in conjunction with the Palau Conservation Society, the Palau International Coral Reef Center and the Coral Reef Research Foundation.
- Academic and vocational training and research trials are carried out by the Palau Community College.
- The Palau Visitor Authority is the government agency responsible for marine tourism operators and industry standards.
- The Palau Sports Fishing Association supports the game-fishing industry.
- The Environmental Quality Protection Board reviews any coastal development project that may potentially impact on fisheries.

Important internet links related to fisheries in Palau include:

- <http://palaugov.pw/executive-branch/ministries/natural-resources/bureau-of-marine-resources/> – the BMR website
- <http://www.spc.int/coastfish/en/countries/palau.html> – general information on fisheries in Palau, including the work of SPC in Palau fisheries
- <http://www.spc.int/coastfish/en/publications/fisheries-address-book.html> – marine resource-related addresses in Palau.
- www.picrc.org – the Palau International Coral Reef Center website
- www.palausportsfishing.com - Palau Sports Fishing Association website

9.7.1 Regional and international institutional framework

The major regional institutions involved with fisheries are the Forum Fisheries Agency (FFA), located in Honiara and the Pacific Community (SPC) in Noumea. Other players are the Parties to the Nauru Agreement (PNA) Office in Majuro, the Pacific Islands Forum Secretariat (PIFS) in Suva, the Secretariat of the Pacific Regional Environment Programme (SPREP) in Apia, and the University of the South Pacific (USP) in Suva. The characteristics of those institutions are given in Table 9.14.

TABLE 9.14
Pacific Island regional organizations involved in fisheries

	FFA	SPC	Other regional organizations with fishery involvement
Main area of emphasis	Providing management advice on tuna fisheries and increasing benefits to Pacific Island countries from tuna fishing activities.	Most aspects of coastal fisheries and scientific research on tuna. Fisheries are only one aspect of SPC's work programme, which also covers such issues as health, demography and agriculture.	PNA – subregional grouping of countries where most purse seining occurs; SPREP – environmental aspects of fisheries; USP – School of Marine Studies (SMS) involved in a wide range of training; PIFS – major political initiatives, some natural resource economics; leads trade negotiations with EU, which have a major fisheries component
Inter-regional relationships	The FFA/SPC relationship has had ups/downs over the years. It was most difficult in the early 1990s, but tremendous improvement in mid/late 1990s. An annual colloquium has helped the relationship. Staff who have moved between the two organizations have made a noticeable improvement in understanding. Much of the success/benefits achieved by FFA/SPC cooperation depends on the personalities of FFA's Director/Deputy and SPC's Director of the Division of Fisheries, Aquaculture and Marine Ecosystems.		At least in theory, all regional organizations come under the umbrella of PIFS. Their activities are coordinated to some degree by the Council of Regional Organisations in the Pacific (CROP), which has a Marine Sector Working Group that meets at least once per year, but is limited by lack of resources for follow-up. FFA originally provided secretariat services to the PNA, but the PNA broke away from FFA in 2010. Currently, there are some sensitivities in the relationship, but it appears to be improving.
Main strengths	Direct contact with its governing body many times per year results in a high degree of accountability. Mandate of tight focus on tuna eliminates considerable dissipation of effort.	Noumea being a pleasant place to work, there is considerable staff continuity. The Oceanic Fisheries Programme often sets the standard for tuna research in the world. Documentation of work is very good.	Because PIFS is under the national leaders, it is considered the premier regional organization. PNA has achieved considerable success and credibility in such areas as raising access fees, 100 percent observer coverage, eco-certification, high seas closures, and controls on FADs. USP is centrally located in the region and SMS has substantial infrastructure. SPREP has close ties to NGOs active in the marine sector.
Membership	Australia and New Zealand, plus Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu	Includes the major metropolitan countries, all Pacific Island countries, and the French/UK/US territories; the most inclusive of any regional organization.	PNA: the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. USP: Cook Islands, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. SPREP: 21 Pacific Island countries and territories, plus Australia, France, New Zealand and United States of America PIFS: same as FFA

Source: Adapted from Gillett (2014a).

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean entered into force in June 2004, and established the Western and Central Pacific Fisheries Commission (WCPFC). Palau is a member of the commission, along with 26 other countries. The WCPFC has its headquarters in Pohnpei, the Federated States of Micronesia, and has held 13 annual meetings to date.

9.8 LEGAL FRAMEWORK

Under Article I, Section 2 of the Constitution, each state in Palau has exclusive ownership of all living and non-living resources, except highly migratory fish, from the land to 12 nautical miles seaward of the baseline. Article X, Section 5 of the Constitution, states that the national government holds the right to regulate ownership, exploration and exploitation of natural resources and to regulate the use of navigable waters.

The main law in Palau for specifically dealing with fisheries is Title 27 of the Palau National Code. Title 27 has several chapters, including Chapter 1 (Fishery Zones and Regulation of Foreign Fishing), Chapter 2 (Monitoring of Foreign Vessels in the Exclusive Economic Zone), and importantly Chapter 12, which is the Marine Protection Act of 1994.

The stated purpose of the Marine Protection Act is to promote sustainable development of the marine resources of the Republic while also preserving the livelihood of the commercial fishers of the Republic. The law defines important terms, specifies certain prohibited acts (the main regulatory provisions of the law are listed in Box 9.7), gives the requirements for permits for taking aquarium fish, gives the power to the Minister to make regulations to carry out the purposes of the Act, stipulates a requirement and regulations for export labelling/reporting, specifies the enforcement provisions and establishes penalties.

In 2007, SPC prepared a public awareness brochure for BMR that explains the major provisions of the Marine Protection Act (available at www.spc.int/coastfish/Countries/palau/PalauDomestic2007.pdf).

In 2003, the Protected Areas Network Act (PAN Act) was signed into law. The act has several purposes: it allows creation of protected areas to enable resource management and to halt habitat degradation and overfishing; it allows states to exert authority over their respective areas; and it allows the national government, through the Ministry of Natural Resources, Environment and Tourism, to assist the states by providing technical assistance, acting as a conduit for funding, and facilitating cooperation among the states in areas of biodiversity importance that cross state boundaries. In 2008, a new law was passed to clarify the intent of the PAN Act and to create the Green Fee (otherwise known as the Environmental Protection Fee) to provide financial resources for establishment and implementation of protected areas (CCIF, 2013b).

Another law that has a major impact on fisheries is the Palau National Marine Sanctuary Act establishing a large MPA. It designates 80 percent of Palau's territory as a fully protected marine reserve in which no extractive activities, such as fishing or mining, can take place.

BOX 9.7

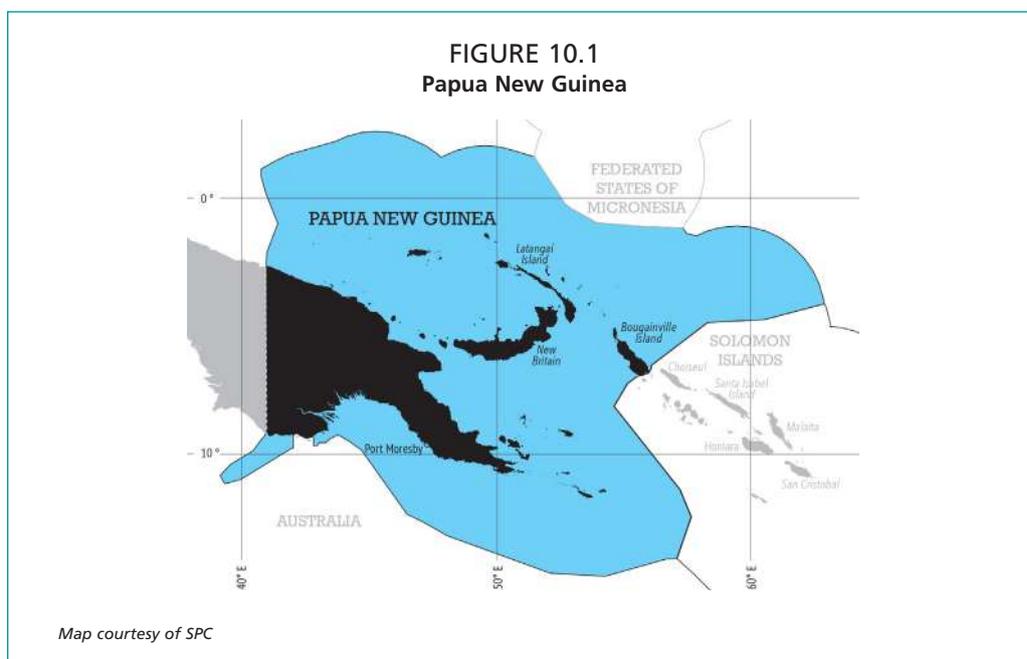
Prohibited acts under the Marine Protection Act of 1994

It shall be unlawful for any person within the fishery zones of the Republic to:

- (1) fish for commercial purposes for, sell, or buy any of the following species of groupers (temekai, tiau) from April 1 to July 31, inclusive: (a) *Plectropomus areolatus* (tiau), (b) *P. leavis* (tiau, katu'u'tiau, mokas), (c) *P. leopardus* (tiau), (d) *Epinephelus microdon* (ksau'temekai), (e) *E. fuscoguttatus* (meteungerel'temekai)
- (2) fish for commercial purposes for, sell, or buy any of the following species: (a) Juvenile parrotfish - *Bolbometopon muricatum* (Berdebed) which means for purposes of this Act, a parrotfish less than 25 inches in length; and (b) Juvenile wrasse - *Cheilinus undulatus* (Ngimer) which means for purposes of this Act, a wrasse less than 25 inches in length.
- (3) Commercially export, or fish for, sell, or buy for commercial export the following species: (a) Adult parrotfish - *Bolbometopon muricatum* (Kemedukl); and (b) Adult wrasse - *Cheilinus undulatus* (maml).
- (4) fish for commercial purposes for, sell or buy rabbitfish (Meyas, *Siganus canaliculatus*) from March 1 to May 31, inclusive;
- (5) fish for commercial purposes for, sell or buy the following species of rock lobsters (cheraprukl): raiklius, bleyached, or melech smaller than six (6) inches in total length of the carapace, as measured from the tip of the rostrum midway between the eyes to the end of the carapace, or a berried female of any size whatsoever;
- (6) fish while using any form of underwater breathing apparatus other than a snorkel;
- (7) commercially export black teatfish (*Holothuria nobilis* (bakelungal)), white teatfish (*Holothuria fuscogilva* (bakelungal)), prickly redfish (*Thelenota ananas* (temetamel)), surf redfish (*Actinopyga mauritiana* (badelchelid)), sandfish (*Holothuria scabra* (molech, delal a molech)), humphead parrotfish (*Bolbometopon muricatum* (kemedukl, berdebed)), coconut crab (*Birgus latro* (ketat)), mangrove crab (*Scylla serrata* (chemang)), rock lobster (*Panulirus longipes fermoristriga*, *Panulirus versicolor*, *Panulirus penicillatus* (cheraprukl)), and wrasse (*Cheilinus undulatus* (ngimer, maml)), except cultured species thereof;
- (8) commencing one year after the effective date of this Act, commercially export sea cucumbers (*Actinopyga miliaris* (cheremrum)) except cultured species thereof;
- (9) buy or sell any coconut crab (*Birgus latro*) smaller than four (4) inches in the greatest distance across the width of its carapace or a berried female coconut crab of any size whatsoever;
- (10) buy or sell any mangrove crab (*Scylla serrata*) smaller than six (6) inches in the greatest distance across the width of its carapace or a berried female of any size whatsoever;
- (11) commercially export clam (*Tridacna gigas* (Otkang)); *T. squamosa* (Ribkungel); *T. derasa* (Kism); *T. maxima* (Melibes); *T. crocea* (Oruer); and *Hippopus hippopus* (Duadeb) meat, or part thereof except cultured species;
- (12) fish with a gillnet or surround net having a mesh size of less than three (3) inches measured diagonally;
- (13) fish, after one year after the effective date of this Act, with a kesokes net with no bag portion or with the bag portion having a mesh size of less than three (3) inches measured diagonally;
- (14) retain possession of, or abandon, a kesokes net having a mesh size of less than three (3) inches measured diagonally or with a bag portion having a mesh size less than three (3) inches measured diagonally. This subsection will come into effect two years after the effective date of this Act;
- (15) until such time as the regulations promulgated pursuant to Section 5 are in effect, take aquarium fish.

Source: Marine Protection Act.

10. Papua New Guinea



REPORTING YEAR

This profile was written in 2017, based on data mostly from 2014.

PART 1. OVERVIEW AND MAIN INDICATORS

10.1 GENERAL GEOGRAPHIC AND ECONOMIC INDICATORS

TABLE 10.1
General geographic and economic indicators - Papua New Guinea

Land area ¹	462 243 km ²
Water area ²	3 120 000 km ²
Population (2011) ³	7 275 324
GDP of Papua New Guinea (2014) ⁴	USD 16 809 339 000
Fisheries contribution to GDP (2014)	N/A
Fisheries contribution as a % of GDP (2014)	N/A

¹ Secretariat of the Pacific Community, 2004. Map of "The Pacific Islands". Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

² Secretariat of the Pacific Community, 2004. Map of "The Pacific Islands". Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

³ 2011 Population Census from the Papua New Guinea National Statistical Office website: www.nso.gov.pg

⁴ Reported in Gillett (2016) from IMF. No official GDP estimate since 2006.

10.2 FAO FISHERIES STATISTICS

TABLE 10.2

FAO Fisheries statistics on total production, employment and trade – Papua New Guinea

2014		
Production (tonnes)	Aquaculture	2 150
	Capture	256 900
	Total	259 050
Employment (thousands)	Aquaculture	N/A
	Capture	N/A
	Total	N/A
Value of trade (USD 1000)	Fisheries exports	137 342
	Fisheries imports	38 668
	Total	176 010

Source: FAO Statistics and Information Branch of the Fisheries and Aquaculture Department. N/A: Data is not available.

PART 2. NARRATIVE

10.3 PRODUCTION SECTOR

10.3.1 Introduction

Papua New Guinea comprises the eastern part of the large island of New Guinea, and the islands of New Britain, New Ireland, Bougainville and Manus plus many smaller ones. Papua New Guinea is by far the largest Pacific Island country in both size and population. Its land mass covers a little over 462 000 km² and it has a population of about 7 million. The country has a diverse range of environments, from the highland and its mountainous cordillera to the lowland rainforests, savannahs, swamps and mangrove forests of the coastal areas, out to the many islands, atolls and extensive fringing and barrier coral reefs. The total length of coastline has been estimated to be approximately 17 110 km, with an estimated 40 000 km² of coral reefs. Papua New Guinea's exclusive economic zone (EEZ) covers about 3 120 000 km², with maritime borders with Australia, the Solomon Islands, Palau and Indonesia (SPC, 2013b).

Fisheries statistics can be presented in different forms to cater for different purposes. In the Papua New Guinea statistics published by FAO (Part 1 of this profile), the presentation follows the international conventions and standards used by FAO and its Member States for reporting catches, which are given by the flag of the catching vessel. Accordingly, the fishery and aquaculture production in 2014 published by FAO (Part 1) was 259 050 tonnes.

In Table 10.3 below, the Papua New Guinea fishery production statistics include the catch by locally-flagged vessels, the catch by small boats (which do not carry a flag) and the catch from fishing activities that do not involve a vessel (e.g. reef gleaning). The offshore category in the table is defined as the catch from locally-flagged, industrial-scale fishing operations that are carried out anywhere in the western and central Pacific Ocean (i.e. inside or outside Papua New Guinea waters).⁵

TABLE 10.3

Papua New Guinea fisheries production in 2014 (as per FAO reporting standards)

	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Locally-flagged offshore
Volume (tonnes)	145 tonnes and 160 000 pieces	8 642	6 500	35 000	54 771
Value (USD)	1 228 288	38 132 296	50 583 658	66 731 518	n/a

Units: tonnes unless otherwise stated.

⁵ In this report, the term "Papua New Guinea waters" comprises the internal waters, the territorial sea and the EEZ as described in the National Seas Act 1977.

The amounts of production given in the above table differ from those shown in Part 1. The table gives production estimated from a variety of sources (see SPC study below), whereas the quantities reported in Part 1 are generally what is reported to FAO by the Papua New Guinea National Fisheries Authority (NFA). The major difference between the amounts in the above table and those in Part 1 is in the category “Locally-flagged offshore”. The amount listed in Table 10.3 for this category is from NFA’s official report (NFA, 2015) to the Western and Central Pacific Fisheries Commission (WCPFC).

A recent study by the Pacific Community (SPC) presents the fishery statistics of the country in a different way from that of FAO. The SPC study reports the amount of catch in Papua New Guinea fishery waters, regardless of vessel flag. In the study, the catches are placed in different categories, which is useful for other purposes, such as administration of the foreign fishing that occurs in the fishery waters of Papua New Guinea. A summary of production from the SPC study is given in Table 10.4 below.

TABLE 10.4
Fisheries production in Papua New Guinea waters

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Offshore locally based ⁶	Offshore foreign-based ⁷
					Both locally- and foreign-flagged vessels	
Volume (tonnes)	145 tonnes and 160 000 pieces	8 642	6 500	35 000	216 896	217 871
Value (USD)	1 228 288	38 132 296	50 583 658	66 731 518	312 719 079	311 048 127

Source: Gillett (2016).

Some comment is required to explain the difference between the information in this table and that in Part 1 of this profile:

- Catches can be given by the flag of the catching vessel (as in the FAO statistics in Part 1), or by the zone where the catch is made (the “offshore foreign-based” and “offshore locally based” columns in the table above). These two different ways of allocating catches each have their purposes. Attribution by flag is important for consistency with international conventions, while attribution by zone is important for determining fishing contributions to GDP, and managing revenue from licence fees for foreign fishing in a country’s zone.
- In Papua New Guinea, there is no fisheries statistical system covering the categories of aquaculture, freshwater, and coastal subsistence/commercial fishing. The estimates above were made by a study carried out by SPC in 2015 that examined a large number of fishery and economic studies covering the last two decades. It is likely that the basis of the information for the three categories in the FAO statistics in Part 1 was a more informal estimate by an NFA staff member.
- It is likely that the FAO data for the category “Locally-flagged” includes some of the catch (but not all) of the locally based, foreign-flagged vessels. According to NFA (2015), the 2014 catch for locally based, foreign-flagged vessels in the WCPFC convention area was 160 433.05 tonnes.

⁶ In the SPC study, “offshore locally based” is the catch in Papua New Guinea waters from industrial-scale, tuna fishing operations that are (a) based at a port in Papua New Guinea, and (b) generally harvested more than 12 nautical miles offshore.

⁷ “Offshore foreign-based” is the catch in the Papua New Guinea zone from industrial-scale tuna fishing operations that are based at ports outside Papua New Guinea. Under the international standardized System of National Accounts (SNA, 2009), those catches do not contribute to the GDP of Papua New Guinea.

10.3.2 Marine sub-sector

10.3.2.1 Catch profile

The marine fisheries have two very distinct components, offshore and coastal:

- The offshore fishery is made up of both the purse-seine and longline sectors with a small handline sector. The longline and handline vessels fish exclusively in Papua New Guinea waters. The purse-seine sector is a mix of both domestic and foreign access vessels. The domestic sector comprises of vessels flagged to Papua New Guinea and Papua New Guinea chartered vessels (locally based foreign) that support processing facilities onshore in Papua New Guinea (NFA, 2016).
- Coastal fishing is primarily carried out for subsistence purposes and for sales in local markets. In addition, there are some export-oriented coastal fisheries: beche-de-mer, lobster and trochus.

The purse-seine catch by locally-based vessels is given in Table 10.5. The purse-seine catch in Papua New Guinea waters by foreign-based vessels has averaged about 275 000 tonnes in recent years. The most dominant trend in purse seining is that in El Niño years, the catch in Papua New Guinea waters tends to fall as areas favourable for purse seining move to the east (i.e. towards the Kiribati zone). Foreign-based purse seining in Papua New Guinea waters has been declining in recent years, with the 2015 catch about 10 percent of the 2011 catch.

TABLE 10.5
Purse-seine effort and catch by locally based vessels

Year	Vessel category	Effort (Fishing days)	Catch (tonnes)	
			Papua New Guinea waters	Outside Papua New Guinea
2011	Papua New Guinea flag	1 790	26 870	0
	Chartered	8 772	122 316	49 573
2012	Papua New Guinea flag	2 370	45 973	113
	Chartered	7 332	114 533	78 591
2013	Papua New Guinea flag	2 058	36 961	1 459
	Chartered	7 770	114 520	74 122
2014	Papua New Guinea flag	2 150	44 172	10 599
	Chartered	6 403	63 789	96 644
2015	Papua New Guinea flag	3 143	25 267	70 367
		3 243	37 815	71 068
Average (Papua New Guinea flag plus chartered)		9 006	126 443	90 507

Source: NFA (2016).

The recent longline catch and effort in Papua New Guinea waters is given in Table 10.6. There is considerable variation in both the effort and catch in recent years, with no discernible trends.

TABLE 10.6
Locally-based longline effort and catch

	2011	2012	2013	2014	2015	Average
Effort (100 hooks)	68 033	71 675	30 138	16 163	35 190	44 240
Catch (tonnes)	2 762	3 155	1 438	1 069	1 919	2 068

Source: NFA (2016).

Coastal fishing activities include the harvesting of reef flats, spearfishing, shallow-water handlining from dugout canoes, netting, and trapping in the freshwater reaches of the larger rivers. In the swampy lowland areas, there are net fisheries for barramundi, catfish and sharks, while in the Gulf of Papua there is also a village-

based lobster fishery. The collection of invertebrates, for both commercial (beche-de-mer, trochus and other shells) and subsistence purposes is extensive (Freidman *et al.*, 2008). Papua New Guinea is unique in the Pacific Islands region in that the underwater topography of the country is appropriate for shrimp trawling. In recent decades, there has been shrimp trawling in four areas of the country, with the major fishery being in the Gulf of Papua.

Estimates of catches from the coastal fisheries vary widely. In 2015, an SPC study (Gillett, 2016) examined a large number of studies on coastal fishing in Papua New Guinea and concluded that in 2014 (a) the coastal subsistence production was about 35 000 tonnes, worth USD 66.7 million; and (b) the coastal commercial production was 6 500 tonnes, worth USD 50.6 million to the producer.

The lack of a fisheries statistical system for coastal fisheries prevents the identification of quantitative trends in these fisheries. There is, however, a general perception that the important coastal resources are increasingly subject to over-exploitation close to urban areas.

Papua New Guinea's coastal commercial fisheries appear small in relation to the size of the country. This is ironic considering the effort that has been focused on their development. Box 10.1 explores this issue.

BOX 10.1

Development of commercial food fisheries in Papua New Guinea

While some of the Papua New Guinea fisheries for dry products have been going on for over a century, very few coastal villagers have supplied fresh chilled or frozen commercial food fish markets in any ongoing way. It has been widely assumed by the public, government and aid donors that it should be profitable to catch fish in rural areas and transport them chilled or frozen for sale in urban areas, or to export them. From the 1970s, governments and aid donors started projects to provide infrastructure, equipment and/or training for rural fishers to kick-start commercial food fisheries. Most of these activities however, collapsed soon after the withdrawal of support from government or the funding agencies. Considering all the investment, why have cash-earning food fisheries not taken off in most rural coastal and island areas in Papua New Guinea to date?

The main reason would appear to be that such fisheries are usually not profitable without high external inputs. Unlike high-value, easy-to-store-and-transport shells and dried marine products, fresh, chilled and frozen fish are low value to weight and are tricky to store and transport in good condition. The costs and difficulties involved in getting fish from rural areas out to markets, and getting fuel and mechanical repairs into rural coastal areas, usually outweigh the prices fetched by the fish. When the project funding stops, therefore, the fisheries stop soon after.

Source: Modified from Barclay and Kinch (2013).

10.3.2.2 Landing sites

In the offshore fisheries, the catch is offloaded at a variety of locations. Longliners mostly offload their catch at Port Moresby due to the relatively simple logistics of airfreighting to overseas destinations. Most of the catch of locally based purse seiners is offloaded directly to a domestic processing facility. The foreign-based purse seiners either transship to a foreign port (mainly those vessels from China, Republic of Korea, Taiwan Province of China and the Philippines) or deliver directly to their home port (mainly those vessels from Japan and the United States of America).

Most of the shrimp-trawler vessels are based in the capital, Port Moresby, and offload their catch there.

The small-scale commercial catch is mainly offloaded in or near coastal urban and semi-urban areas throughout the country. Non-perishable fishery products (e.g. beche-de-mer, trochus) are offloaded in virtually any coastal area, though mainly at the fishers' base of operations. Subsistence fishery landings occur at coastal villages throughout the country, roughly in proportion to the distribution of the population.

10.3.2.3 Fishing practices/systems

Virtually all offshore fishing in Papua New Guinea waters is by purse seining and longlining. Table 10.7 gives the number of active locally-based purse seiners and longliners in 2015. Table 10.5 indicates the catches by area of the purse-seine fleet (i.e. whether inside or outside Papua New Guinea waters).

The fishing areas of Papua New Guinea's offshore fleet are related to where the vessels are based. The purse seiners that are based at local processing facilities tend to fish more in Papua New Guinea waters than outside. The locally based longline vessels fish exclusively in Papua New Guinea waters.

The coastal commercial fisheries use a wide variety of production means. These range from relatively sophisticated operations targeting live reef fish (for food), using large vessels capable of transporting the catch to Asia, to small-scale operators who collect invertebrates by hand for export. Although there has never been a national survey to catalogue production means, fish for sale are typically harvested using lines, spears and nets from an unpowered canoe or outboard-powered skiff. Handlining takes large and small reef-associated carnivores, underwater spearing takes large reef fish, surface spearing takes pelagic carnivores, and netting exploits nearly all sections of the reef community, from large carnivores to small herbivores.

Coastal subsistence fisheries use extremely varied means of production, reflecting the diversity of the country's coastal environments. Different fishing gear is used along the mainland and high island coasts, in the swampy lowland areas, and in the Gulf of Papua. In general, subsistence fishing techniques are knowledge intensive, but the gear is relatively unsophisticated.

10.3.2.4 Main resources

Table 10.8 shows the species composition of the catch of locally-based purse seiners fishing inside and outside Papua New Guinea waters. The incidence of yellowfin and

TABLE 10.7
Locally-based offshore fleet

Purse seiners		Longliners	
Size class (GRT)	Number	Size class (GRT)	Number
0-500	3	0-50	5
500-1 000	8	50-200	15
1 000-1 500	30	200-500	0
1 500+	11	500+	0
Unknown	1	Unknown	0
Total	53	Total	20

Source: NFA (2016).

TABLE 10.8
Species composition of the catch of locally-based purse seiners

	Skipjack		Yellowfin		Bigeye		Other	
	Papua New Guinea waters	Outside Papua New Guinea	Papua New Guinea waters	Outside Papua New Guinea	Papua New Guinea waters	Outside Papua New Guinea	Papua New Guinea waters	Outside Papua New Guinea
Average annual catch 2011-2015 (tonnes)	86 872	77 942	35 508	11 257	654	549	3 410	759
Percentage composition	69%	86%	28%	12%	1%	1%	3%	1%

Source: Modified from NFA (2016).

TABLE 10.9
Species composition of the catch of locally-based longliners

		2011	2012	2013	2014	2015	Average	Percentages
Tuna	Albacore	269	528	220	182	407	321	16%
	Bigeye	54	69	4	9	83	44	2.1%
	Skipjack	6	1	0	0	7	3	0.1%
	Yellowfin	1 858	2 017	852	555	1 288	1 314	63.5%
Billfish	Black Marlin	12	25	22	10	18	17	0.8%
	Blue Marlin	133	119	69	35	25	76	3.7%
	Striped Marlin	8	6	0	5	8	6	0.3%
	Swordfish	46	60	35	19	4	33	1.6%
Shark	Blue Shark					0	0	0.0%
	Silky Shark					7	7	0.3%
	Mako Shark					0	0	0.0%
	White Tip					1	1	0.0%
	Thresher							0.0%
	Shark sp.	107	79	115	202	4	102	4.9%
Others	Others	269	250	119	52	66	151	7.3%
Total		2 762	3 155	1 438	1 069	1 919	2 068	100%

Source: Modified from NFA (2016); units: tonnes unless otherwise noted.

“other” in the catch is much greater in Papua New Guinea waters, probably due to greater use of fish aggregation devices (FADs) in Papua New Guinea waters than outside.

Table 10.9 gives the composition of the catch of locally-based longliners. All of their fishing is in Papua New Guinea waters, and as the table shows, the fishery is oriented to yellowfin. In terms of the status of the main fish resources described in the above tables, the four major species of tuna in Papua New Guinea mix freely with those of the neighboring countries in the western and central Pacific. Recent information from the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC, 2016) shows that for:

- **skipjack** – the stock is currently only moderately exploited and fishing mortality levels are sustainable;
- **bigeye** – recent analysis indicates that overfishing is occurring for the bigeye tuna stock and that to reduce fishing mortality to that at maximum sustainable yield a large reduction in fishing mortality is required;
- **yellowfin** – the current total biomass and spawning biomass are higher than at levels associated with maximum sustainable yields. Therefore, yellowfin tuna is not considered to be in an overfished state;
- **South Pacific albacore** – there is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries. It should be noted that longline catch rates are declining, and catches over the last 10 years have been at historically high levels and are increasing.

The coastal fisheries of Papua New Guinea comprise four broad categories: demersal fish (bottom-dwelling fish associated with mangrove, seagrass and coral reef habitats), nearshore pelagic fish (including tuna, wahoo, mackerel, rainbow runner and mahimahi), invertebrates targeted for export, and invertebrates gleaned from intertidal and subtidal areas (Bell *et al.*, 2011).

The small-scale coastal marine fisheries (both commercial and subsistence) take a very large number of finfish and invertebrate species. Kailola (1995) states that Papua New Guinea contains some of the highest diversity of reef-associated fishes in the Indo-Pacific. The food fishes characteristically found on coral reefs include wrasse (Labridae),

groupers (Serranidae), emperors (Lethrinidae), bream (Sparidae), sea perch and fusiliers (Lutjanidae), parrotfish (Scaridae), sweetlips (Haemulidae), butterflybream and monocle bream (Nemipteridae), squirrelfish (Holocentridae), drummers (Kyphosidae), eels (Muraenidae), triggerfish (Balistidae), rabbitfish (Siganidae), surgeonfish and unicornfish (Acanthuridae) and goatfish (Mullidae). Trevallies (Carangidae), mullet (Mugilidae) and barracuda (Sphyraenidae) are frequent pelagic reef inhabitants. In addition to the above reef-associated finfish species, the small-scale coastal marine fisheries also harvest those species associated with estuaries, mangroves, deep reef slope and pelagic environments. The common invertebrates taken in coastal fisheries include beche-de-mer, lobsters, trochus, giant clams, crabs, octopus and green snail. Seaweeds are also gathered as a contribution to subsistence food supplies.

BOX 10.2

Papua New Guinea fisheries resources profiles – Information on mullets

Species present: Kailola (1987) recorded 18 species belonging to seven genera of mullet (family *Mugilidae*) from Papua New Guinea waters. They are Goldie River mullet (*Cestraeus plicatilis*), wart-lipped mullet (*Crenimugil crenilabis*), fringe-lipped mullet (*C. heterocheilus*), basket mullet (*Liza alata*), large-scaled mullet (*L. macrolepis*), cream mullet (*L. melinoptera*), giant-scaled mullet (*L. parmata*), flat-tailed mullet (*L. subviridis*), rock mullet (*L. tade*), diamond-scale mullet (*Liza vaigiensis*), sea mullet (*Mugil cephalus*), hornlip mullet (*Oedalechilus labiosus*), shark or mud mullet (*Rhinomugil nasutus*), bluetail mullet (*Valamugil buechanani*), round-headed mullet (*V. cunnesius*), Engel's mullet (*V. engeli*), blue-spot mullet (*V. seбели*) and Speigler's mullet (*V. speigleri*).

Distribution: Mulletts occur in all tropical and temperate seas, usually near shore, frequently in brackish estuaries and fresh water. Within Papua New Guinea, *L. vaigiensis* and *V. seбели* are common in the New Guinea islands (Wright and Richards, 1985), *L. macrolepis* and *V. seбели* are common in Sissano Lagoon on the north coast of the mainland (Ulaiwi, 1992) and *Liza* species and *Mugil* species are common on the south coast (Lock, 1986). In the Purari River system, different species of mullet replace each other upstream and downstream: *L. parmata* and *V. buechanani* in the Purari River are replaced downstream respectively by *L. vaigiensis*, *L. dussumieri*, *L. tade*, and *V. seбели* (Haines, 1983). Haines also deduced that small juveniles of the freshwater species *Crenimugil labiosus* migrate upstream (in the Purari River) against a powerful current.

Additional Papua New Guinea mullet information on:

- biology and ecology
- utilisation
- stock status
- management
- current legislation/policy regarding exploitation
- recommended legislation/policy regarding exploitation
- references

Source: Kailola (1995).

Kailola (1995) profiled 30 groups of Papua New Guinea coastal fishery resources. As an example, Box 10.2 summarizes the information on mullets in the country.

A review of Papua New Guinea's inshore fisheries and fisheries management instruments (SPC, 2013b) contains some general information on the status of coastal fishery resources:

Overall, exploitation of coastal fisheries is thought to occur below localised maximum sustainable yields, although fishing pressure has seen the collapse of some fisheries in some localities, e.g. poor fish catches around urban centres, such as the national capital, Port Moresby. Another example is the collapse of the sea cucumber fishery, which has just had its previous three-year moratorium extended for another three years to 2015. The extended closure of the sea cucumber fishery is thought to have some impacts on other fisheries, particularly as fishing for reef fish and deep-water snapper as an artisanal activity has declined; and artisanal shark fishing for fins has increased in significance as an income-earning activity for coastal and island fishers.

10.3.2.5 *Management applied to main fisheries*

The tuna fisheries in Papua New Guinea are managed on national, subregional, and regional levels:

- On the national level, the management of the tuna fishery is guided by the National Tuna Fishery Management and Development Plan,⁸ which establishes an overall management structure and an application framework for all tuna fisheries. This includes licence limits, catch and effort controls, gear restrictions, the use of FADs and other management tools for the purpose of tuna resource conservation and management, and combating illegal, unregulated and unreported fishing activities. The plan is updated when necessary to conform to the country's development plans as well as regional and international obligations and agreements (NFA, 2015).
- On the subregional level, Papua New Guinea cooperates with the other countries that are members of the Parties to the Nauru Agreement, which is described below.
- On the regional level, Papua New Guinea is a member of the Western and Central Pacific Fisheries Commission (WCPFC) that was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Papua New Guinea and the other 26 members of the commission enact tuna management measures at the annual WCPFC meeting. From the Papua New Guinea perspective, the most important recent measure is the Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean.

A crucial aspect of the management of the offshore fisheries in Papua New Guinea is the Parties to the Nauru Agreement (PNA). The early history of the PNA is given by Tarte (2002):

In February 1982, the Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest was opened for signature. The Nauru Agreement was negotiated by seven Pacific Island states – the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea and Solomon Islands. This group of countries (later joined by Tuvalu) is known collectively as the Parties to the Nauru Agreement (PNA). The conclusion of the Nauru Agreement marked the beginning of a new era in Pacific Island cooperation in the management of the region's tuna stocks. It was an important milestone in the exercise of coastal state sovereign rights over their 200-mile EEZs. The PNA group accounts for much of the tuna catch in the Pacific Island region. In 1999, it produced 98 percent of the tuna catch taken from the EEZs of Pacific Island Forum Fisheries Agency (FFA) members; 70 percent came from three PNA members: Papua New Guinea, The Federated States of Micronesia and Kiribati. The group also accounted for 94 percent of the access fees paid to the FFA Pacific Island states. By controlling access to these fishing grounds, the PNA group collectively wields enormous influence and power.

⁸ Version certified 25 September, 2014.

The most important fishery management tool of the PNA is the Vessel Day Scheme (VDS), which is described in Box 10.3.

BOX 10.3
PNA Vessel Day Scheme

In 2000, a study suggested that the PNA purse-seine management scheme that was then based on vessel numbers be replaced by a scheme based on purse-seine fishing days. The transition was actually made seven years later. In 2007, the Parties to the Nauru Agreement began implementing the Vessel Day Scheme (VDS), transitioning from permitting a total number of purse-seine vessels in the region (205) to permitting a total allowable effort (TAE) in number of purse-seine fishing days (44 703 days for 2012; 44 890 days for 2016). Given the volume, value and multi-jurisdictional nature of the fishery, it is arguably one of the most complex fishery management arrangements ever put in place. Its key features are as follows:

- System of tradable fishing effort (days) allocated to the 8 Parties
- Limit on total effort (TAE) ~ 45,000 days
- TAE is allocated to Parties based on zonal biomass and historical effort as PAEs (Party Allowable Effort)
- Fishing days are sold to fleets for fishing in each EEZ
- There is a minimum benchmark price for VDS days sold to foreign vessels
- Fishing days are monitored by a satellite-based Vessel Monitoring System (VMS)
- VMS monitoring is supported by observers on board all vessels
- Days are tradable between Parties
- Scheme costs are financed by levies on vessels

Due to the complicated nature of the new VDS system and the various constraints of the government fisheries agencies of the region (e.g. under-funded, under-staffed), it was expected there would be problems in the introduction of the scheme. This is not to say that the VDS has not produced substantial benefits for PNA countries. The system is creating competition for a limited number of days, thereby increasing the value of each day. In practice, the value of a fishing day before the VDS was roughly USD 1 350, but it increased to about USD 5 000 in July 2011 and days were being sold in 2016 for over USD 12 000.

On a different and less tangible level, another benefit is that the VDS moves fisheries management in the region to a desirable rights-based system. That is, fishing rights (such as vessel days) can be defined, allocated and traded. Consistent with this transition to a rights-based approach, a VDS-style arrangement for management of the tropical longline fishery is being implemented by PNA.

Source: Havice (2013); Campling (2013); Gillett (2014a); Clark & Clark (2014).

Several coastal commercial fisheries are managed through fishery management plans. These include the:

- National Live Reef Food Fish Fishery Management Plan
- National Beche-de-mer Fisheries Management Plan
- Barramundi Fishery Management Plan
- Torres Strait and Western Province Tropical Rock Lobster Management Plan
- Gulf of Papua Prawn Fishery Management Plan.

A general feature of the management of coastal fisheries in Papua New Guinea and of the management plans above is the sharing of management responsibilities between the various levels of government. An extract from the National Beche-de-mer Fisheries Management Plan (Box 10.4) describes this sharing of management action.

BOX 10.4

Beche-de-mer management in Papua New Guinea

The sea cucumber fishery in Papua New Guinea will be primarily managed jointly by the National Fisheries Authority, respective Maritime Provincial Governments, respective Local Level Governments (LLGs) and communities. The role of the National Fisheries Authority, respective Maritime Provincial Governments, and Maritime LLGs and communities will be as follows:

- The National Fisheries Authority will be responsible for formulating and implementing the Management Plan and will provide resources for obtaining, analysing data and determining management measures which will include the minimum size limits, closed seasons, total allowable catches (TACs), the maximum number of exporters and buyers per province, licensing criteria and guidelines for licences, aquaculture and sea ranching guidelines, as well as the establishment of the National Management Advisory Committee.
- The Maritime Provincial Governments will be responsible for implementing the Management Plan at their respective levels; this includes the ability to set lower TACs (only at the Provincial level or split amongst LLGs but only as long as it does not exceed the Provincial TAC), higher size limits, longer closed seasons, advising the National Fisheries Authority on licenses, supporting resource owners and communities in their management actions and will also have the option to establish Management Advisory Committees at either or both the Provincial and LLG level if they feel that this will enhance the legal and management framework at those levels for the sea cucumber fishery. Any new provincial and Local Level Government management strategies, must not conflict with this Management Plan.
- Communities and resource owners will be responsible for implementing the Management Plan at their respective levels, as well as developing management strategies at their level or with the support of the LLG and Provincial governments or other civil society actors. strategies developed by resource owners, must not conflict with this Management Plan.

Source: National Beche-de-mer Fisheries Management Plan.

The traditional management of fisheries in Papua New Guinea is complex. Section 5 of the Customs Recognition Act of the Constitution bestows ownership rights over water, and to reefs, seabed and species of fish to traditional owners. The law thus provides for the acknowledgement of existing traditional rights of ownership of inshore waters and fisheries. The difficulty is that marine tenure systems vary greatly across the country (SPC, 2013b).

In practice, the management of coastal subsistence fisheries is mainly carried out by communities. Though there is a huge variety of systems in place, an intervention that is common to many management systems is the selective exclusion of outsiders from fishing.

Management objectives

The Fisheries Management Act 1998 (as amended in 2012) stipulates that fisheries management plans are to specify management objectives. Accordingly, the National Tuna Fishery Management and Development Plan⁹ states:

- To achieve the aims of this Plan the following objectives have been identified:
- (a) Increased domestication of tuna industries.
 - (b) Building fisheries businesses.

⁹ Version certified 25 September, 2014.

(c) Improved fisheries access agreements. (d) Enhanced regional cooperative arrangements. (e) Increased social benefits. (f) Improved harvest strategies. (g) Increased market and trade opportunities. (h) Sustainability certification and price premiums. (i) Increased control over fishing in the Papua New Guinea fisheries management area. (j) Increased use of rights-based approaches. (k) Increased capacity to realize commercial opportunities. (l) Actively combat IUU activities. (m) Implement a full and thorough catch documentation regime. (n) Apply technology and tools for comprehensive near real-time management. (o) Implement user pays policy to cost recover management. (p) Provide direct and indirect opportunities to the local population to both participate in, and benefit from, economic development.

In addition to these stated objectives, an important objective of the management of tuna fisheries in the country has been the generation of government revenue. An SPC study estimated that access fees for foreign tuna fishing in Papua New Guinea waters were USD 44 million in 2013 and USD 85 million in 2014 (Gillett, 2016).

The objectives of the management of coastal fisheries in Papua New Guinea are varied but have many common elements, as shown in the management plans for two coastal fisheries:

- The objectives in the National Beche-de-mer Fisheries Management Plan are to: (a) manage the sea cucumber fishery for the long-term economic benefit of coastal and island communities throughout Papua New Guinea; (b) ensure the use of sea cucumber stocks is biologically sustainable and that sea cucumber populations are maintained at required levels that will allow them to continue to play their role in the marine ecosystem; and (c) ensure that the co-operative implementation of this Management Plan and associated governance involve support and input from relevant government, industry, resource owners, communities, other civil society actors and research institutions.
- The objectives in the Torres Strait and Western Province Tropical Rock Lobster Fishery Management Plan are to: (a) manage the fishery to ensure that the stock size would be maintained annually at a level that will give maximum sustainable economic yield; (b) ensure that the development of the tropical rock lobster fishery benefits the traditional users, particularly the traditional inhabitants of the Torres Strait Protected Zone; (c) maximise the opportunities for traditional inhabitants to participate by implementing policies that include managing the fishery as a dive fishery; and (d) manage the fishery with a precautionary approach.

In the huge array of coastal subsistence fisheries, there is great diversity of management arrangements and objectives.

NFA's objectives in its work with community fisheries are given in the Policy Framework and Strategic Plan (2006–2008) for Community-based Fisheries Management in Papua New Guinea (FAO, 2006). This policy's goals are to:

- achieve sustainable livelihoods for stakeholders, particularly the rural-based population, in socio-economic terms;
- attain a balanced level of conservation and management action that ensures sustainable use of natural resources and protection of the environment for the benefit of present and future generations;
- contribute to local, provincial and national revenue generation for the promotion and continuation of sustainable development of Papua New Guinea.

Management measures and institutional arrangements

The main management measure for the tuna purse-seine fishery is the allocation of a limited number of days in the Vessel Day Scheme (Box 10.3 above). A similar scheme for the longline fishery is being introduced. For both purse-seine and longline fisheries, other management measures operate concurrently with the VDS.

These include closed areas (e.g. bans on fishing close to shore), gear restrictions (e.g. seasonal bans on FADs) and vessel restrictions (e.g. purse seiners in archipelagic waters to be less than 80 m in length).

The management measures for coastal commercial fisheries are stated in the associated management plans. As an example, the Torres Strait and Western Province Tropical Rock Lobster Fishery Management Plan uses several management measures, including restricted licensing (e.g. all licenses holders must be based in Daru.), size limits (e.g. ban on catching tropical rock lobster with a tail length of less than 115 mm), gear restrictions (e.g. ban on fishing using scuba gear), and total allowable catch (based on the catch-sharing arrangement between Papua New Guinea and Australia).

Under the Fisheries Management Act, a function of NFA is to “manage the fisheries within the fisheries waters” of Papua New Guinea. The NFA’s institutional arrangements are described below.

Devolution of fisheries management powers from the national level to provincial governments is provided for under the auspices of the 1997 Organic Law on Provincial Governments and Local-level Governments, whereby lower-level governments can make management regulations for natural resources under Sections 42 and 44 (SPC, 2013b).

10.3.2.6 Fishing communities

The concept of “fishing communities” has limited applicability to Papua New Guinea. Nearly all households in coastal villages are involved in fishing activities. It could therefore be stated that all coastal villages are “fishing communities”. To some extent this concept also applies to villages adjacent to significant rivers and other bodies of fresh water.

10.3.3 Inland sub-sector

Coates (1996) describes the major features of the inland fisheries in Papua New Guinea:

- Over 87 percent of the population live inland and have no direct access to marine, only to freshwater, aquatic resources.
- Even in highland areas, where fish stocks are very poor, over 50 percent of the population engages in fishing activities in many areas, traditionally for eels but, more recently, catches include a number of exotic species.
- Commercial exploitation of fresh waters is limited: southern-flowing rivers support a small barramundi (*Lates calcarifer*) fishery, although this has recently declined; modest amounts of freshwater prawns are landed seasonally, estimated at no more than 10 tonnes per year.

Two major river systems, the Sepik/Ramu and the Fly/Purari, are quite extensive and provide most of the freshwater fish harvest. The Fly River system in the Western Province is the largest river in the country and has the most diverse freshwater fish fauna in Australasia (Swales, 2000). Box 10.5 describes the river and its fisheries.

BOX 10.5

The Fly River and its fisheries

The first systematic survey of the fish populations of the Fly River was carried out in the mid-1970s by T. R. Roberts, who discovered that the fish populations in the Fly are characterized by the large size of some species, the abundance of endemic species and the dominance by groups that are poorly represented in other parts of the world. The Fly River system was found to support the most diverse fish fauna in the Australasian region, with 128 recorded native freshwater species representing 33 families. Seventeen species are known only from the Fly basin, and 30 or more are known only from the Fly River and

one or more of the large rivers in central-southern New Guinea. The total catch from both areas reached 330 tons/year in the early 1970s, but the commercial fishery on the coast ceased operation in 1990 because of declining catch rates.

The primary human use of the aquatic ecosystem is the subsistence fishery, which forms part of the traditional way of life of villagers living along the river. Most fish are consumed by the villagers, with catfish being the preferred species, compared to barramundi and black bass in the commercial fishery. It has been estimated that the current use is 416 tons/year, assuming a weekly fish intake of 2 kg/person and a population size of 4 000 people. Based on new data released in March 1999, there are now estimated to be 5 000 people living along the middle Fly River, resulting in a new fish yield estimate of 520 tons/year. These estimates do not account for by-catch that is not used or the commercial barramundi and bass fishery. Assuming that by-catch equals 10 percent of the fish consumed and that the commercial barramundi and bass fishery is responsible for approximately 36 tons/year, the estimated yield based on the combined artisanal and commercial fishery is approximately 600 tonnes/year.

Source: Swales (2000).

Most of the present landings from the Sepik/Ramu consist of two introduced species. Because of the very limited fish biodiversity, a project aimed at increasing fishery productivity by introducing exotic species operated for several years up to 1997. As a result of the project, many freshwater bodies have been enhanced through stocking with imported species. These include tilapia, Java carp, rainbow trout and at least seven other types.

Similar to the situation for coastal fisheries, there is insufficient information in Papua New Guinea for estimating the annual production from inland fisheries. Preston (1996a) made an educated guess of 13 500 tonnes annually, and that amount is often cited. Two studies (Gillett, 2009a; 2016) took the Preston amount and increased it to account for population growth. In summary, the freshwater production 2014 was estimated to be 20 000 tonnes, worth USD 38 million. The very poor factual basis for this estimate should be recognized.

Except for the barramundi fishery (Box 10.6) and some commercial sales of tilapia, there has been little commercial development of freshwater fishery resources.

BOX 10.6

Barramundi in Papua New Guinea

In Papua New Guinea, barramundi, *Lates calcarifer*, occurs naturally only in the southern part of the country, from Mullins Bay in the east to Irian Jaya/Papua New Guinea border in the west. Barramundi are most abundant in rivers with substantial lake and swamp systems, and with extensive deltas, an obvious characteristic of the Gulf of Papua and the adjacent Papuan coast. The population is concentrated in the Gulf of Papua, with the deltaic systems of the Fly, Kikori and Purari Rivers. Studies on the life history and reproductive biology of barramundi show that it is a protandrous hermaphrodite that starts life primarily as males, with the proportion of females in the population increasing with length. This life history pattern shows that the fish has greater vulnerability to fishing activities during the seasonal growth and spawning migrations (peak spawning migration between October and November) to a relatively restricted area; thus management of the barramundi should focus on the protection of the juveniles and the large breeding females.

The commercial fishery for barramundi in Papua New Guinea began in the late 1960s and early 1970s and was based in Western Province. Following government surveys around Daru in the early 1960s, the Western Province commercial barramundi fishery developed rapidly with processing and distribution centres being set up in the province. In the late 1980s barramundi ranked fourth among commercial fisheries in Papua New Guinea in terms of total fish production and foreign exchange earnings. The fishery was important to coastal communities in Western Province because of the large number of artisanal fishers involved and the cash income generated in areas with few alternative sources of income. This export commercial fishery caught 200-300 tonnes of barramundi a year, with the majority of this being caught in the Daru area. However, in the early 1990s the catches were as low as 4 tonnes from the Daru based fishery, which forced the commercial fishery to close. Since then only the artisanal barramundi fisheries on the coast and the middle Fly River have continued to operate. Production by the coastal artisanal fishery has resumed in recent years, with catches up to 170 tonnes annually. This is indicative of the recovering barramundi stock in the Western Province and the Gulf of Papua.

Source: Barramundi Fishery Management Plan.

The means used for inland fisheries production are almost exclusively very small-scale fishing gear, with the most significant methods being trapping, netting and handlining from shore and dugout canoes, and spearing.

With respect to management of inland fisheries, because most of the fishing is on a very small-scale subsistence basis, most management interventions are undertaken by local communities. Exceptions include fisheries such as the Fly River barramundi fishery for which an NFA fishery management plan has been formulated and implemented.

The Barramundi Fishery Management Plan states that the management objectives are to: (a) protect the barramundi stock in the management area from depletion or stock decline; and (b) ensure sustainable fisheries development practices for the participation and benefit of traditional resource users. The plan specifies several management measures, including:

- the requirement for the following types of licences: fish buyers' licence, fish export facility licence, fish storage facility licence and collector vessel licence;
- a total allowable catch of 260 tonnes per annum;
- a ban on gillnets and beach seine nets with mesh size greater than 15 cm;
- closure of the main spawning and breeding grounds between Sigabaduru Village and the Papua New Guinea /Irian Jaya border

The management objectives and measures for the other inland fisheries are not formalized. They consist of local community interventions, often in support of the objective of protecting the flow of fishery foods to villages.

An important management concept concerns the relationship of freshwater to inland fisheries. The issues, problems and solutions for fresh water, in general, tend to run in parallel with those for freshwater fisheries, so interventions to improve water quality are likely to improve freshwater fisheries.

10.3.4 Aquaculture sub-sector

A recent SPC study (Gillett, 2016) estimated recent aquaculture production in Papua New Guinea based on discussions with the staff of NFA's Aquaculture and Inland Fisheries Section, available documentation, and correspondence with knowledgeable individuals. The results are summarized in Table 10.10.

TABLE 10.10
Papua New Guinea aquaculture production

Commodity	Type of production	Current estimated annual production (tonnes except where noted)	Annual production value (USD)	Comment
Tilapia	Subsistence and small-scale commercial	100	389 105	Estimates of up to 50 000 farms have been made, which – considering total country production of 100 mt – indicates an annual average of 2 kg per farm
Carp	Subsistence	20 to 30	82 685	Many farmers have switched to tilapia recently
Seaweed	Small-scale commercial	300	116 732	
Trout	Production for restaurants and supermarkets	5 to 10	94 844	Started production in late 2007; currently only one farm due to feed issues
Prawn	Production for restaurants and supermarkets	10	175	Recent ownership change
Pearl	Export	?	?	Farm, which started production in 2007, is currently for sale
Barramundi	Most production is currently oriented to re-stocking	100 000 to 200 000 fingerlings	58 366	Farm is partly owned by mining company that is accused of polluting the Fly River, so production is related to the corporate social responsibilities of that company
Crocodile	Large and small operations for export	10 000 skins	486 381	A few large and many small farms.

Sources: J. Wani, M. Brownjohn, Alitana Trout Farm staff; Mainland Holdings staff; Gillett (2009a).

The above production equates to about 145 tonnes plus 160 000 pieces, with a farm-gate value of about USD 1 228 288.

For many years there has been debate on the quantity of tilapia farmed in the highlands. The SPC study (Gillett, 2016) explores this subject:

A 2001 survey (Smith, 2007) alluded to a very large number of farms in the highlands area. In 2008, a student studying tilapia in Papua New Guinea stated there are between 40 000–50 000 small-scale tilapia operations, which, based on the average number of ponds, stocking rates, mortality and expected output, would give an annual production of 924 tonnes. In contrast, the Executive Manager of NFA's Aquaculture and Inland Fisheries Section feels that the student's estimate of the number of ponds and the productivity of the ponds is too high, and he confirms his estimate of 100 tonnes of tilapia per year in the country.

The NFA Corporate Plan 2008–2012 lists priority actions with respect to aquaculture:

- Ongoing consultation with stakeholders to promote sustainable fisheries and identify opportunities for potential new fishery and aquaculture development.
- Undertake a consultative review of the NFA aquaculture policy so as to better reflect domestic and global trends in aquaculture.
- Facilitate and undertake research and projects in collaboration with international and national stakeholders to overcome challenges in aquaculture development.
- Work with stakeholders to develop and facilitate training and skill development opportunities to increase human resource capacity in relation to aquaculture development demands.

As can be seen from the above list, the priorities for NFA's involvement in aquaculture lie in developing an aquaculture industry, rather than in managing existing activities. Another indication of aquaculture management in the country is the list of requirements for an aquaculture licence. According to the "Papua New Guinea National Fisheries Authority Licensing Policy", an aquaculture licence requires:

- a preliminary audit report
- lease/rental agreement
- plans and specification of the facility
- the resource owner's approval

- a water treatment or discharge plan
- Department of Environment and Conservation – Environmental Permit
- National Agriculture Quarantine Inspection Authority – Certificate of Fitness
- proposal/business plan – a model is provided by NFA
- an incorporation/registration certificate
- a photo of the business owner
- a bank statement
- provincial endorsement
- an application fee.

In terms of the future for aquaculture:

- the Papua New Guinea Inland Aquaculture and Fisheries Strategic Plan 2014–2023 gives the following key results areas: (a) effective broodstock management and fingerling production, (b) market chain and fish farming economics knowledge and planning for a sustainable, strong industry, (c) high-quality, inexpensive feed formulations for existing aquaculture species available at all times, (d) increased capacity, and (e) enhanced growth in emerging industries;
- the “Papua New Guinea Vision 2050” (National Strategic Plan Taskforce) includes the statement: “develop aquaculture as a priority programme targeting inland areas for wealth creation”.

10.3.5 Recreational sub-sector

Although subsistence fishing may have a large social component and be enjoyed by participants, there is little recreational fishing as a leisure activity for villagers.

Regular sport-fishing activities (mainly targeting tunas and other oceanic fish) are found in the larger population centers, including Lae, Port Moresby and Madang. Most participants are resident expatriates. Less regular, tourism-associated sport fishing occurs in some resort centres, such as Kavieng and Rabaul, most often associated with resorts offering diving and other water sports. Sport-fishing competitions are held regularly in some areas, including an international competition organized by the Port Moresby Game Fishing Club. FADs have been deployed by some recreational sport-fishing associations off Port Moresby and Lae to increase productivity. Recreational fishing of black bass in fresh water is becoming important in the country, and is receiving considerable international attention (Martin, 2015).

There is little formal management of recreational fishing activities. The Fisheries Management Act states: “Unless otherwise specified by or under this Act, the provisions of this Act do not apply to or in relation to the taking of fish....for sport or pleasure”. The National Tuna Fishery Management and Development Plan contains some mention of game fishing:

- All vessels involved in the tuna fishery and associated operations (which may include game fisheries and artisanal fisheries) shall be licensed in accordance with the Fishery Management Act 1998.
- The game-fish fishery remains in its infancy and there is significant scope for expansion. Under this Plan, NFA shall maintain an open dialogue with the game-fishing sector including collaboration on tagging and other scientific programmes.
- Inshore FADs and commercially deployed, anchored FADs, are encouraged to be used without restriction by artisanal, small-scale handline, and game fishers.

10.4 POST-HARVEST SECTOR

10.4.1 Fish utilization

For the offshore fisheries, the prime tuna catch from the longline fleet is exported to Japan, with lesser grades and catch of non-tuna species sold domestically. For the purse-seine fleet, a growing amount of purse-seine tuna is processed in Papua New

Guinea. Part of the purse-seine catch is transhipped to canneries (mainly in Asia) or delivered directly by the seiners to a cannery in the Philippines or American Samoa.

In 2015, the country hosted five large tuna-processing facilities, with a sixth under construction. The locations, Wewak, Lae and Madang, were chosen for a variety of logistical, political and practical reasons. The capital, Port Moresby, has not been mentioned seriously as a processing site, most likely because of its distance to Papua New Guinea's purse-seine fishing grounds relative to the other sites (McCoy *et al.*, 2015).

The five existing tuna-processing facilities, with ownership, and maximum and current processing capacities, are shown in Table 10.11.

TABLE 10.11
Ownership and capacities of existing tuna-processing facilities in Papua New Guinea

Company (location, year established)	Ownership (country)	Maximum capacity (tonnes input per day)	Production tonnes/day; tonnes/year
RD Tuna Processors (Madang, 1997)	RD Group of Companies (Philippines)	200	120 (2011) 25 000–30 000
Frabelle Corp. (Lae, 2006)	Frabelle Fishing Corporation (Philippines)	100–120	70–80 (2011) ~20 000
SSTC (Wewak, 2003)	FCF (Taiwan Province of China) Bank of South Pacific (Papua New Guinea) East Sepik Provincial Government (Papua New Guinea)	200	70–80 (2011) ~20 000
IFC (Lae, unknown)	Kumpulan FIMA Berhad (Malaysia)	40	3 (2012) ~750
Majestic Seafoods (Lae, 2013)	Thai Union (Thailand Frabelle (Philippines) Century Canning (Philippines)	120 with target of 350	80 (2014) 20 000

Sources: J. Wani, M. Brownjohn, Alitana Trout Farm staff; Mainland Holdings staff; Gillett (2009a).

One product that is highly acceptable in the domestic market is relatively inexpensive canned tuna containing a significant quantity of red meat or “blood meat”, sometimes referred to as “black meat”, which is obtained during the tuna loining process. The product was initially produced in the region by Solomon Taiyo as “Solomon Blue” in the late 1970s. Sales outside Solomon Islands created a favourable marketing environment in Papua New Guinea and processors took note. Blood meat is also used to produce pet food and fish meal (McCoy *et al.*, 2015).

Most of the coastal commercial catch destined for domestic consumption is utilized in urban or peri-urban areas, close to the fishers' base of operations. Much commercial seafood demand in Papua New Guinea is from commercial or institutional buyers, such as fast-food outlets, restaurants and hotels. However, small-scale fishers and fish merchants have difficulty responding to the needs of these buyers due to problems of quality, product volume and form, and consistency of supply. Most institutional and commercial buyers prefer to purchase from larger fishing companies, which can assure regular supplies of the desired product quality and form.

The subsistence fisheries (both coastal and inland), as the name implies, are focused on production of food for home use. Significant amounts of fish are, however, given away to friends and relatives. In some communities, production in excess of immediate needs is salted or dried for future use.

10.4.2 Fish markets

The major markets for Papua New Guinea's important offshore fisheries are located overseas. Japan is the main market for fresh longline tuna. Unprocessed purse-seine tuna is exported mainly to canneries in Asia. Canned tuna is marketed domestically as well as exported. In the past, the United States of America provided most of the market for RD's exported loins and cans, often in larger institutional/food service sizes. SSTC

also used the US, primarily Bumble Bee, as its primary market for light-meat, frozen, cooked loins. However, the trade concessions obtained from the EU have changed the export landscape and now almost all exported processed tuna is sent to the EU.

Domestic fish markets are found in the urban areas of the country. Papua New Guinea has about 20 coastal cities and towns with populations of over 5 000 and most of these places have fish markets, although some are quite rudimentary.

Papua New Guinea, like many other Pacific Island countries, has had major involvement in rural fish collection and marketing schemes. Box 10.7 below reviews some of the lessons learned from the country's largest collection/marketing attempt.

BOX 10.7

Papua New Guinea's fish collection and marketing centres

During the early 1970s a number of fish collection and marketing centres were established. This led to the Coastal Fisheries Development Program, the biggest publicly funded fisheries development activity ever undertaken in Papua New Guinea. The program, planned in the late 1970s, envisaged the construction or rehabilitation of 20 coastal fisheries stations separated by distances of about 200 km and each equipped to freeze and store about 1 tonne of fish per day. Fish collection vessels would deliver ice to outlying villages and collect their catches, while a vessel with freezer storage would collect the product and transport it to the major towns for local sale or export. Funding was provided mainly by the National Government, but in some cases Provincial Governments and donors also provided inputs.

Twenty-two coastal fisheries stations were actually established and became operational at one time or another. Up to a dozen collection vessels over 10 m length and numerous smaller collection boats were deployed, but results were disappointing. A review of four stations undertaken in 1984 concluded that they were all over-capitalized, under-utilized and economically non-viable. Three of the most productive stations were refurbished with loan funding from the International Fund for Agricultural Development, and although the best of these (Samarai in Milne Bay Province) produced up to 300 tonnes of fish a year, all of them still operated at a loss. Problems included delays in installing and maintaining equipment (a government department's responsibility), poor fish quality and marketing problems, difficulty in recruiting and retaining competent managers, and a confusion between commercial and service activities.

With the benefit of hindsight, the weaknesses of the project can easily be identified:

- Insufficient attention was paid to site selection. The project was intended to cover the whole country, rather than focusing on areas of opportunity in terms of production and marketing. Even the most productive station was located on an island with an inadequate water supply.
- The use of freezing as a means of preservation was inappropriate. It involved high operating costs to produce a product that is not valued on the local market.
- Estimates of fish production were over-optimistic, and failed to take account of the part-time nature of most artisanal fishing in rural Papua New Guinea.
- No specific measures were taken to integrate increased fish production into the project design. It was assumed that providing a Government-run fish buying centre would be enough.
- As with many Government-run facilities in Papua New Guinea, there was a lack of commercial focus and accountability. Indeed, making a profit was seldom stated as an objective of any of the stations.

Source: Preston (2001b).

10.5 SOCIO-ECONOMIC CONTRIBUTION OF THE FISHERY SECTOR

A recent study by SPC (Gillett, 2016) attempted to quantify the fishery-related benefits received by Papua New Guinea and other Pacific Island countries. The study gave the available information on the contribution of fishing to GDP, exports, government revenue, employment and nutrition. Unless otherwise noted, the information in this section is from that study.

10.5.1 Role of fisheries in the national economy

Staff of the National Statistics Office indicate that, due to various constraints, they have not calculated the Papua New Guinea GDP for any year since 2006. Table 10.12 gives the official estimates for the contributions of the fishing sub-sectors to the Papua New Guinea GDP in 2006.

TABLE 10.12
Official estimates of fishing contribution to GDP in 2006

	USD millions
Fishing: Market component	126.9
Fishing: Non-market component	22.4
Total fishing	149.3
Total Papua New Guinea GDP	5 521.8
Fishing as % of Papua New Guinea GDP	2.7%

Source: National Statistics Office, unpublished data.

TABLE 10.13
Papua New Guinea tuna exports (USD millions)

	2012	2013	2014	2015
EU	151	181	141	120
Japan	10	4.1	5.4	4.0
Thailand	32	8.5	18	64
United States of America	5.7	5.6	0.21	0
Total	198.7	199.2	164.6	188

Source: FFA (2017).

The SPC study examined the official methodology and, using its independent estimate of the value of fisheries production, re-estimated the fishing contribution to GDP as being USD 285.1 million for 2014. Although there is not yet an official GDP estimate for Papua New Guinea for 2014, IMF estimated that the GDP in 2014 was USD 16.8 billion. Using that figure, the 2014 re-estimated fishing contribution was about 1.7 percent of GDP in 2014.

It is estimated that Papua New Guinea received about USD 85 million in access fees for foreign fishing in 2014. Access fees represented about 1.7 percent of government revenue for that year.

10.5.2 Trade

FAO estimated that total exports of fish and fishery products in 2014 were worth USD 137.3 million (Part 1 of this profile). The SPC study estimated the value of fishery exports to be USD 96.8 million in 2013 and USD 134.6 million in 2014. That equates to 1.8 percent and 1.6 percent of the value of all exports from Papua New Guinea in 2013 and 2014, respectively.

Papua New Guinea's most important fishery export commodity is tuna. A recent study (FFA, 2017) examined the country's tuna exports by destination market (Table 10.13).

10.5.3 Food security

Preston (2001b) summarized older information on fish consumption:

- Most documents and reports on nutrition focus on agriculture and animal husbandry and pay little attention to fish. Nevertheless, fish play an important role in food security, particularly in certain areas. On average, Papua New Guineans were estimated to have consumed 10 kg of fresh, frozen or dried fish per capita. Urban dwellers had higher rates of per capita consumption than rural dwellers.
- In addition to fresh fish and seafood, tinned fish is an important source of dietary protein for many people. On average, Papua New Guineans consumed 3 kg/capita of tinned fish, valued at PGK 63 million, in 1996. Again, urban dwellers consumed more per capita than rural people (7 kg as against 2 kg), but their consumption had a lower total value.
- Most of the fish and seafood consumed in the country is domestically produced, including tinned fish. After accounting for seafood imports and exports, the

apparent per capita seafood consumption¹⁰ has been estimated by Preston (2000) to lie between 18.2 kg per year and 24.9 kg per year.

- Together, fresh and tinned fish provide a small but important source of high-quality protein in the diet of Papua New Guineans. Fresh fish provides about 1.1 percent of the average calorific intake of the average Papua New Guinean (0.9 percent in rural areas and 2.3 percent in urban areas), while tinned fish provides an average of 0.6 percent (0.5 percent in rural areas, 1.4 percent for urban dwellers).

Bell *et al.*, (2009b) used information from household income and expenditure surveys (HIES) conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES were designed to enumerate consumption based on both subsistence and cash acquisitions. For Papua New Guinea, annual per capita fish consumption (whole weight equivalent) was 28.1 kg in urban areas (fresh fish made up 76 percent of this amount) and 10.2 kg in rural areas (77 percent fresh fish).

The SPC PROCFish programme did survey work at four sites in the country (Friedman *et al.*, 2008a), including estimations of per capita fish consumption. The results are shown in Table 10.14.

TABLE 10.14
Fishery product consumption at PROCFish sites
(kg/person/year)

Village	Fresh fish consumption	Invertebrate consumption	Canned fish consumption
Andra	35.66	6.54	11.79
Tsoilaunung	35.11	11.28	6.88
Sideia	23.95	9.47	5.64
Panapompom	37.39	1.77	2.70
Average across the four sites	33.77	7.02	6.75

Source: Friedman *et al.* (2008a).

10.5.4 Employment

Three reports have summarized participation in Papua New Guinea's subsistence fisheries. Although those studies use data from the 1990s, it is unlikely that the circumstances have changed significantly.

- UNDP (1994) indicates that the coastal fishing population (those who are involved in some fishing activity at least once a week) numbers about 120 000. People involved in freshwater fishing (those who do some fishing at least once per week) number somewhat less than 125 000.
- Preston (2001b) summarizes much of what has been written on the subject in recent years: "Despite the widespread nature of subsistence fishing, in many instances it is sporadic, as most food production continues to be derived from agriculture. Nevertheless, a large number of people, estimated at somewhere between 250 000 and 500 000, participate in the coastal subsistence fishery. The 1990 census estimated that 130 963 households, which is 23 percent of all rural households in the country, were engaged in catching fish (both marine and freshwater fishing). Of these households, 60 percent said they caught fish for home consumption only, while 40 percent caught fish both for food and for sale. A significant proportion of households were involved in fishing in all provinces except those in the highlands. The highest proportion of fishing households occurred in Milne Bay (14.3 percent of households), East Sepik (11.3 percent) and Madang (10.0 percent)."
- Avalos (1995) comments on the gender aspect of participation in the country's subsistence fisheries: "Women's role in fishing is much larger than is generally acknowledged. According to the Women's Sector Review, studies have shown that women catch at least 25 percent of the subsistence catch, or more if the crab catch is added. Furthermore, they are dominant in the processing stage of small-scale fisheries and contribute to the marketing of fish where the husband is involved in catching."

¹⁰ Apparent consumption is the composite of domestic production (subsistence and commercial) plus imports, less exports.

The number of people employed in small-scale commercial fishing in Papua New Guinea has never been adequately surveyed – and many of the current estimates are at least partially based on a UNDP fisheries sector study in the late 1980s. Diffey (2005), using several sources, summarized the current state of knowledge: “In 1989, UNDP estimated that Papua New Guinea had about 2 000 coastal village communities with populations of about 500 000 people. Of these, it was estimated that 120 000 were involved in regular fishing activity at least once a week and that there were between 2 000 and 4 000 part-time artisanal fishers. These figures are confirmed by the 1990 population census, with the National Statistics Office estimating that, of 131 000 coastal rural households, 23 percent (30 000) were engaged in catching fish with 60 percent fishing purely for subsistence consumption and 40 percent for both food and for sale.”

NFA’s corporate statement (NFA, 2015) mentions the employment that it has helped create:

Within the last 14 years, NFA has accomplished fisheries development and infrastructure, impact projects, processing plants, aquaculture developments, research facilities, capacity building and international fisheries cooperation/agreements. For the fisheries sector alone, this is a massive milestone achievement for Papua New Guinea, creating employment for more than 30 000 Papua New Guineans and providing income earning opportunities of nearly PGK 10 million a year to ordinary Papua New Guineans.

The local tuna industry is a large employer, in terms of both processing and fishing. Box 10.8 summarizes employment in the tuna-processing industry.

FFA has a programme that collects data on tuna-related employment in a standard form. According to FFA (2015b), a total of 9 312 people from Papua New Guinea were employed in the tuna industry in 2014 (Table 10.15).

BOX 10.8

Employment in Papua New Guinea tuna processing

The largest segment of employment of Papua New Guinea nationals in the tuna sector is in tuna processing. Much of the impetus in fostering tuna industry development in Papua New Guinea has come from recognition of the need for increased employment in a country with chronic unemployment, pervasive underemployment and dismal development indicators. Various estimates have stated the level of direct employment provided by tuna processing plants in the country during the period 2011–2012 as being from 5 800 to nearly 7 000 people. A 2012 report gave the total as around 6 700, 98 percent of whom were Papua New Guinea nationals.

Taking stated production levels and employment for the three canneries, it is estimated that for daily production of up to around 150 tons (the average maximum processed so far by any one facility) an average of 20 to 24 employees are required for each ton of tuna processed.

The labour-intensive nature of work within tuna processing facilities and difficult working conditions (i.e. standing for long periods each day, working in hot/damp conditions), results in canneries actively seeking young, fit workers with an emphasis on those between 18 to 35 years of age. The maximum age for production-line workers in Papua New Guinea is said to be around 45.

In July 2014 a new minimum wage requirement became effective in Papua New Guinea. The new rate is pegged at K3.20 (US\$1.17 in March, 2015). It is estimated that the total annual gross wages that will be paid under the new requirement is on the order of K35 million to K40 million (US\$12.8 million to US\$14.6 million).

Experience in large industrial tuna processing investments in Papua New Guinea so far (RD, SSTC, Frabelle, Majestic) demonstrates that access to Papua New Guinea’s tuna

resources is the main driver behind investment. Companies investing in the Papua New Guinea tuna industry do so to achieve core business interests, and this includes investing to secure long-term access to resources. In the past all companies have limited production costs by reducing the percentage of catch processed in Papua New Guinea and by keeping wages low. This keeps them competitive in the global industry, which in turn shapes the nature of tuna-based development in Papua New Guinea. New requirements to process greater amounts of catch within Papua New Guinea will test the viability of processors, some of which are already calling for additional government support to offset their higher costs of doing business in the country.

Source: McCoy *et al.* (2015).

The number of tuna-related jobs in the country (Table 10.15) can be viewed from regional and national perspectives. Across the Pacific Island region, in 2014 a total of 17 663 people were employed as crew on tuna vessels or in tuna processing and ancillary work (FFA, 2015b). Tuna industry employment in Papua New Guinea (9 312 from the above table) represents 52.7 percent of regional tuna employment.

TABLE 10.15
Tuna-related employment in Papua New Guinea,
2009–2014 (number of people employed)

	2009	2010	2011	2012	2013	2014
Processing and ancillary	5 783	5 600	5 962	6 640	7 000	7 536
Local crew	1 102	1 102	1 153	1 509	1 776	1 776
Total	6 885	6 702	7 115	8 149	8 776	9 312

Source: FFA (2015b).

10.5.5 Rural development

Rural fisheries development projects have included trials and promotion of various designs of fishing boats and fishing gear and methods. Several initiatives have been taken to introduce or adapt exotic fishing techniques or technology to the Papua New Guinea situation, and to expose local fishers to these innovations with the aim of improving the productivity, economic efficiency, safety or comfort of fishing operations. The success of these efforts has been mixed. Constraints include high investment costs and generally high opportunity costs. Preston (2001b) states that despite their initial curiosity about innovative ideas, fishers are by nature conservative and prefer to stay with tried and familiar methods wherever possible. In a society as traditional as Papua New Guinea's, this conservatism might be expected to be even stronger than in some other countries.

Barclay and Kinch (2013) comment on the development of coastal commercial fisheries in Papua New Guinea and the Solomon Islands (Box 10.9).

10.6 TRENDS, ISSUES AND DEVELOPMENT

10.6.1 Constraints and opportunities

Major constraints for the fisheries sector include the following:

- Small-scale fishers have great difficulty in economically accessing the relatively abundant offshore fishery resources.
- There are considerable difficulties associated with marketing fishery products from the remote areas where abundance is highest to the urban areas where the marketing opportunities are greatest. Costly and protracted experience has shown that the value and volume of production from coastal fisheries is insufficient to cover the high cost of establishing and running fish-handling, distribution and marketing infrastructure.
- The costs of both inbound and outbound freight from Papua New Guinea are high.

BOX 10.9

Development of coastal commercial fisheries in Papua New Guinea and the Solomon Islands

From the 1970s, governments and aid donors started projects to provide infrastructure, equipment and/or training for rural fishers to kick-start commercial food fisheries. Most of these activities, however, collapsed soon after the withdrawal of support from government or the funding agencies. The types of support given in the projects have also changed somewhat over the decades, partly due to lessons learned from prior projects, and partly in response to changing policy directions in aid, particularly the shift in emphasis from government provision of extension services to a focus on enabling private-sector-driven development through partnerships with village fishers and established fisheries businesses.

Considering all the investment, why have cash-earning food fisheries not taken off in most rural coastal and island areas to date? The main reason would appear to be that such fisheries are usually not profitable without high external inputs. Unlike high-value, easy-to-store-and-transport shells and dried marine products, fresh, chilled and frozen fish have low value to weight and are tricky to store and transport in good condition. The costs and difficulties involved in getting fish from rural areas out to markets, and getting fuel and mechanical repairs into rural coastal areas, usually outweigh the prices fetched by the fish. When the project funding stops, therefore, the fisheries stop soon after.

Source: Modified from Barclay and Kinch (2013).

- To some degree, tuna processing in Papua New Guinea is leveraged by the country's preferential access to European markets – but that preferential access is being eroded.
- The low wages paid in tuna-processing plants (which operate in a highly competitive international environment) may be insufficient to meet the expectations/needs of the workforce.
- Papua New Guinea was ranked 133 out of 189 economies for ease of doing business in 2015 by the World Bank. Papua New Guinea ranks comparatively poorly on many factors including starting a business (130), dealing with construction permits (141), getting credit (165), trading across borders (138), enforcing contracts (181) and resolving insolvency (141).

Opportunities in Papua New Guinea's fisheries sector include:

- the extensive tuna resources of its EEZ and archipelagic waters;
- development of the Pacific Maritime Industrial Zone in Madang, which involves tuna canneries, tuna loining plants and vessel servicing in a scheme that requires foreign vessels operating in Papua New Guinea and some other Pacific Island countries to deliver tuna to a marine industrial park located near Madang;
- encouraging more offloading of offshore fisheries catches for domestic consumption in the country;
- development of the relatively under-exploited coastal resources of the country by “piggy-backing” on the industrial offshore fisheries infrastructure;
- development of aquaculture in the highlands in such a way that it does not require subsidies in perpetuity.

10.6.2 Government and non-government sector policies and development strategies

Papua New Guinea's new development policy, as outlined in Vision 2050, is premised on the important and mutually reinforcing roles of economic growth, human development and environmental management, and is based on seven strategic focus areas or 'pillars of development'. The 'ideal' of Vision 2050 is that Papua New Guinea develops and builds a solid and sustainable economic foundation based on renewable sectors. These renewable sectors are agriculture, forestry, ecotourism and fisheries (SPC, 2013b).

The most up-to-date source of government policies and development strategies in the fisheries sector is the NFA Corporate Plan 2008–2012. Important points are:

- the Domestication Policy, which encourages the full participation of Papua New Guinea citizens and locally-based companies in the development of commercial fisheries. The policy aspires to have citizens actively participate in all aspects of fishing, from harvesting and post harvesting to downstream processing and value-adding;
- the government's "development framework" for fisheries which promotes:
 - preferential – but not necessarily protected – access for national operators dependent on increasing participation by nationals;
 - active consultation with industry to consider its interests when developing policy; an awareness programme promoting industry activities and potential;
 - working with other regulators to remove impediments to efficient operation;
 - provision of marketing and resource information;
 - training for operators on planning and managing their businesses well;
 - provision of a range of practical training programmes to provide skilled labour for the industry through the National Fisheries College;
 - increasing restrictions on direct foreign employment where skilled nationals are available.

The National Tuna Fishery Management and Development Plan gives some indication of government policies and strategies for the offshore fisheries:

To achieve the aims of this Plan the following objectives have been identified: (a) Increased domestication of tuna industries. (b) Building fisheries businesses. (c) Improved fisheries access agreements. (d) Enhanced regional cooperative arrangements. (e) Increased social benefits. (f) Improved harvest strategies. (g) Increased market and trade opportunities. (h) Sustainability certification and price premiums. (i) Increased control over fishing in Papua New Guinea fisheries management area. (j) Increased use of rights-based approaches. (k) Increased capacity to realize commercial opportunities. (l) Actively combatting IUU activities. (m) Implementing a full and thorough catch documentation regime. (n) Applying technology and tools for comprehensive near real-time management. (o) Implementing user-pays policy to cost recover management. (p) Provide direct and indirect opportunities to the local population to both participate in, and benefit from, economic development.

Another indication of Papua New Guinea's policies and strategies for the offshore fisheries is given in NFA's statement to the WCPFC:

Papua New Guinea is focused on building its domestic tuna industry to an extent where the generated revenue can offset that currently obtained from bilateral access fees. The government's main objective is to maximize the benefits from tuna resources to citizens and promote the involvement of nationals in the industry. A growth in the industry would provide an increase in employment opportunities, increased foreign exchange earnings for the country, and direct and indirect spin-off benefits among other benefits of value-adding to tuna resources (NFA, 2016).

At their March 2012 summit, the leaders of the Melanesian Spearhead Group (MSG) which comprises Fiji, New Caledonia, Papua New Guinea, Solomon Islands

and Vanuatu, agreed to develop a roadmap for the protection of inshore fisheries (Box 10.10). That roadmap gives some insight into Papua New Guinea's future policies and strategies for inshore fisheries management.

BOX 10.10

Melanesian Spearhead Group (MSG) roadmap for inshore fisheries

The “Melanesian Spearhead Group Roadmap for Inshore Fisheries Management and Sustainable Development 2015–2024” is a management framework and subregional roadmap for sustainable inshore fisheries developed by the MSG Secretariat in cooperation with representatives of the fisheries departments of member countries and with the technical assistance of SPC. The regional roadmap provides overarching guidance for MSG members and enumerates the actions they have agreed to take to address the management of inshore fisheries in Melanesia.

The vision of the roadmap is “sustainable inshore fisheries, well managed using community-based approaches that provide long-term economic, social, ecological and food security benefits to our communities”.

The objectives of the road map are: 1. Development of an effective policy, legislation and management framework for the management of inshore resources, in accordance with other relevant international agreements, to empower coastal communities to manage their marine resources. 2. Education, awareness raising and the provision of information on the importance and management of inshore fisheries. 3. Capacity building to sustainably develop and manage inshore resources with particular reference to experience in the MSG members. 4. Adequate resources to support inshore fisheries management and best available science and research. 5. Secure long-term economic and social benefits to coastal communities from the sustainable use of inshore resources. 6. Establishment of effective collaboration with stakeholders and partners. 7. Restoration and maintenance of beche-de-mer stocks to maximize long-term economic value to coastal communities.

The roadmap was adopted by the leaders of Fiji, New Caledonia, Papua New Guinea, Solomon Islands and Vanuatu in June 2015.

Source: SPC (2013b).

The Fishing Industry Association of Papua New Guinea is involved in fisheries policies and development strategies. The association is an important force in national fisheries policies through its representation on the NFA Board. According to its website (<http://www.pngfia.org.pg/>), “FIA’s core business objective is to deliver a cohesive and cost-effective service to its members and assist in pursuing best ways to improve the profitability and sustainability of the fishing and associated industries. FIA will attain this by strategically addressing fishing and seafood industry development issues comparable to global standards.”

10.6.3 Research

The Fisheries Act mandates NFA “to operate research facilities aimed at the assessment of fish stocks and their commercial potential for marketing”. At NFA, the Fisheries Management Business Group (one of seven business groups in NFA) is charged with “facilitating required research for the effective development and management of Papua New Guinea’s fisheries”.

The results of many previous research programmes in the country are given in a bibliography of Papua New Guinea’s aquatic resources (Kailola, 2003) and profiles of its fisheries (Kailola, 1995). Past research has mostly been carried out by NFA,

its predecessor agency (the Department of Fisheries and Marine Resources), the University of Papua New Guinea, SPC, FFA, FAO, and agencies based in Australia, Japan, New Zealand and the United States of America.

In the past few years, the strategy for fisheries research has been re-oriented to focus primarily on obtaining information needed to refine fishery management plans. This approach involves making greater use of partnerships with local and overseas research agencies, NGOs, private institutions and donors.

An important development in fisheries research is the Nago Island Mariculture and Research Station. Box 10.11 describes the establishment of the station.

BOX 10.11

NFA's Nago Island Mariculture and Research Station

Nago Island is a small uninhabited islet located just off the town of Kavieng in New Ireland Province. It is the site of the National Fisheries Authority (NFA) Nago Island Mariculture and Research Station, which is currently under construction. NFA has secured 11 hectares of land connected by a jetty. The station has a hatchery, algal laboratory and "wet" laboratory and indoor and outdoor larval tanks and raceways, with replicates and free spacing set aside for experiments. There is a separate area for quarantine. There are also offices and two resident houses onsite for staff. Because the island is uninhabited, the facility will be fully self-sufficient in providing its energy and water needs. Nago Island also has tourism potential and NFA intends to sub-lease part of its land to Nusa Resort to build some tourist accommodation. Current project ideas include trochus community restocking trials, cage farming rabbitfish, introducing *Kappaphycus* seaweed, mariculturing marine ornamentals and mabe pearl culture trials.

Source: Ponia (2009).

One of the major research projects is the Papua New Guinea Inland Aquaculture Research Project, which began in August 2015. The project seeks to evaluate the socio-economic impacts of fish farming, improve fish husbandry technologies and develop low-cost feeding and fertilizer strategies (<https://www.facebook.com/pg/inlandaqua2014>).

10.6.4 Education and training

The most important institution for education related to fisheries is the National Fisheries College. The College provides training in:

- commercial fisheries, including courses for skippers and deckhands
- post-harvest aspects of fisheries
- on-vessel observing
- business aspects of fisheries.

The National Fisheries College is a branch of NFA. It is located in Kavieng in the north of the country, but some of its courses are given in other areas of Papua New Guinea. The College has been incorporated into a new NFA entity, the Institute of Sustainable Marine Resources.

Several other institutions in the country offer training relevant to the fisheries sector:

- The Papua New Guinea Marine School in Madang provides more advanced and officer-level vocational training for merchant shipping.
- The University of Papua New Guinea offers degree courses in marine biology and other relevant scientific disciplines through its main campus, as well as via its Marine Research Station at Motupore Island.

- The University of Technology at Lae offers a food technology degree.
- The Papua New Guinea Institute of Public Administration offers accountancy, management and other training programmes relevant to the fisheries sector.

Training courses, workshops and attachments are frequently organized by the regional organizations: the Pacific Community (SPC) in New Caledonia and the Forum Fisheries Agency (FFA) in the Solomon Islands. Subject matter has included such diverse topics as fish-quality grading, stock assessment, seaweed culture, fisheries surveillance, and on-vessel observing. Courses and workshops are also given by NGOs and bilateral donors.

10.6.5 Foreign aid

SPC (2013b) states that Papua New Guinea has been the recipient of many fisheries development projects over the last three decades, with several of these instituted by various aid agencies to develop coastal fisheries in the country. Such projects include:

- the Coastal Fisheries Development Program's Baimaru and Milne Bay Fisheries Authorities, funded by a series of donors including the International Food and Agricultural Development's Artisanal Fisheries Programme;
- the MOMASE (Morobe-Madang-Sepik) Coastal Fisheries Development Project, funded by the German Development Corporation;
- numerous, smaller fisheries projects funded by UNDP.

In the last decade, Papua New Guinea was also the recipient of two large, multi-sectoral programmes:

- The European Union-funded Rural Coastal Fisheries Development Project (RCFDP). To achieve its overall aim of "poverty alleviation" by "increasing rural family incomes through greater participation in sustainable commercial production and improved marketing of marine products", the RCFDP attempted to develop the deep-water snapper fishery in Papua New Guinea.
- The Asian Development Bank's loan-funded Coastal Fisheries Management and Development Project (CFMDP). The CFMDP was also premised on "poverty reduction" in rural areas by increasing or preventing further decline in the incomes of coastal and island communities. This was to be done by promoting improved management of resources (in areas currently overfished, or threatened with overfishing) and by creating sustainable earning and employment opportunities.

10.7 INSTITUTIONAL FRAMEWORK

The Fisheries Act provided for the establishment of the National Fisheries Authority (NFA) to replace the former Department of Fisheries and Marine Resources. The NFA, which has a more commercial orientation than its predecessor, began operating in 1995. It was mandated to manage Papua New Guinea's fisheries resources under the Fisheries Management Act (1998). In 2001, NFA was completely reorganized and re-staffed and strengthened, with staff numbers dropping by two thirds.

The Fisheries Management (Amendment) Act 2015 changed the composition of the NFA Board. It now has nine members, who represent government, the fishing industry, resource owners and NGOs. The National Executive Council appoints the Chair of the Board, which is required to meet at least once every three months.

Access fees from foreign fleets currently form the bulk of the revenues received and managed by NFA. Other income sources include licence fees from other operators, assistance from donors, and penalties arising from prosecutions under the Fisheries Management Act.

The functions of NFA, as given in the National Fisheries Authority Corporate Plan 2008–2012, are to:

- manage the fisheries within the fisheries waters in accordance with this Act and taking into account the international obligations of Papua New Guinea in relation to tuna and other highly migratory fish stocks;
- make recommendations to the Board on the granting of licences and implement any licensing scheme in accordance with this Act;
- liaise with other agencies and persons, including regional and international organizations and consultants, whether local or foreign, on matters concerning fisheries;
- operate research facilities aimed at the assessment of fish stocks and their commercial potential for marketing;
- subject to the Pure Foods Act, the Commerce (Trade Descriptions) Act, the Customs Act, the Customs Tariff Act and the Exports (Control and Valuation) Act, control and regulate the storing, processing and export of fish and fish products;
- appraise, develop, implement and manage projects, including trial fishing projects;
- prepare and implement appropriate public investment programmes;
- collect data relevant to aquatic resources;
- act on behalf of the government in relation to any domestic or international agreement relating to fishing or related activities or other related matters to which the independent State of Papua New Guinea is or may become a party;
- make recommendations on policy regarding fishing and related activities;
- establish any procedures necessary for the implementation of this Act, including tender procedures; and
- implement any monitoring, control, and surveillance scheme, including cooperation, agreements with other States or relevant international, regional or subregional organizations in accordance with this Act.

NFA has been structured into the following business groups, each under the leadership of an Executive Manager reporting directly to the NFA Managing Director:

1. Directorate
2. Corporate Services
3. Finance and Accounts
4. Fisheries Management
5. Licensing and Data Management
6. Monitoring, Control and Surveillance
7. Provincial Support and Industry Development
8. Project Management
9. Institute of Sustainable Marine Resources (including the National Fisheries College).

Most of the governments of maritime provinces in Papua New Guinea have fisheries offices. Those offices receive funding from both NFA and provincial governments to carry out fisheries development and management.

Another institution involved in fisheries is the Fishing Industry Association (FIA), which was formed in January 1991 to provide a formal channel through which fishing-related businesses could voice their ideas, opinions and concerns relating to the development of the sector. FIA membership is drawn from across the fisheries sector, representing a diversity of commercial operations covering sedentary resources, lobsters, prawns, finfish and pelagic species. FIA has been quite outspoken since its formation and has become both respected and influential in the development of fisheries policy in the country. The Association has successfully lobbied Government for the removal of a range of taxes and levies and the granting of other concessions to the industry. A representative of FIA sits on the National Fisheries Board, as well as on the Governing Council of the National Fisheries College.

Important internet links related to fisheries in Papua New Guinea include:

- <http://www.fisheries.gov.pg> – website of the National Fisheries Authority
- www.pngfia.org.pg – Information on the Fishing Industry Association of Papua New Guinea

- <http://www.spc.int/coastfish/en/countries/papua-new-guinea.html> – information on Papua New Guinea fisheries and some SPC reports on Papua New Guinea fisheries
- www.ffa.int – information on the regional organization that is primarily involved in the development and management of offshore fisheries
- www.pnatuna.com – information on the sub-regional, regional organization of eight Pacific Island countries where most of the tuna in the region is harvested
- www.paclii.org/databases.html – the laws of Papua New Guinea, including those related to fisheries

10.7.1 Regional and international institutional framework

The major regional institutions involved with fisheries are the Forum Fisheries Agency (FFA), located in Honiara and the Pacific Community (SPC) in Noumea. Other players are the Parties to the Nauru Agreement (PNA) Office in Majuro, the Pacific Islands Forum Secretariat (PIFS) in Suva, the Secretariat of the Pacific Regional Environment Programme (SPREP) in Apia, and the University of the South Pacific (USP) in Suva. The characteristics of those institutions are given in Table 10.16.

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean entered into force in June 2004, and established the Western and Central Pacific Fisheries Commission (WCPFC). Papua New Guinea is a member of the commission, along with 26 other countries. WCPFC has its headquarters in Pohnpei, Federated States of Micronesia, and has held 13 annual meetings to date.

10.8 LEGAL FRAMEWORK

The Fisheries Management Act 1998 defines the role and responsibilities of the National Fisheries Authority. The Act essentially empowers NFA to manage, control and regulate all of Papua New Guinea's fishery resources, whether inland, coastal or offshore. Although the Act recognizes and allows for customary uses, rights and traditional resource ownership, it does not in itself empower provincial or lower-level governments to manage fisheries in what they may consider to be their areas of jurisdiction. Such powers may be delegated by the Minister for Fisheries through regulation or promulgation, but this is entirely discretionary.

The Act is 56 pages in length and has nine parts:

<i>Part i</i>	Preliminaries
<i>Part ii</i>	Institutional arrangements
<i>Part iii</i>	Fisheries management, conservation and development
<i>Part iv</i>	Licences
<i>Part v</i>	Enforcement and observer programme
<i>Part vi</i>	Jurisdiction, procedure, offences, penalties and liability
<i>Part vii</i>	Administrative proceedings
<i>Part viii</i>	Evidence
<i>Part ix</i>	Miscellaneous

With respect to the details of the Act, its provisions on the functions of NFA are given in section 10.7 above, and its provisions on the content of fisheries management plans and the objectives of fisheries management in Papua New Guinea are given in section 10.3.2 above.

Many of Papua New Guinea's fishery management plans, including the following, are formulated as regulations under the Fisheries Management Act:

- National Beche-de-mer Fishery Management Plan
- Barramundi Management Plan
- National Lobster Fisheries Management Plan
- National Tuna Fishery Management and Development Plan 2014.

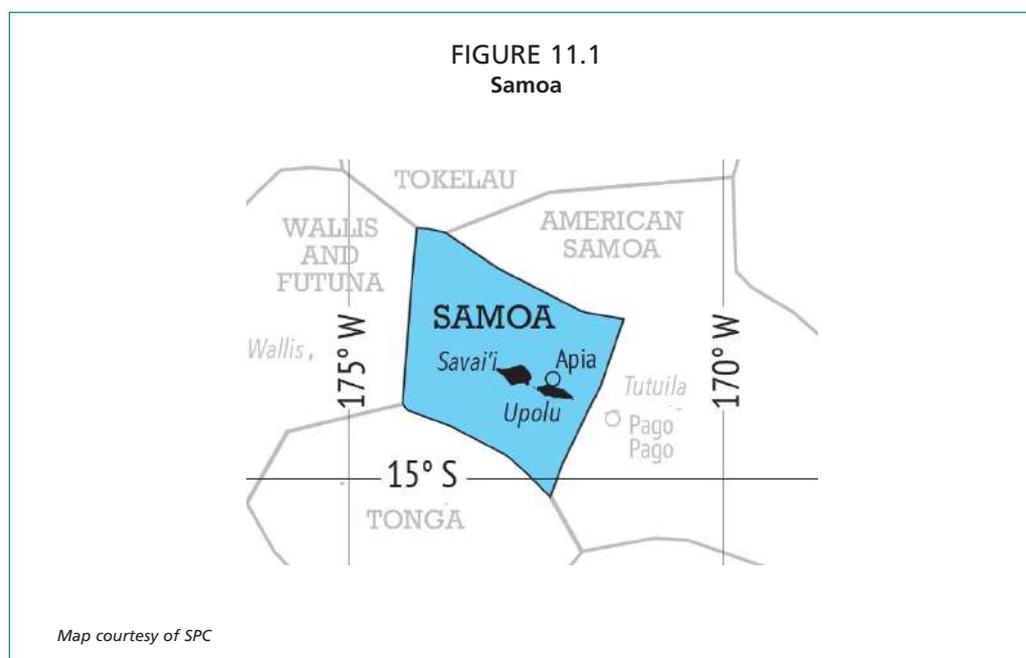
TABLE 10.16
Pacific Island regional organizations involved in fisheries

	FFA	SPC	Other regional organizations with fishery involvement
Main area of emphasis	Providing management advice on tuna fisheries and increasing benefits to Pacific Island countries from tuna fishing activities.	Most aspects of coastal fisheries and scientific research on tuna. Fisheries are only one aspect of SPC's work programme, which also covers such issues as health, demography and agriculture.	PNA – subregional grouping of countries where most purse seining occurs; SPREP – environmental aspects of fisheries; USP – School of Marine Studies (SMS) involved in a wide range of training; PIFS – major political initiatives, some natural resource economics; leads trade negotiations with EU, which have a major fisheries component
Inter-regional relationships	The FFA/SPC relationship has had ups/downs over the years. It was most difficult in the early 1990s, but tremendous improvement in mid/late 1990s. An annual colloquium has helped the relationship. Staff who have moved between the two organizations have made a noticeable improvement in understanding. Much of the success/benefits achieved by FFA/SPC cooperation depends on the personalities of FFA's Director/Deputy and SPC's Director of the Division of Fisheries, Aquaculture and Marine Ecosystems.		At least in theory, all regional organizations come under the umbrella of PIFS. Their activities are coordinated to some degree by the Council of Regional Organisations in the Pacific (CROP), which has a Marine Sector Working Group that meets at least once per year, but is limited by lack of resources for follow-up. FFA originally provided secretariat services to the PNA, but the PNA broke away from FFA in 2010. Currently, there are some sensitivities in the relationship, but it appears to be improving.
Main strengths	Direct contact with its governing body many times per year results in a high degree of accountability. Mandate of tight focus on tuna eliminates considerable dissipation of effort.	Noumea being a pleasant place to work, there is considerable staff continuity. The Oceanic Fisheries Programme often sets the standard for tuna research in the world. Documentation of work is very good.	Because PIFS is under the national leaders, it is considered the premier regional organization. PNA has achieved considerable success and credibility in such areas as raising access fees, 100 percent observer coverage, eco-certification, high seas closures, and controls on FADs. USP is centrally located in the region and SMS has substantial infrastructure. SPREP has close ties to NGOs active in the marine sector.
Membership	Australia and New Zealand, plus Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu	Includes the major metropolitan countries, all Pacific Island countries, and the French/UK/US territories; the most inclusive of any regional organization.	PNA: the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. USP: Cook Islands, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. SPREP: 21 Pacific Island countries and territories, plus Australia, France, New Zealand and Untied States of America. PIFS: same as FFA

Source: Adapted from Gillett (2014a).

Apart from the Fisheries Act, there are at least 28 other legislative instruments currently in force and relevant to the fisheries sector. Most important of these is the Organic Law on Provincial and Local-level Governments of July 1995, which gives provincial governments responsibility for fisheries and other development activities and the provision of basic services. The Organic Law requires that national bodies devolve as many of their functions as possible to the provincial authorities, or carry them out at provincial level. Other relevant legislation includes the environment, maritime zones, shipping and maritime safety acts and regulations, and laws governing business and company management.

11. Samoa



REPORTING YEAR

This profile was written in 2017, based on data mostly from 2014.

PART 1. OVERVIEW AND MAIN INDICATORS

11.1 GENERAL GEOGRAPHIC AND ECONOMIC INDICATORS

TABLE 11.1
General geographic and economic indicators - Samoa

Land area ¹	2 935 km ²
Water area ²	120 000 km ²
Population (2016) ³	195 843
GDP of Samoa (2014) ⁴	USD 804 208 000
Fisheries contribution to GDP (2014) ⁵	USD 24 045 000
Fisheries contribution as a % of GDP (2014) ⁶	3

¹ Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

² Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

³ 2016 Samoa Population and Housing Census.

⁴ Reported in Gillett (2016) from the Samoa Bureau of Statistics (2015).

⁵ Reported in Gillett (2016) from the Samoa Bureau of Statistics (2015).

⁶ Reported in Gillett (2016) from the Samoa Bureau of Statistics (2015).

11.2 FAO FISHERIES STATISTICS

TABLE 11.2

FAO Fisheries statistics on total production, employment and trade – Samoa

2014		
Production (tonnes)	Aquaculture	5
	Capture	7 501
	Total	7 506
Employment (thousands)	Aquaculture	0.081
	Capture	0.247
	Total	0.328
Value of trade (USD 1000)	Fisheries exports	2 520
	Fisheries imports	6 668
	Total	9 188

Source: FAO Statistics and Information Branch of the Fisheries and Aquaculture Department.

PART 2. NARRATIVE

11.3 PRODUCTION SECTOR

11.3.1 Introduction

Samoa consists of two main islands, Upolu and Savaii, and two inhabited but much smaller islands, Manono and Apolima. In addition, there are several uninhabited, little islands and large rocks. Because the islands of Samoa are relatively new in a geological sense, the lagoons are fairly small and consequently the inshore fishing areas are limited compared to those of many other Pacific Island countries.

Fish and fishing are important to Samoa, both economically and socially. Fish (fresh, frozen and canned) is an important feature of the Samoan diet and, on average, households consume fish most days of the week. Fish is also one of Samoa's most important exports. Both subsistence and commercial fishing are significant occupations in Samoa.

Fisheries statistics can be presented in different forms, to cater for different purposes. In the Samoa statistics published by FAO (Part 1 of this profile) the presentation follows the international conventions and standards used by FAO and its Member States for reporting catches, which are given by the flag of the catching vessel. Accordingly, the fishery and aquaculture production of Samoa in 2014 published by FAO (Part 1) was 7 506 tonnes.

In Table 11.3 below, the Samoa fishery production statistics include the catch by Samoa-flagged vessels, the catch by small boats (which do not carry a flag) and the catch from fishing activities that do not involve a vessel (e.g. reef gleaning). The offshore category in the table is defined as the catch from Samoa-flagged, industrial-scale fishing operations that are carried out anywhere in the western and central Pacific Ocean (i.e. inside or outside Samoa waters).

TABLE 11.3

Samoa fisheries production in 2014 (as per FAO reporting standards)

	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Samoa-flagged offshore
Volume (tonnes)	12	10	5 000	5 000	1 254
Value (USD)	15 054	3 226	17 782 427	12 447 699	4 666 309

The amounts of production given in the above table differ from those shown in Part 1. The table consists of production estimated from a variety of sources (see SPC study below), whereas the quantities reported in Part 1 are generally what is reported to FAO by the Samoa Fisheries Division. The major difference appears to be in the estimates of commercial/subsistence coastal fisheries production.

A recent study by the Pacific Community (SPC) presents the fishery statistics of Samoa in a different way from that of FAO. The SPC study reports the amount of catch in Samoa fishery waters, regardless of vessel flag. In the study, the catches are placed in different categories, which is useful for other purposes. A summary of the fishery production from the SPC study is given in Table 11.4 below. The catches reported in Tables 11.3 and 11.4 are identical due to the lack of fishing by foreign-flagged vessels in Samoa waters in 2014. In 2015, however, there was a significant amount of fishing in Samoa waters by foreign-flagged vessels (Fisheries Division, 2016b).

TABLE 11.4
Fisheries production in Samoa waters

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Offshore locally based ⁷	Offshore foreign-based ⁸
					Both Samoa- and foreign-flagged vessels	
Volume (tonnes)	12	10	5 000	5 000	1 254	0
Value (USD)	15 054	3 226	17 782 427	12 447 699	4 666 309	0

Source: Gillett (2016).

Some comment is required to explain the difference between the information in this table and that in Part 1 of this profile. The estimates in Table 11.3 and 11.4 were made by a study carried out by SPC in 2015 that examined a large number of fishery and economic studies covering the last two decades. It is likely that the basis of the information for the three categories in the FAO statistics in Part 1 above was a more informal conjecture by a nominated person in the Samoa Fisheries Division.

11.3.2 Marine sub-sector

The main components of the marine fisheries are the offshore tuna longline fishery and the coastal subsistence and commercial fisheries. There is also some pelagic trolling by small vessels and deep-slope bottomfishing.

11.3.2.1 Catch profile

Estimates of the volumes and values of catches of the four main commercial species of tuna in the Western and Central Pacific Fisheries Commission (WCPFC) area have been made by the Forum Fisheries Agency (FFA) using data sourced from SPC's Oceanic Fisheries Programme (Table 11.5).

TABLE 11.5
Volume and value of the catch by the Samoa-flagged offshore fleet

	2010	2011	2012	2013	2014
Volume tuna catch (tonnes)	3 090	1 932	2 352	2 020	1 091
Delivered value tuna catch (USD)	11 247 834	8 780 682	9 982 534	7 158 455	4 574 813
Volume catch adjusted for bycatch (tonnes)	3 553	2 221	2 704.8	2 323	1 254
Catch value adjusted ⁹ for delivery costs and value of bycatch (USD)	11 472 791	8 956 296	10 182 185	7 301 624	4 666 309

Source: Adjusted from FFA (2015a).

⁷ In the SPC study, "offshore locally based" is the catch by industrial-scale tuna fishing operations that are (a) based at a port in Samoa, and (b) generally harvested more than 12 nautical miles offshore.

⁸ "Offshore foreign-based" is the catch in the Samoa zone from industrial-scale tuna fishing operations that are based at ports outside Samoa. Under the international standardized System of National Accounts (SNA, 2009), those catches do not contribute to Samoa's GDP.

⁹ The values from the FFA (2015a) spreadsheet (tuna prices at destination ports) have been adjusted by transport charges to arrive at Apia dockside prices and adjusted for the value of the bycatch.

There is a large range in the various estimates of Samoa's coastal fisheries production:

- A nationwide, household fisheries survey was undertaken in October and November 2000 to collect subsistence fisheries data and to profile Samoan village fisheries. The survey covered 1 092 households in 66 villages, 40 in Upolu and 26 in Savaii, i.e. 20 percent coverage of Samoa's villages and 5 percent coverage of its households. The survey was based on respondents' recall of their fishing activities and seafood consumption patterns, rather than on direct measurements, such as creel surveys or weighing of food items to be consumed. The total coastal catch for the year 2000 was estimated at 7 169 tons, with a value of WST 45 million. A total of 2 876 tons was sold or given away, leaving 4 293 tons for home consumption (Passfield, 2001).
- In 2012, the Samoa Socio-Economic Fisheries Survey was implemented in 100 villages in June and July 2012 (56 in Upolu and 44 in Savaii), which was about 30 percent of the total number of villages in Samoa. A total of 881 households were surveyed – 584 in Upolu and 297 in Savaii. The results of the survey showed that in 2012, the estimated total finfish catch was 9 066 tonnes/year with an estimated value of WST 89 million. The estimated catch of invertebrates was 7 804.42 tonnes/year, with an estimated value of WST 86 million in income generated. The total annual coastal catch (commercial/subsistence and finfish/invertebrates) was 16 870 tonnes (Tiitii *et al.*, 2014).
- For many years, the Fisheries Division has carried out a programme of regular surveys of the landings of inshore fisheries that are sold. These surveys are conducted at four main market outlets, such as the Fugalei Agriculture Market, Apia Fish Market and Salelologa Market, on three, randomly selected sampling days. Roadside sales were sampled once per week. The 2013/2014 Fisheries Division Annual Report (Fisheries Division, 2014) gives the results for that fiscal year. The overall estimate of inshore landings of fishery products traded at the local market outlets was WST 1.3 million (USD 0.54 million) with a volume of 113 tonnes during the fiscal year.
- An SPC study in 2015 (Gillett, 2016) examined about 15 past estimates of coastal fisheries production in Samoa (including the three cited above) and commented on the very large range. The study concluded that production is likely to consist of 5 000 tonnes from coastal commercial fishing and 5 000 tonnes from coastal subsistence fishing.

The Fisheries Division Annual Report for Fiscal Year 2014–2015 stated that the troll fishery landed an estimated 319 tonnes with an estimated value of WST 2.2 million (USD 0.92 million) at the main fish markets in Samoa. The same report indicated that the bottomfish fishing fleet landed an estimated 10.3 tonnes of fish at the main fish markets.

11.3.2.2 Landing sites

Most locally based offshore vessels unload their catch in Apia, the capital and largest urban area. Some of the smaller alia longliners (when they are operating) offload catch at smaller landing sites, especially at the east and west ends of the island of Savaii.

Subsistence and coastal commercial fishery landings occur at villages throughout the coastal areas of the country, roughly in proportion to the distribution of the population. Much of the coastal commercial catch is transported by road for sale in urban areas. Some is sold on the roadside.

11.3.2.3 Fishing practices/systems

The early history of offshore fishing in Samoa is described in Vunisea *et al.* (2008). Two surveys of the tuna and baitfish resources of Samoa were undertaken by the United States National Marine Fisheries Service, the first in February/March 1970, and the second in March 1972 and January/February 1973. These surveys found that skipjack

tuna was abundant, but baitfish resources for pole-and-line operations were limited. SPC's Skipjack Survey and Assessment Programme conducted a tuna-tagging cruise in Samoan waters in June 1978 and February 1980. Pole-and-line fishing operations by locally based vessels have only been attempted on a small scale in Samoa. The Samoan Government acquired a 16 tonne Japanese-style pole-and-line vessel (*Tautai Samoa*) in early 1978. This vessel was used for training and exploratory fishing until August 1980, resuming operations in 1982. Catches recorded by this vessel were low, at around 8 tonne, during 1979 and 1980. In support of this operation, the Fisheries Division, with financial assistance from FAO/UNDP, attempted to culture mollies in 1978 as baitfish for pole-and-line fishing operations. This project was terminated in 1982/83 because of the high costs and low catch-to-bait ratio. The next development in offshore tuna fishing came as an offshoot of small-scale tuna fishing around fish aggregation devices (FADs). This included the development of the alia catamaran (Box 11.1).

Currently, offshore fishing in Samoa is almost exclusively by longlining. Samoa's 2016 report to WCPFC (Fisheries Division, 2016b) contains information about fleets and fishing practices. The Samoa-flagged vessels range from 9 m to over 20.5 m in length. Table 11.6 presents information on the domestic fleet. In addition, 10 foreign longliners were operating in Samoa waters in 2015: Cook Islands (1 vessel), Vanuatu (8) and Kiribati (1).

TABLE 11.6
Characteristics of the Samoan longline fleet

Gross registered tonnage	Class	Length (m)	Fishing method	Number of vessels				
				2011	2012	2013	2014	2015
0–10	A	Up to 11	Longline and troll	35	23	27	29	42
	B	>11–12.5	Longline	1	1	0	0	0
0–10	C	>12.5–15	Longline	3	2	2	2	1
	D	>15–20.5	Longline	5	8	8	7	6
50–200	E	>20.5	Longline	2	2	2	4	4

Source: Fisheries Division (2016b).

Class A in the table above are alia catamaran vessels. No discussion of the fisheries sector in Samoa would be complete without information on the alia. Originally designed and built by an FAO project in Samoa in the mid-1970s, much of the recent history of fishing in the country involves these vessels. Box 11.1 describes the large change in the alia fleet in the past decade.

The 2012 Samoa Socio-Economic Fisheries Survey (Tiitii *et al.*, 2014) included information on coastal fish catches by habitat and by gear:

- By habitat: 40 percent of fishing trips are to the lagoons, and 37 percent to the outer reefs, with the remainder a combination of the two.
- By gear: 47 percent of the catch is by spear diving, 9 percent by handlining, 6 percent by gillnet, and the remainder by a variety of gear.

11.3.2.4 Main resources

The longline fishery in Samoa's exclusive economic zone (EEZ) is primarily based on albacore, which has made up around 70 percent of the catch over the past decade. Yellowfin contributes about 11 percent of the catch, and bigeye and skipjack around 3 percent each. The remaining catch (around 15 percent) is a mix of non-tuna species, such as black and blue marlin and swordfish. The average 2008–2012 albacore catch of around 2 230 tonnes represents around 3.7 percent of the total albacore catch taken in the Western and Central Pacific south of 10°S. While only a small proportion of the

BOX 1.11

Rise and fall of the Samoan alia fishery

The offshore fishery in Samoa began in the late 1970s when alia were first constructed for deep-water bottomfishing and trolling around FADs. An alia is a catamaran style-vessel of around 9 m in length, originally constructed using plywood, but now made using aluminium. They are powered by a 40 horsepower outboard motor. Trial vertical and horizontal longlining, primarily targeting albacore, began in the early 1990s, with many alia being converted or purpose-built for longlining in the mid-1990s. Commercial longline fishing vessels (over 12.5 m) entered the fishery in the late 1990s. In 1994, Samoa's longline fleet comprised 25 alia, increasing to around 200 vessels in 1999, the majority of which were alia. Following four years of sustained high fishing effort (more than 7.5 million hooks set per year), catch rates in the Samoan longline fishery declined substantially in 2002/2003. Localized depletion, general overfishing, interactions with large longliners, oceanographic factors and natural cycles of abundance have been cited as possible explanations for this decline. However, the exact cause is yet to be determined. In recent years, the number of active alia longliners has ranged from 23 to 42 vessels.

Alia are constrained by size as to the amount of gear, bait, catch and personnel they can safely carry. The vessels in use as longliners can reportedly fish up to 300 or 400 hooks per day using a manually cranked drum longline reel. This increase over effort 10 or 15 years ago is said to be required to compensate for lower catch rates. It is unlikely that the number of hooks per set can go beyond this level, given the limited crew, gear and bait capacity of the alia. The average annual catch of an alia used in longlining was estimated to be about 19 tonnes in 2007.

Sea safety related to the use of alia in the Samoa longline fishery has long been a concern of the Samoan government and regional and international aid agencies. In the early years of the fishery (1996–2001), a total of 41 fishermen lost their lives at sea. An FAO survey of sea safety noted that in addition to recorded fatalities, over the years, alia fishermen and their vessels have drifted to American Samoa, Niue, Tonga, Wallis, Fiji, Solomon Islands, Papua New Guinea and Vanuatu.

Source: Hamilton (2007); Gillett (2008d); McCoy *et al.* (2015).

total catch is taken in the Samoa EEZ, the catch taken relative to the size of the EEZ is high. Similarly, the relative density of fishing effort in Samoa's EEZ is high (FFA, 2014).

As to the status of the offshore resources, recent information from the WCPFC's Scientific Committee (WCPFC, 2016) shows that for:

- **skipjack** – the stock is currently only moderately exploited and fishing mortality levels are sustainable;
- **bigeye** – recent analysis indicates that overfishing is occurring for the bigeye tuna stock and that to reduce fishing mortality to that at maximum sustainable yield, a large reduction in fishing mortality is required;
- **yellowfin** – the current total biomass and spawning biomass are higher than at levels associated with maximum sustainable yields. Therefore, yellowfin tuna is not considered to be in an overfished state;
- **South Pacific albacore** – there is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries. It should be noted that longline catch rates are declining, while catches over the last 10 years have been at historically high levels and are increasing. Despite the health of the albacore population, any increase in catches (even within sustainable levels) is predicted to have a significant impact on the catch rates in the longline fishery.

The catch of Samoa's coastal fisheries is very diverse. An FAO study carried out in Samoa in the 1990s (Zann, 1992) reported that subsistence fisheries make use of 500 species. The most important resources for Samoa's small-scale fisheries are: finfish (especially surgeonfish, grouper, mullet, carangids and rabbitfish), octopus, giant clams, beche-de-mer, *Turbo* spp. and crab. A study by FAO in 2006 identified the major species caught by spearfishing (Table 11.7).

A statement in Samoa's Agriculture Sector Plan 2016–2020 (which includes fisheries) summarizes the official position on the status/potential of coastal fishery resources in Samoa:

Inshore fisheries, whilst important for food security in rural areas, have restricted potential for increased production due mainly to the limited areas within the reef and vulnerability to exploitive fishing practices. With some commodities already overfished, increasing fish supplies, particularly to urban areas, is likely to rely more on landings of tuna and the further development of aquaculture.

The ministerial foreword to the Samoa Coastal Fisheries Management and Development Plan (Fisheries Division, 2013) gave another view on the status of coastal fisheries: "Coastal fisheries have not, however, been well understood and managed, mainly because they are a multi-species and multi-gear type of fishery."

11.3.2.5 Management applied to main fisheries

The tuna fishery in Samoa is managed on regional and national levels:

- On the regional level, Samoa is a member of the Western and Central Pacific Fisheries Commission (WCPFC) that was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Samoa and the other 26 members of the commission enact tuna management measures at the annual WCPFC meeting. From Samoa's perspective, the two most important measures are: (1) the Conservation and Management Measure for South Pacific Albacore, and (2) the Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in The Western and Central Pacific Ocean.
- On the national level, the tuna fishery in Samoa is managed under the Samoa Tuna Management and Development Plan 2011–2015. The plan covers two main areas: management of Samoa's tuna resources and development of the tuna industry. The plan sets licence caps and licence fees for categories determined by length of vessel. The categories and maximum number of licences allowed are: up to 11 m (100 vessels), over 11 m and up to 12.5 m (10), over 12.5 m and up to 15 m (10), over 15 m and up to 20.5 m (12) and over 20.5 m (5). The plan provides for flexibility in adjustment of the number of licences per category. Similarly, licence fees are set out in the plan but subject to review. The plan formalizes a consultation process, the Commercial Fisheries Management Advisory Committee, requiring regular consultations to be held with domestic fishing industry participants by the Fisheries Division and other relevant government departments. Other notable provisions in the plan include an exclusion zone for larger vessels that reserves fishing within 50 miles from shore for vessels under 12.5 m in length, and a trip limit of five sharks caught incidentally during tuna targeting operations, with an exemption for vessels under 12.5 m in length from the requirement to land carcasses with fins.

TABLE 11.7

Common species in Samoa's spearfishing catch

Samoa name	English name	Scientific name
Alogo	Lined surgeonfish	<i>Acanthurus lineatus</i>
Pone	Striated surgeonfish	<i>Ctenochaetus striatus</i>
Fuga	Five-banded parrotfish	<i>Scarus ghobban</i>
Saesae	Unicornfish	<i>Naso</i> spp.
Laea	Parrotfish	<i>Scarus</i> spp.

Source: Gillett and Moy (2006).

The Fisheries Division Annual Report for fiscal year 2014–2015 states that a review of the Tuna Management and Development Plan 2011–2015 was carried out in May 2015 with technical assistance provided by the Forum Fisheries Agency (FFA) and SPC. The review looked at what had been achieved and priorities for a new plan. The discussions during the review mostly focused on how to implement Samoa’s allocation for South Pacific albacore and how to operationalise this allocation in different sectors of the commercial fishing community.

Coastal fisheries management in Samoa is largely the responsibility of the 230 coastal villages. Village-level management was enhanced considerably in the mid and late 1990s by the Community-based Fisheries Management Program (Box 11.2).

BOX 11.2

Community-based Fisheries Management Program

The Community-based Fisheries Management Program (CBFMP) was initiated in 1995 with assistance from the Australian Agency for International Development to provide coastal villages in Samoa with much needed advisory assistance. The process used a “bottom-up” approach to management in that each participating village develops its own strategy to manage its marine resources and its environment, rather than being told what to do by a government authority. The Fisheries Division is mandated to develop sustainable conservation and fisheries management measures under the Fisheries Act 1988; therefore, the Fisheries Division works with communities to pursue fisheries development and marine conservation, and to provide technical assistance. To date, 98 villages work collaboratively with the Fisheries Division under the CBFMP with 73 active fish reserves, 1 with protected mangroves only. Two other districts, Safata and Aleipata, are under a marine protected area program overseen by the Ministry of Natural Resources and Environment; the rest were inactive due to some localized and unforeseen issues within their communities. The Fisheries Division is working on reactivating all of these fish reserves as well as involving new communities in the CBFMP. One of the conservation and resource management procedures adopted by the communities participating in the program is the establishment of village-owned fish reserves in lagoon waters. It is a practical management strategy to protect the biodiversity of the marine and fish species and to enhance depleted coastal fisheries resources. The fish reserve areas vary among communities, depending on the lagoon area and also take into consideration that most communities reserve a portion of the marine environment and leave the rest for fishing activities for family consumption. The CBFMP identifies various communal issues as listed in each village’s Fisheries Management Plan, incorporates bylaws into the Fisheries Act (which legalizes communal management initiatives), and assists communities with managing their own marine environment, especially controlling fishing activities from outside villagers.¹⁰

Source: Tiitii *et al.* (2014).

Management objectives

The Fisheries Management Act 2016 gives fisheries management objectives in only very general terms:

¹⁰ The 2015/2016 issue of the Samoa Fisheries Newsletter stated that from July to September 2015, a total of four new sites joined the Community-based Fisheries Management Program. So far, more than 100 sites have joined the program since its establishment in 1995.

“Management decisions are based on the best information available and are designed to maintain or restore stocks at levels capable of producing maximum sustainable yield, or any other approved reference points, as qualified by relevant environmental, social and economic factors, and taking into account fishing patterns and the interdependence of stocks.”

The Samoa Tuna Management and Development Plan 2011–2015 states: “The Plan will pursue the following objectives through the management of tuna fishing:

- a) Continuing to strengthen the exercise of sovereign rights of Samoans over tuna.
- b) Increasing the economic gains received by Samoa through exercising its rights over tuna and through optimal management of the fishery.
- c) Contributing to the sustainable management of tuna resources and the associated ecosystem, including through effective participation by Samoa in regional activities.
- d) Continual recognition of cultural values in tuna policy and planning, particularly the importance of the contribution of tuna to food security, and protection of the interests of small-scale fishers.”

For coastal management, the Samoa Coastal Fisheries Management and Development Plan 2013–2016 (Fisheries Division, 2013) indicates that the overall goal of interventions in coastal fisheries is to ensure sustainable food security and livelihoods through sustainable utilisation, development and management of coastal fisheries in Samoa. The objectives of the plan provide some degree of insight into coastal fisheries management objectives:

- To develop fishery management plans for the conservation, sustainable development and management of coastal fisheries in Samoa.
- To encourage and strengthen the participation of communities in management of the coastal and marine resources.
- Improved monitoring of programmes to document the status of resources and detect changes in abundance, size and structure of stocks, and in the catches and their utilization.
- To enhance food security, community livelihoods and economic growth through sustainable development and management of coastal fisheries.
- To promote applied scientific research to ensure sustainability of coastal resources, taking into account traditional knowledge and practices.
- To preserve, protect, develop and, where possible, to restore or enhance the coastal fisheries resources and habitats of Samoa.
- To strengthen the capacity of the Fisheries Division in research and analysis activities, and enhance the capacity of Samoan communities to respond effectively to climate change.

Because much of the coastal fisheries management in Samoa occurs at the village level, many villages have their own management schemes and objectives. Because there are about 230 coastal villages in Samoa, the number of management schemes and associated objectives is quite large. A typical objective for village-level management in Samoa is given in King *et al.* (2001): “To protect the marine environment in order to increase the number of fish and shellfish available for present and future generations.”

Management measures and institutional arrangements

Management measures for the offshore tuna fishery are given in section 11.3.2.5 above. Briefly, the measures include licence caps, licence fees, an exclusion zone for large vessels, limits on shark catches, and mandatory landing of shark carcasses with fins.

At the national level, management measures for coastal fisheries include requirements for fishing licences, minimum size limits for fish, marine protected areas (MPAs), re-stocking efforts, and development of alternative livelihoods to reduce coastal fishing effort.

A large number of management measures are formulated and applied at the village level. A report on the status of village fishery management (King and Fa’asili, 1998)

gives the management tools in use at the village level (Table 11.8). Figures in the right-hand column indicate the percentage of all villages using the particular measure. Those measures are largely still in use at present.

TABLE 11.8
Village-level management measures

Action/Regulation	Percentage
Banning the use of chemicals and dynamite to kill fish.	100%
Banning the use of traditional plant-derived fish poisons.	100%
Establishing small protected areas in which fishing is banned.	86%
Banning other traditional destructive fishing methods.	80%
Organizing collections of crown-of-thorns starfish.	80%
Enforcing (national) mesh size limits on nets.	75%
Banning the dumping of rubbish in lagoon waters.	71%
Banning the commercial collection of sea cucumbers.	41%
Banning the capture of fish less than a minimum size.	41%
Banning removal of mangroves (in villages with mangroves).	27%
Restricting underwater torches for spearfishing at night.	21%
Banning the removal of beach sand.	14%
Placing controls or limits on the number of fish fences or traps.	<10%
Prohibiting the collection of live corals for the aquarium trade.	<10%
Banning the coral-damaging collection of edible anemones.	<10%
Protecting areas where palolo worms are traditionally gathered.	<10%
Offering prayers for the safe-keeping of the marine environment.	<10%

Source: King and Fa'asili (1998).

The institutional arrangements for fisheries management are discussed in section 11.7 below.

11.3.2.6 Fishing communities

The concept of “fishing communities” is not very relevant to Samoa. Those individuals that are involved in the offshore fisheries do not live in separate communities, but rather are widely dispersed around where the vessels are based, mainly the Apia urban area. Nearly all households in coastal villages are involved in coastal fishing activities – mainly for subsistence but often selling the surplus.

11.3.3 Inland sub-sector

Compared to the marine fisheries of Samoa, the production from inland fisheries is quite small. According to officials of the Fisheries Division, the total annual inland harvest is unknown but likely to be about 10 tonnes per year. The main freshwater fishery species are tilapia (there are occasionally roadside sales near lakes), eels and freshwater shrimps. The Asian Development Bank (ADB, 2008) reports that 2 percent of all households in Samoa do at least some fishing on inland rivers and lakes.

Where inland fishing is managed, it is done so on a village level. It is likely that the management is oriented to protecting the flow of freshwater foods to the village.

11.3.4 Aquaculture sub-sector

The history of the development of aquaculture in Samoa is given in Box 11.3.

From Box 11.3, it can be seen that aquaculture activities have been attempted in Samoa to:

- increase production of fish and invertebrates
- create/enhance aquaculture-related employment

BOX 11.3
Aquaculture development in Samoa

During the 1970s and early 1980s, several commodities were introduced to Samoa for aquaculture projects. Seaweed (*Kappaphycus alvarezii* and *K. denticulatum*) were initially introduced in 1975. The Fisheries Department conducted culture trials on seaweed in 1991, but these ceased in 1992. In 1978, FAO funded aquaculture trials of the top minnow or mollie (*Poecilia mexicana*) as baitfish for pole-and-line fishing operations. While the trials were successful, the project was abandoned in 1983 because of the economics of the operation. The tiger prawn (*Penaeus monodon*) was introduced from Tahiti in 1979 by the Fisheries Division and FAO, with the aim of testing the commercial viability of production; however, this project did not develop any further. Trials for culturing and growing Philippine green mussels (*Perna viridis*) began in Samoa in 1981 at four sites; however, by 1983, operations had stopped at two locations due to localised problems. Juvenile mussels were imported from Tahiti for the trials, and were reared on ropes attached to rafts. The 1983 trials allowed them to spawn; however, there was no success at collecting the spat. Trials continued through the 1980s, although the project was discontinued by 1990. The giant clam (*Tridacna derasa*) was first imported from Palau in 1982, which led to a private sector commercial farm being set up; however, the farm was destroyed by the 1990 and 1991 cyclones. The Fisheries Division also imported clams (*Tridacna* spp. and *Hippopus* spp.) in 1987 from several locations (Palau, Tokelau, Australia, Solomon Islands, Fiji and American Samoa), mainly for farming and restocking purposes. The cyclones also affected this operation. The AusAID community management project in the mid to late 1990s introduced hatchery-reared clams to village fishing reserves established under the project, with around 1 700 young clams provided to villages in 1999/2000. The recommendations of this project also led to the establishment of the Toloa giant clam hatchery in 2000. The Toloa hatchery continued to propagate giant clams, with around 60 000 juveniles (around 4 cm in length) being cultured on-site in 2003, but a lot of the broodstock for the hatchery perished in January 2004 as a result of Cyclone Heta. Two other species were introduced to Samoa in 1990: the Pacific oyster (*Crassostrea gigas*) and the commercial topshell (*Trochus niloticus*, also known as *Tectus niloticus*). The oysters came from California and the trials were to test commercial viability; however, after the harvest in 1991, there was no further activity due to constraints that could not be overcome. The trochus were brought in from Fiji under an FAO/Fisheries Division project for seeding to enhance the resource. The green snail (*Turbo marmoratus*) was introduced to Samoa in April 1999, when 300 individuals were imported from Tonga. The animals were held in quarantine at the Fisheries Department's raceway ponds before being released at three locations that had the appropriate habitat. A tilapia demonstration farm was established in 1993, which also saw the introduction of the Nile tilapia (*Oreochromis niloticus*), although some early problems were encountered with feed quality and management at the farm. Several other tilapia farms were subsequently established and, by 2000, there were 19 tilapia farms: 11 on Upolu and 8 on Savaii. From October 1999 to May 2000, around 4 000 tilapia were stocked in 9 ponds. In 2004, the Fisheries Division's hatchery was upgraded with assistance from SPC, to allow for increased production of Nile tilapia fingerlings. Tilapia rearing was not confined to ponds, and a project was undertaken in 2006/07 to restock Lake Satoalepai on the island of Savaii. This lake had originally been stocked with Mozambique tilapia in 1966 and was restocked with Nile tilapia in 1994 and 2003. In July 2006, 10 000 Nile tilapia fingerlings were transported from the Apia hatchery, tagged (clipping of the right pelvic fin with scissors) and released into the lake.

Source: Modified from Vunisea (2008).

- introduce new species to enhance food production or create export opportunities
- alleviate pressure on overexploited reef and lagoon fishery resources.

A review of aquaculture in Samoa in 2001 (Rimmer *et al.*, 2001) stated that aquaculture in Samoa could be broadly divided into two types:

- Village-level aquaculture – mainly involving Nile tilapia aquaculture in local waterways, and the provision of giant clams to participating villages.
- Commercial aquaculture – this had not developed in Samoa, despite attempts using a range of species.

In 2015, an SPC study (Gillett, 2016) estimated aquaculture production across the Pacific Islands, including Samoa. From discussions with Fisheries Division staff and a review of documentation, the study concluded that, in 2014, about 12 tonnes of tilapia were produced. As the farm-gate price was about WST 5.00–6.00 (USD 2.09–2.51) per kg, the annual production was worth about WST 66 000 (USD 27 615). The study also noted that, although in Samoa there is some culture of tridacna, seagrapes, mudcrabs and prawns, the amounts produced and sold in 2014 were very small.

The Samoa Aquaculture Management and Development Plan (SPC, 2012) identifies a vision and goal for aquaculture in Samoa. The vision is that “long-term benefits of socio-economic growth for Samoa accrue as a result of development of the aquaculture sector in a sustainable and responsible way, as an income-generating activity alternative to capture fisheries”. The plan also states: “The overall goal is to ensure food and nutritional security and improve rural and urban livelihoods through sustainable and responsible development and management of the aquaculture sector in Samoa.”

The Samoa Aquaculture Management and Development Plan has eight objectives that support the development and management of aquaculture in the country:

- To promote better aquaculture management practices
- To improve the marketability of aquaculture products in Samoa
- To diversify the number of aquatic species that can be cultured in Samoa
- To improve the quality and availability of lower-cost feeds for aquaculture
- To ensure access by farmers to the best possible genetic quality of seed stocks
- To promote private sector development
- To improve human resource capacities to manage and develop aquaculture
- To improve aquaculture networking.

11.3.5 Recreational sub-sector

Although subsistence fishing may have a large social component and be enjoyed by the participants, there is little recreational fishing in the village as a leisure activity. In Apia, there is some sport fishing (mainly offshore trolling) and occasionally there are sport-fishing competitions. Some hotels offer fishing as an activity for guests.

11.4 POST-HARVEST SECTOR

11.4.1 Fish utilization

Samoa’s latest Annual Report to the WCPFC (Fisheries Division, 2016b) states that over half of total tuna exports go to the canneries in American Samoa as frozen tuna, while the rest is exported fresh chilled, mostly to Japan and the United States. The catch from offshore fisheries that is not exported is sold locally, mostly in the Apia fish market.

McCoy *et al.* (2015) describe tuna-processing facilities in Samoa:

- The main government facility connected to the tuna sector is the Apia Fish Market on the fisheries wharf near the Fisheries Division premises. Originally built by Japanese aid in the early 1980s, the facility is well maintained and includes a small processing area and fish-and-chips takeaway restaurant that is leased to a private operator. Tables in the market itself are rented by individual fish sellers, including

those who deal with inshore products as well as tuna. An adjacent ice machine, which is also run by the Fisheries Division, provides ice to the local small-boat alia fleet.

- There are two private sector, tuna processing facilities. An export-oriented fishing and fish-processing operation, Apia Export Fish Packers Ltd, is located on the fisheries wharf adjacent to the Fisheries Division premises. The facility processes the catch of the company's nine, large, longline vessels based in Apia. Production includes fresh and frozen albacore and yellowfin loins and fillets for export and local sale. Also processed are mahimahi, wahoo and occasionally swordfish. A second facility has been built in the main Apia wharf area to handle the catch of the Taiwanese vessels that have been licensed recently. The facility will be used to pack and export whole gilled and gutted fish, with possible loining as staff become trained and facilities are expanded. The facility, Apia Deep Sea Fishing Co., had obtained all the necessary permits and approvals, but had not yet commenced operations in February, 2015.

Fish from coastal fisheries is largely for domestic consumption, but some is exported by Samoans travelling overseas. There is typically little processing involved prior to sale, although for some types of seafood, the preparation can be elaborate (Box 11.4).

BOX 11.4

Preparation of sea cucumbers in Samoa

Sea cucumbers are harvested for subsistence and artisanal use, and are consumed either raw or bottled with sea water. The two main target species are *Stichopus horrens* (dragonfish), which is fished for its viscera, and *Bohadschia vitiensis* (brown sandfish), which is fished for its body wall. Other bottled sea cucumber species are sold at prices of between WST 15 to WST 25 (USD 6.28 to USD 10.46). Some fishers selling these products engage in the practice of filling the bottles with alternative invertebrates or algae (mixed bottles), depending on what they find or catch on a fishing trip, such as a mix of brown sandfish body wall with seagrape (*Caulerpa racemosa*), or dragonfish viscera with sea hare eggs (*Dolabella auricularia*). These mixed products have become more diverse in type, as well as having a greater variation in bottle volumes, rather than the traditional 285 ml and 750 ml bottles.

Source: Samoa Sea Cucumber Fisheries Management and Development Plan.

11.4.2 Fish markets

The main fish market in Samoa is the Apia Fish Market (described in the section above). Fish is also sold at the Fugalei Agriculture Market on the Apia–Faleolo roadside, and at the Salelologa Market. There are also informal roadside sales.

According to the Fisheries Division Annual Report for FY 2014–2015, the Apia Fish Market handled 43.79 percent of seafood sales in Samoa, followed by roadside sales (27.28 percent), Salelologa Market (16.32 percent) and Fugalei Agriculture Market (12.61 percent).

The catch from subsistence fisheries is consumed in the coastal villages near where it is caught, but some is shipped to friends and family in Apia. The giving of fish for cultural purposes (faasoso) is important in Samoa. Most of this occurs domestically, but a significant amount of faasoso fish is exported.

The small amount of inland and aquaculture production is mainly for subsistence purposes, but some roadside sales of tilapia occur.

11.5 SOCIO-ECONOMIC CONTRIBUTION OF THE FISHERY SECTOR

A recent study by SPC (Gillett, 2016) attempted to quantify the fishery-related benefits received by Samoa and other Pacific Island countries. The study gave the available information on the contribution of fishing to GDP, exports, government revenue, employment, and nutrition. Unless otherwise noted, the information in this section is from that study.

11.5.1 Role of fisheries in the national economy

The Samoa Bureau of Statistics makes the official estimates of GDP. Information on the fishing sector contribution is given in Table 11.9.

TABLE 11.9
Official estimate of the fishing contribution to Samoa's GDP

GDP (current market prices; local currency '000s)	Fishing GDP contribution (local currency '000s)	GDP (USD '000s)	Fishing GDP contribution (USD '000s)	Fishing as % of GDP	Year of GDP estimate
1 922 057	57 467	804 208	24 045	3.0%	2014

The contribution of fishing to Samoa's 2014 GDP was re-estimated in 2015 by an SPC project using a standard methodology developed for the fishing sectors of Pacific Island countries. That study indicated that the fishing contribution was 3.4 percent of Samoa's GDP (i.e. 0.4 percent greater than the official estimate). It is likely that the official estimate is smaller than that of the recalculated estimate because it makes use of fisheries production information from a household income and expenditure survey, and not from the fisheries surveys.

Many Pacific Island countries receive substantial government revenue from foreign fishing activities in their zones. In 2014, the only authorized foreign fishing in the Samoa zone was by the purse-seine vessels covered by the US tuna treaty. Although there was no fishing by that fleet in Samoa waters in 2014, the country received a payment. According to FFA staff, for the 26th licensing period of the treaty (the one-year period ending June 14, 2014), Samoa received USD 555 815 (WST 1 328 395) as its share of the treaty money that is divided equally amongst all parties. The total revenue of the Samoan government for the fiscal year ending 30 June 2014 was WST 473.6 million. Therefore, WST 1 328 395 in access fees is equivalent to 0.3 percent of the total revenue of the Samoan government for that year.

11.5.2 Trade

The quarterly merchandise trade report for March 2015 (SBS, 2015) gives Samoa's fish exports and total exports. In 2014 WST 5 562 000 (USD 2 327 197) of fish was exported. This represented 4.7 percent of all the exports of the country for the year. The report states that in 2013, WST 10 740 000 (USD 4 609 000) worth of fish was exported.

FAO export data for 2013 reports that USD 5 543 000 worth of fish was exported. The reason for the difference between the Samoa Bureau of Statistics (SBS) and FAO export data is unclear, but it is likely due to the difference between values declared by exporters (SBS data) and values determined by importing countries (FAO data). For 2014, as reported in Part 1 of this profile, the value for fisheries exports was USD 2 520 000.

According to Fisheries Division staff, starting in 1997 export bans on several types of fishery products (coral, aquarium fish and beche-de-mer) have resulted in almost all commercial fishery exports in recent years being tuna products.

The FAO data in Part 1 indicate that in 2014, USD 6 668 000 worth of fishery products were imported.

11.5.3 Food security

Table 11.10 below summarizes historical estimates of fish consumption in Samoa. It can be seen that there is some inconsistency, or at least lack of clarity, in what is being measured (fresh fish only, fresh plus canned) and how it is measured (fish actually consumed versus whole fish equivalent).

TABLE 11.10
Estimates of per capita fisheries consumption in Samoa (various years)

Source	Year of estimate	Estimate	Comments
Tiitii <i>et al.</i> (2014)	2012	Finfish: Annual per capita consumption is 46.15 kg Invertebrates: Annual consumption is 54.74 kg Canned fish: Annual consumption is 28.61 kg	Report contains the note: Invert consumption refers to "whole fish equivalent"; for example, for giant clams, includes weight of shells
Bell <i>et al.</i> (2009b)	2001 to 2006	From HIES surveys conducted between 2001 and 2006, annual per capita fish consumption (whole weight equivalent) was 45.6 kg for urban, and 98.3 kg for rural.	
Mulipola <i>et al.</i> (2007)	2006	Fresh fish: Average frequency of consumption of finfish = 2.8 per days/week; inverts= 0.8 days/week Average annual per capita consumption = 59.4 kg (163 g/day) Total annual consumption = 10 508 mt (7 900 mt for Upolu, 2 608 mt for Savaii) Tinned fish: Average frequency of consumption = 4.5 days/ week Average annual per capita consumption = 73 kg (206 g/person/day) 8 120 mt of tinned fish consumed per year in Samoa	Based on asking people to estimate their usual catch. Study appears to use food actually consumed
Lambeth (2001)	1990s	Women contribute around 23% of the total weight of seafood. Because women collect the majority of marine invertebrates in Samoa, it is estimated that they provide 20% of the per capita seafood consumption of 71 kg per year, consisting of 44 kg of fresh fish, 13 kg of invertebrates and seaweed, and 14 kg of canned fish	Gender-oriented survey applied to earlier consumption data
Passfield (2001)	2000	Average annual per capita consumption of [local] seafood is 57.0 kg, made up of 44.0 kg of fish, and 13.0 kg of invertebrates and seaweed. In addition, annual canned fish consumption per capita is 14.0 kg; total (local plus imports) is 71.0 kg per capita per year.	Survey was based on respondents' recall of their fishing activities and seafood consumption patterns; used whole fish equivalent
Preston (2000)	1995	46.3 kg of fish per capita per year	Based on FAO production, import and export statistics

11.5.4 Employment

A socio-economic fisheries survey was carried out in June and July 2012 (Tiitii *et al.*, 2014). Overall, the survey found that fishing is third to agriculture and paid salary in terms of income source. Nonetheless, fishing remains an extremely important source of household income in the villages under study. On average, 14 percent of all households

ranked fishing as their first source of household income. The average for households in coastal communities was higher at 18 percent. The report of the survey contained a considerable amount of information on the gender aspects of fishing (Box 11.5).

BOX 11.5

Gender aspects of coastal fishing in Samoa

Male and female fishers are mainly commercially oriented for finfish (*sic*). All fishers target mostly coastal reef and lagoon habitats, and only men fish for pelagic fish or in the open seas and mangrove areas; there are a few women, however, who fish on the outer reefs. For invertebrates, women target mostly soft bottom species, while men mainly glean and dive for clams, octopus, lobster, mother-of-pearl and beche-de-mer, and equally target reef tops and mangrove areas. Most fishers go out exclusively during the day, while the rest fish both night and day, depending on tidal and weather conditions. Reef gleaning is performed only during the day by both men and women, while some diving for invertebrates, such as lobsters, trochus, giant clams and sea cucumbers, is performed at night. Boats are used mainly by men when diving and/or gleaning, especially for sea cucumbers, trochus, turban shells and seagrapes, while few women use boats when they glean. Both men and women fish around three times per week, with men fishing for an average of four hours and catching 13.7 kg per fishing trip, and women fishing for an average of five hours and catching 10 kg per fishing trip. Men fish about 10 months out of the year, and women fish for about 9 months out of the year. About 86 percent of male fishers and 91 percent of female fishers used one technique per fishing trip. Catch per unit of effort for men is 4.3 kg/hour and for women it is 2.22 kg/hour. The frequency of fishing for men diving for invertebrates is five times per week for an average of three hours per fishing trip, over 10 months of the year. Gleaning takes place three times per week, for an average of three hours per fishing trip over seven months of the year. Women, on the other hand, spend three hours diving for invertebrates four times per week, for an average of nine months out of the year. Women glean two times per week, for an average of 2.5 hours over seven months of the year.

Source: Tiitii *et al.* (2014).

An agricultural census (which included fisheries) was conducted in Samoa in 2009 as a joint exercise by the Samoa Bureau of Statistics and the Ministry of Agriculture and Fisheries (SBS, 2012). The 2009 census aimed to measure household agricultural activity. The results were able to be compared with those of a previous agriculture census in 1999. Some of the fisheries-relevant results were as follows:

- The total number of households engaged in fishing during the reference period was 5 752. Of these, 63 percent of households engaged in fishing reside in Upolu and 37 percent in Savaii. Samoa's vulnerability to abnormal weather patterns coupled with the devastating tsunami in 2009 are likely to be contributing factors to the significant drop of 14 percent in the total number of households engaged in fishing activities since 1999.
- The main purpose of engaging in fishing was for home consumption only. However, some households also occasionally sold some of their catch. As reported in 2009, only 146 households (2.5 percent) out of 5 752 fished mainly for commercial purposes: 1 842 (32 percent) occasionally sold fish and the majority of 3 764 (65 percent) engaged in fishing for household consumption only.
- Fishing appears to have grown as a minor source of income when comparing 2009 to 1999. In 2009, 39 percent of fishing households sold some or all of their catch,

compared to 33 percent in 1999. In 2009, 14 percent of households engaged in fishing reported having sold about a quarter of their fish catch, 12 percent sold about half, 10 percent sold three quarters and 2.2 percent sold all their catch.

- On average, two members of each fishing household engaged in fishing in 1999 and 2009. There were more males (81 percent) than females (19 percent) involved in fishing activities in 2009. However, when comparing 1999 and 2009, there was an increase of 28 percent in the number of females engaged in fishing, while the number of males engaged dropped. This is consistent across the regions except in Apia where both the number and proportion of females engaged in fishing dropped.

11.5.5 Rural development

Rural development is a major thrust of the government's efforts in the fisheries sector. A major component of the work programme of Fisheries Division is to enhance the capabilities of villages to manage their coastal fisheries resources, as an integrated part of village development. In addition, the Fisheries Division has major involvement in rural extension activities, and in supporting rural port facilities at the village level.

Unlike many other countries, all villages in Samoa are within an easy commute of the largest urban area – so halting the rural-urban drift is not a major government policy objective. Rather, the major issue in population movement is migration to overseas countries, especially New Zealand.

11.6 TRENDS, ISSUES AND DEVELOPMENT

11.6.1 Constraints and opportunities

Some of the major constraints for the fisheries sector in Samoa are:

- the small size and limited productivity of the village fishing areas;
- the small area of the Samoa EEZ – the smallest of any Pacific Island country;
- the difficulties associated with developing a small-scale offshore fishery, especially the sea-safety issues associated with longlining from small catamarans;
- considerable dependence on fish-processing facilities in a neighboring country, which have an uncertain future;
- lack of inexpensive air transport to markets for fresh chilled tuna;
- with growing exploitation of albacore, the increasingly noticeable seasonality of the resource;
- crowded conditions in Apia Harbour (expanded on in Box 11.6).

Opportunities in the fisheries sector include:

- value-adding to fishery products, for both domestic consumption and export;
- cooperation with neighboring countries to enable greater exploitation of the offshore resources outside the Samoa EEZ;
- greater use of FADs to promote offshore fishing by small-scale fishers;
- stronger linkages to the expanding tourism industry;
- taking advantage of the relatively easy transport from rural areas to urban markets.

11.6.2 Government and non-government sector policies and development strategies

In a general sense, the major government policies in fisheries are to stabilize the harvests in the offshore commercial fishery, and to devolve responsibility for management of inshore fisheries to villages.

At a more detailed level, the policies and development strategies are best articulated in the latest Coastal Fisheries Management and Development Plan and Tuna Management and Development Plan.

The Samoa Coastal Fisheries Management and Development Plan 2013–2016 (Fisheries Division, 2013) indicates that the overall goal is to ensure sustainable food

BOX 11.6
Conditions in Apia Harbour

The current fisheries boat basin is crowded at times, but offers sufficient space for vessels active in the tuna fishery that land their catch and take on supplies. Any expansion of those fleets would quickly make things worse and contribute to inefficiencies in the industry. In spite of improvements in recent years, the boat basin is still relatively unprotected and susceptible to bad weather. A further major limitation to expansion of the domestic fleet is the lack of a slipway and other support facilities, which means only minor maintenance can be done in the country. Better repair facilities are available in American Samoa. However, they are expensive and larger vessels are given priority. These limitations make Samoa an unattractive location for further investment in locally based vessels of the size and type that now are used in the fishery, unless perhaps that investment involves the replacement of existing vessels.

Source: McCoy et al. (2015).

security and livelihoods through sustainable utilisation, development and management of coastal fisheries in Samoa. The strategies of the plan are:

- to develop fishery management plans for the conservation, sustainable development and management of coastal fisheries in Samoa;
- to encourage and strengthen the participation of communities in management of the coastal and marine resources;
- to improve monitoring of programmes to document the status of resources and detect changes in abundance, size and structure of stocks, and in the catches and their utilization;
- to enhance food security, community livelihoods and economic growth through sustainable development and management of coastal fisheries;
- to promote applied scientific research to ensure sustainability of coastal resources, taking into account traditional knowledge and practices;
- to preserve, protect, develop and, where possible, to restore or enhance the coastal fisheries resources and habitats of Samoa;
- to strengthen the capacity of the Fisheries Division in research and analysis activities, and enhance the capacity of Samoan communities to respond effectively to climate change.

The Samoa Tuna Management and Development Plan 2011–2015 contains the following policy statements: (a) Continuing to strengthen the exercise of sovereign rights of Samoans over tuna; (b) Increasing the economic gains received by Samoa through exercising its rights over tuna and through optimal management of the fishery; (c) Contributing to the sustainable management of tuna resources and the associated ecosystem, including through effective participation by Samoa in regional activities; and (d) Continual recognition of cultural values in tuna policy and planning, particularly the importance of the contribution of tuna to food security, and protection of the interests of small-scale fishers.

The development strategies in the plan are to:

- provide an enabling environment that will promote and encourage private sector development in the commercial fishing, processing and support sectors in Samoa;
- maintain and expand the export of tuna and tuna products from Samoa;
- promote the development of new markets for Samoan tuna;
- promote value-adding to tuna catches in Samoa, to maximise local employment, and produce a high-value product for both domestic and export markets;

- encourage the private sector to enter into joint ventures with foreign investors to establish viable fishing operation with shore facilities for processing and exporting fresh or processed tuna based in Samoa;
- increase the catches of the Samoan tuna fleet through the negotiation of access arrangements with neighbouring countries and territories and through the chartering of vessels to fish on the high seas;
- increase the participation of private sector interests in tuna fishing through the provision of infrastructure needed to foster development, such as anchorage for fishing vessels, and constructing support services, such as ice-making machines for processing and/or storage facilities, including in rural locations;
- explore the feasibility of ‘super alia’ vessels, or other suitable alternatives to improve the economics of the fishery and increase safety at sea;
- strengthen the performance of the Competent Authority on fish and fishery products destined for exports;
- ensure that all developments are sustainable and economically viable, with benefits flowing directly to the local people.

The private sector’s policies are not formalized. Judging from the attitudes and recent action of the companies engaged in offshore fishing, the main policy is not one of expansion but rather survival during periods of poor albacore fishing.

11.6.3 Research

A large amount of fisheries research has been undertaken in Samoa over the years. Much of the older work is listed in the “Western Samoa fisheries bibliography” (Gillett and Sua, 1987). The research carried out on the main fishery resources in Samoa is summarized in the “Western Samoa fisheries resources profiles” (Bell and Mulipola, 1995).

Current fisheries research, as listed in the latest available annual report of the Fisheries Division (Fisheries Division, 2014), includes:

- ecological assessments of fish reserves
- trochus baseline survey
- fish landings in domestic markets
- palolo rising survey
- ciguatera fish poisoning monitoring.

There is also an active tuna research programme that collects catch and effort data from the locally based longliners. This information is analyzed by the Fisheries Division and by SPC’s Oceanic Fisheries Programme in New Caledonia.

11.6.4 Education and training

Education related to fisheries in Samoa is provided by a variety of institutions:

- Academic training in biological, economic and other aspects of fisheries is given at the University of the South Pacific in Suva, Fiji.
- Maritime training is available at the National University of Samoa.
- Training courses are frequently organized by the following regional organizations: SPC in New Caledonia and FFA in the Solomon Islands.
- Courses and workshops are also given by NGOs and bilateral donors, such as those by Japan.
- Many government fisheries officers and other professionals have received advanced degrees in fishery-related subjects at overseas universities, especially those in New Zealand, Australia and Hawaii.

11.6.5 Foreign aid

The largest fisheries-related programme in Samoa in recent years has been the Australian-funded Samoa Fisheries Project. The project had major involvement in the promotion of management of coastal resources by adjacent communities and

of conventional management of offshore fishing. A re-orientation of the Fisheries Division to a stronger focus on fisheries stakeholders was a major achievement. The project concluded in 2003, but the positive impact of that work is still very evident today.¹¹ That programme is arguably the most effective national capacity development initiative ever carried out in the fisheries sector of any Pacific Island country.

Bilateral programmes of technical cooperation, collaboration and assistance have been provided by the governments of Australia, China and Japan, and by the European Union. Multilateral donors include UNDP and FAO. Samoa also enjoys technical assistance or the channelling of multilateral donor assistance from various regional agencies, including FFA and SPC.

11.7 INSTITUTIONAL FRAMEWORK

Government responsibility for fisheries and marine resource matters is vested in the Fisheries Division of the Ministry of Agriculture and Fisheries. It is headquartered in Apia, on the waterfront near the Apia Fish Market.

The Fisheries Division is one of seven divisions of the Ministry of Agriculture and Fisheries. The Division, which is headed by an Assistant Chief Executive Officer, has several components including Coastal Fisheries, Offshore Fisheries, Enforcement, Administration, Aquaculture and Extension.

According to the Ministry's website (www.maf.gov.ws), the Fisheries Division undertakes research, analysis, monitoring and reporting to facilitate the development of fishery resources in Samoa, and promotes the involvement of communities, fishers, private investors and relevant stakeholders in the adoption of sustainable fisheries practices and sustainable development and management of fisheries.

Under the Fisheries Management Act 2016, the functions of the Fisheries Division are:

- (a) to liaise with international, regional and government agencies and village communities on issues affecting the development and management of fisheries resources and their environment;
- (b) to assist government agencies, villages, non-government organizations and stakeholders meet their obligations under this Act;
- (c) to advise government agencies, villages and other communities on the management of coastal fisheries resources, aquaculture, environment and the protection and conservation of the fishery resources for the present and future generations of the people of Samoa;
- (d) to monitor activities and proposals in other sectors and advise the Minister concerning their effect on fisheries;
- (e) to establish, operate, maintain, and administer government facilities for fishing and related activities;
- (f) to act in combination or association with any other person whether in Samoa or another country, for the purposes of this Act;
- (g) to manage finance incurred for the purposes of this Act and to collect prescribed fees for services rendered under this Act;
- (h) to carry out any other function determined by the Chief Executive Officer and to do any other thing to give effect to the objects or for the purposes of the Act.

The Commercial Fisheries Management Advisory Committee (CF-MAC) is the official body that represents the offshore fishing industry. The Committee comprises representatives from the private sector and relevant government departments. It includes two elected representatives from the Upolu Fishermen's Association, Savaii Fishermen's Association, Fish Exporters Association and Boat Builders Association, and one appointed representative from the Treasury Department, Fisheries Division, Ministry of Transport, Port Authority and the Department of Trade, Commerce and Industry.

¹¹ This is demonstrated by the documents from that programme that are listed in References.

By their nature, stakeholders in the village fisheries are less formally organized. Individual village councils often consult with representatives of the Fisheries Division. Many villages have fishery management committees made up of local stakeholders in fisheries.

Important internet links related to fisheries in Samoa include:

- www.maf.gov.ws – *website of the Ministry of Agriculture and Fisheries*
- <http://www.spc.int/coastfish/en/countries/samoa.html> – information on Samoa fisheries, links to other sites concerning Samoa and its fisheries, and some SPC reports on Samoa fisheries
- www.paclii.org/countries/ws.html – text of Samoa fishery legislation
- <http://moana.library.usp.ac.fj> – institutional repository for published and unpublished documents produced by the Fisheries Division of the Ministry of Agriculture and Fisheries, Samoa.

11.7.1 Regional and international institutional framework

The major regional institutions involved with fisheries are the Forum Fisheries Agency (FFA), located in Honiara and the Pacific Community (SPC) in Noumea. Other players are the Parties to the Nauru Agreement (PNA) Office in Majuro, the Pacific Islands Forum Secretariat (PIFS) in Suva, the Secretariat of the Pacific Regional Environment Programme (SPREP) in Apia, and the University of the South Pacific (USP) in Suva. The characteristics of those institutions are given in Table 11.11.

TABLE 11.11
Pacific Island regional organizations involved in fisheries

	FFA	SPC	Other regional organizations with fishery involvement
Main area of emphasis	Providing management advice on tuna fisheries and increasing benefits to Pacific Island countries from tuna fishing activities.	Most aspects of coastal fisheries and scientific research on tuna. Fisheries are only one aspect of SPC's work programme, which also covers such issues as health, demography and agriculture.	PNA – subregional grouping of countries where most purse seining occurs; SPREP – environmental aspects of fisheries; USP – School of Marine Studies (SMS) involved in a wide range of training; PIFS – major political initiatives, some natural resource economics; leads trade negotiations with EU, which have a major fisheries component
Inter-regional relationships	The FFA/SPC relationship has had ups/downs over the years. It was most difficult in the early 1990s, but tremendous improvement in mid/late 1990s. An annual colloquium has helped the relationship. Staff who have moved between the two organizations have made a noticeable improvement in understanding. Much of the success/benefits achieved by FFA/SPC cooperation depends on the personalities of FFA's Director/Deputy and SPC's Director of the Division of Fisheries, Aquaculture and Marine Ecosystems.		At least in theory, all regional organizations come under the umbrella of PIFS. Their activities are coordinated to some degree by the Council of Regional Organisations in the Pacific (CROP), which has a Marine Sector Working Group that meets at least once per year, but is limited by lack of resources for follow-up. FFA originally provided secretariat services to the PNA, but the PNA broke away from FFA in 2010. Currently, there are some sensitivities in the relationship, but it appears to be improving.
Main strengths	Direct contact with its governing body many times per year results in a high degree of accountability. Mandate of tight focus on tuna eliminates considerable dissipation of effort.	Noumea being a pleasant place to work, there is considerable staff continuity. The Oceanic Fisheries Programme often sets the standard for tuna research in the world. Documentation of work is very good.	Because PIFS is under the national leaders, it is considered the premier regional organization. PNA has achieved considerable success and credibility in such areas as raising access fees, 100 percent observer coverage, eco-certification, high seas closures, and controls on FADs. USP is centrally located in the region and SMS has substantial infrastructure. SPREP has close ties to NGOs active in the marine sector.
Membership	Australia and New Zealand, plus Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu	Includes the major metropolitan countries, all Pacific Island countries, and the French/UK/US territories; the most inclusive of any regional organization.	PNA: Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. USP: Cook Islands, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. SPREP: 21 Pacific Island countries and territories, plus Australia, France, New Zealand and United States of America. PIFS: same as FFA

Source: Adapted from Gillett (2014a).

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean entered into force in June 2004, and established the Western and Central Pacific Fisheries Commission (WCPFC). Samoa is a member of the commission, along with 26 other countries. The WCPFC has its headquarters in Pohnpei, Federated States of Micronesia, and has held 13 annual meetings to date.

11.8 LEGAL FRAMEWORK

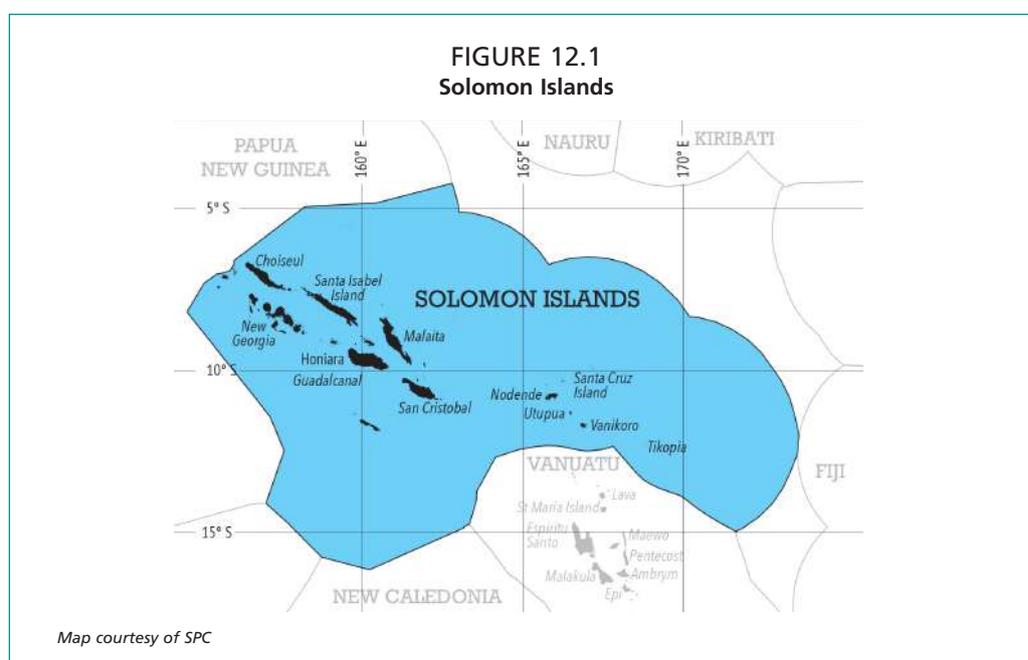
The main legislative instrument relating to fisheries in Samoa is the Fisheries Management Act 2016, more formally known as “An act to regulate and control the conservation, management or development of fisheries and the licensing of Samoan fishing vessels and foreign fishing vessels and for related purposes”. It is a 75-page document, containing nine parts:

1. Preliminary
2. Administration, treaties and fisheries management plans
3. Licences
4. Fishing activities
5. Processing, trading and marketing of fish and fish products
6. Enforcement
7. Evidence, liabilities and offences
8. Village fisheries bylaws
9. Miscellaneous

Notable features of the Act include the following:

- The precautionary approach (as described in the Fish Stocks Agreement) to the conservation and management of fishery resources must be applied.
- The functions of the Fisheries Division (given in Section 11.7 above) are specified.
- The Chief Executive Officer may declare and mark an area as a village fisheries management area.
- The Minister may declare an area to be a designated fishery, if the Minister considers that: (a) it is in the national interest; and (b) management measures are needed to ensure sustainable use of the fishery resource.
- The Chief Executive Officer must prepare, make and review a fishery management plan for the management of a designated fishery.
- Samoan fishing vessels must be licensed.
- Aquaculture operations outside village fisheries management areas must be authorized by the Chief Executive Officer, and the Fisheries Division must manage any aquaculture activity which is not allocated to a village fisheries management area.
- A licence is necessary for the processing, trading and marketing of fish and fish products.
- A village Fono may make village fishery bylaws, consistent with the Act, for the purpose of conserving, protecting, managing, developing and sustaining harvest of fish in the village fisheries management area.

12. Solomon Islands



REPORTING YEAR

This profile was written in 2017, based on data mostly from 2014.

PART 1. OVERVIEW AND MAIN INDICATORS

12.1 GENERAL GEOGRAPHIC AND ECONOMIC INDICATORS

TABLE 12.1
General geographic and economic indicators - Solomon Islands

Land area ¹	28 370 km ²
Water area ²	1 340 000 km ²
Population (2009) ³	515 870
GDP of Solomon Islands (2014) ⁴	USD 1 024 842 000
Fisheries contribution to GDP (2014) ⁵	USD 25 459 000
Fisheries contribution as a % of GDP (2014) ⁶	2.5

¹ Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

² Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

³ 2009 Census of Population and Housing from Solomon Islands National Statistics Office website: www.statistics.gov.sb.

⁴ Reported in Gillett (2016) from the Solomon Islands National Statistics Office (provisional figure).

⁵ Reported in Gillett (2016) from the Solomon Islands National Statistics Office (provisional figure).

⁶ Reported in Gillett (2016) from the Solomon Islands National Statistics Office (provisional figure).

12.2 FAO FISHERIES STATISTICS

TABLE 12.2

FAO Fisheries statistics on total production, employment and trade – Solomon Islands

2014		
Production (tonnes)	Aquaculture	2
	Capture	73 618
	Total	73 620
Employment (thousands)	Aquaculture	N/A
	Capture	N/A
	Total	N/A
Value of trade (USD 1000)	Fisheries exports	48 511
	Fisheries imports	2 428
	Total	50 939

Source: FAO Statistics and Information Branch of the Fisheries and Aquaculture Department. N/A: Data is not available.

PART 2. NARRATIVE

12.3 PRODUCTION SECTOR

12.3.1 Introduction

Most of the people of the Solomon Islands depend on agriculture, fishing and forestry for part of their livelihood. Most manufactured goods and petroleum products are imported. Natural resources include fish, forests, gold, bauxite, phosphates, lead, zinc and nickel. Agriculture products include cocoa beans, coconuts, palm kernels, rice, potatoes, vegetables, fruit, timber, cattle, pigs and fish. The main industries are based on fish (tuna), mining, timber, palm oil and tourism. Approximately 75 percent of the labour force in 2000 worked in agriculture, 20 percent in services and 5 percent in industry (Pinca *et al.*, 2009b).

The fisheries situation of the country is characterized by the importance of both subsistence fisheries and offshore industrial fisheries. Because 90 percent of the Solomon Islands population lives in remote rural areas, subsistence fishing is of great importance for nutrition. The offshore fisheries are responsible for a large percentage of formal jobs in the country, while both processed and raw tuna are major export commodities. The licence fee for foreign vessels to fish in the Solomon Islands exclusive economic zone (EEZ) is a substantial source of revenue for the government.

Fisheries statistics can be presented in different forms to cater for different purposes. In the Solomon Islands statistics published by FAO (Part 1 of this profile), the presentation follows the international conventions and standards used by FAO and its Member States for reporting catches, which are given by the flag of the catching vessel. Accordingly, the fishery and aquaculture production of the Solomon Islands in 2014 published by FAO (as given in Part 1) was 73 620 tonnes.

In Table 12.3 below, the Solomon Islands fishery production statistics include the catch by Solomon Islands-flagged vessels, the catch by small boats (which do not carry a flag) and the catch from fishing activities that do not involve a vessel (e.g. reef gleaning). The offshore category in the table is defined as the catch from Solomon Islands-flagged, industrial-scale fishing operations that are carried out anywhere in the western and central Pacific Ocean (i.e. inside or outside Solomon Islands waters).

Some comment is required to explain the difference between the information in this table and that in Part 1 of this profile. The estimates in Table 11.3 and 11.4 were made by a study carried out by SPC in 2015 that examined a large number of fishery and economic studies covering the last two decades. It is likely that the basis of the information for the three categories in the FAO statistics in Part 1 above was a more informal conjecture by a nominated person in the Samoa Fisheries Division.

TABLE 12.3
Solomon Islands fisheries production in 2014 (as per FAO reporting standards)

	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Solomon Islands-flagged offshore
Volume (tonnes)	1530 tonnes and 20 000 pieces	10	5 000	5 000	1 254
Value (USD)	773 263	3 800 786	12 848 296	33 027 523	n/a

Units: tonnes unless otherwise stated.

The amounts of production given in the above table differ from those shown in Part 1. The table consists of production estimated from a variety of sources (see SPC study below), whereas the quantities in Part 1 are generally those reported to FAO by the Solomon Islands Ministry of Fisheries and Marine Resources (MFMR). The major difference between the above table and Part 1 is in the category “Solomon Islands-flagged offshore”. The amount listed in Table 12.3 for this category is from the official report of the Solomon Islands (MFMR, 2015) to the Western and Central Pacific Fisheries Commission (WCPFC).

A recent study by the Pacific Community (SPC) presents the fishery statistics of the Solomon Islands in a different way from that of FAO. The SPC study reports the amount of catch in the Solomon Islands fishery waters, regardless of vessel flag. In the study, the catches are placed in different categories, which is useful for other purposes, such as administration of the foreign fishing that occurs in the fishery waters of the Solomon Islands. A summary of fishery production from the SPC study is given in Table 12.4 below.

TABLE 12.4
Fisheries production in Solomon Islands waters, 2014

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Offshore locally based ⁷	Offshore foreign-based ⁸
					Both Solomon Islands- and foreign-flagged vessels	
Volume (tonnes)	1 530 tonnes and 20 000 pieces	2 300	6 468	20 000	41 523	36 573
Value (USD)	773 263	3 800 786	12 848 296	33 027 523	57 520 263	79 228 378

Source: Gillett (2016).

Some comment is required to explain the difference between the information in this table and that in Part 1 of this profile:

- Catches can be given by the flag of the catching vessel (as in the FAO statistics given in Part 1), or by the zone where the catch is made (the “offshore foreign-based” and “offshore locally based” columns in the table above). These two different ways of allocating catches each have their purposes. Attribution by flag is important for consistency with international conventions, while attribution by zone is important for determining fishing contributions to GDP, and managing revenue from licence fees for foreign fishing in a country’s zone.
- There is no fisheries statistical system covering the categories of aquaculture and coastal subsistence/commercial fishing. The estimates above were made by a study

⁷ In the SPC study, “offshore locally based” is the catch in Solomon Islands waters from industrial-scale tuna fishing operations that are (a) based at a port in the Solomon Islands, and (b) generally harvested more than 12 nautical miles offshore.

⁸ “Offshore foreign-based” is the catch in the Solomon Islands zone from catch from industrial-scale tuna fishing operations that are based at ports outside the Solomon Islands. Under the international standardized System of National Accounts (SNA, 2009), those catches do not contribute to the GDP of Solomon Islands.

carried out by SPC in 2015 in which a large number of fishery and economic studies covering the last two decades were examined. It is likely that the basis of the information for the three categories in the FAO statistics in Part 1 above was a more informal conjecture by a nominated person in the Solomon Islands Ministry of Fisheries and Marine Resources.

- Aquaculture production in the Solomon Islands includes non-food items, such as coral for the aquarium trade, which may not be included in the FAO statistics.

12.3.2 Marine sub-sector

12.3.2.1 Catch profile

In the offshore fishery, the domestic fleet⁹ in 2014 consisted of purse-seine vessels and pole-and-line vessels (MFMR, 2015; E. Honiwalu, personal communication, August 2015). Estimates of the volume and value of catches of the four main commercial species of tuna in the WCPFC area have been made by the Forum Fisheries Agency (FFA) using data sourced from SPC's Oceanic Fisheries Programme. Using the "catch by national fleet" and "value by national fleet" spreadsheets of FFA (2015a) the volumes and values¹⁰ can be determined (Table 12.5).

TABLE 12.5
Volume and value of the tuna catch by the Solomon Islands domestic fleet

	2010	2011	2012	2013	2014
Volume of national purse-seine catch (tonnes)	12 965	25 561	26 500	24 769	40 874
Value of national purse-seine catch (USD)	14 764 414	39 666 717	49 987 179	45 308 815	56 538 410
Volume of national pole-and-line catch (tonnes)	-	871	2 135	1 666	649
Value of national pole-and-line catch (USD)	-	1 303 927	3 908 932	2 988 541	834 575.1

Source: Gillett (2016).

For 2014, the combined purse-seine and pole-and-line catch of 41 523 tonnes was worth USD 57 520 263 or SBD 438 879 607 (Gillett, 2016).

The FFA spreadsheet (FFA, 2015a) can be used to estimate the volume and value of the foreign tuna fleet catches in Solomon Islands waters (Table 12.6).

TABLE 12.6
Volume and value of the tuna catch by the Solomon Islands domestic fleet

	2010	2011	2012	2013	2014
Total volume in national waters	195 995	173 482	95 523	127 993	107 999
National fleet volume in national waters	26 907	28 192	28 635	26 418	71 425
Foreign fleet volume in national waters	169 087.79	145 289	66 888	101 574	36 573
Total value in national waters (USD)	388 656 357	377 391 745	291 167 750	309 980 334	322 210 525
National fleet value in national waters (USD)	80 265 435	57 113 221	63 407 189	56 785 179	229 000 668
Foreign fleet value in national waters (USD)	308 390 921	320 278 524	227 760 561	253 195 155	93 209 856
Foreign fleet value in national waters adjusted for bycatch sales and transshipment costs (USD)	262 132 283	272 236 745	193 596 477	215 215 882	79 228 378

Source: Gillett (2016).

⁹ In some recent government publications (e.g. MFMR, 2016) the "national fleet" appears to include foreign-flagged, locally based vessels (i.e. a large number of foreign-flagged longliners). In this report, the "national fleet" and "domestic fleet" are considered to consist solely of Solomon Islands-flagged vessels.

¹⁰ The values from the FFA (2015a) spreadsheet have been reduced by 15 percent to adjust the Bangkok price to a Solomon Islands dockside price.

In 2014, the volume of the catch by foreign tuna vessels in Solomon Islands waters was 36 573 tonnes, with a Solomon Islands dockside value of USD 79 228 378 or SBD 604 512 524 (Gillett, 2016).

It appears that 2014 was not a typical year for offshore fishing in the Solomon Islands zone. It was a strong El Niño year and foreign-based purse-seine catches characteristically move eastward from Papua New Guinea and the Solomon Islands towards Kiribati, Tuvalu and Tokelau during El Niño periods. The increase in catch by the domestic offshore fleet between 2013 and 2014 (almost doubling) could have been due to the increase in the number of purse seiners or to counting some of the catch of the locally based foreign fleet as domestic catch.

Estimates of the catches of the coastal fisheries vary widely. SPC recently examined a large number of Solomon Islands fisheries studies on coastal fishing and used the information selectively to make catch estimates (Gillett, 2016):

- Baitfish for pole-and-line tuna fishing: 32.5 tonnes
- Exported, coastal fishery products: 1 435 tonnes
- Domestically consumed, coastal commercial fishery products: 5 000 tonnes
- Coastal subsistence catch: 20 000 tonnes.

The lack of a fisheries statistical system for coastal fisheries prevents the identification of quantitative trends in these fisheries. There is, however, a general perception that the important coastal resources are increasingly subject to over-exploitation close to urban areas.

A recent study of fishing in four villages in Solomon Islands (Albert *et al.*, 2015) presents evidence showing that, to some degree, fishers compensate for falling catches of reef fish from shallow coral reefs by visiting fishing sites further away, diversifying fishing methods, and targeting pelagic species through trolling.

12.3.2.2 Landing sites

Landing sites for the offshore fishery are diverse. All landings by the local pole-and-line vessels are made at the cannery at Noro in the Western Province. The local purse-seine vessels mostly offload at Noro, either for processing at the local tuna cannery or for transshipment to overseas canneries. Foreign purse-seine vessels either transship out of Honiara, or deliver to a foreign port. When locally based longliners operate, the catches are unloaded in Honiara for air freighting overseas.

Landings from the coastal commercial fishery are made mostly at population centres. Most small-scale commercial fisheries are located near the main urban area of Honiara, and to a much lesser extent, around the towns of Auki on Malaita Island and Gizo in the west.

Subsistence fishery landings occur at villages throughout the coastal areas of the country, roughly in proportion to the distribution of the population.

12.3.2.3 Fishing practices/systems

The number of Solomon Islands-flagged vessels in the offshore fisheries is given in Table 12.7. The purse seiners are responsible for well over 90 percent of the catch of Solomon Islands-flagged vessels.

No discussion of offshore fishing in the Solomon Islands would be complete without some mention of the rise and fall of the Solomon Taiyo Fishing Company. Box 12.1 summarizes the company's story. The Japanese partner pulled out in 2000 during a period known in the Solomon Islands as the "ethnic tensions". Shortly after, the company restructured itself as Soltai Fishing and Processing Ltd but has struggled to survive to the present.

In July 2016, the Solomon Islands skipjack and yellowfin purse-seine and pole-and-line fisheries achieved Marine Stewardship

TABLE 12.7
Volume and value of the tuna catch by the Solomon Islands domestic fleet

Gear type	Number of vessels by year				
	2010	2011	2012	2013	2014
Longline	0	0	2	0	1
Purse seine	5	5	6	7	8
Pole-and-line	3	3	3	3	2
Total	8	8	11	10	11

Source: MFMR (2016).

BOX 12.1

Solomon Taiyo Fishing Company

Before the ethnic tensions, Solomon Islands had the most vibrant domestic tuna fishery of any country in the Pacific: the long-running Solomon Taiyo Ltd, established in 1973 as a joint venture between the Solomon Islands Government (Investment Corporation of Solomon Islands had a 51 percent shareholding since the mid-1980s) and the large Japanese fishing multinational Taiyo Gyogyo (which changed its name to Maruha Corporation in 1993). Solomon Taiyo had a fleet of 21 pole-and-line vessels employing about 900 Solomon Islanders, of which seven were completely localized, the rest with just the positions of Fishing Master and Chief Engineer (sometimes also Captain) held by expatriates. Around 2 200 permanent staff and 800 casuals were employed by Solomon Taiyo. The base at Noro included a large cannery, *arabushi* smoking factory and a fishmeal plant.

Source: Barclay (2008).

Council (MSC) certification (Blaha, 2016). The MSC sets standards for sustainable fishing and supply chain traceability. Organizations meet these standards to demonstrate to consumers that their products are sustainable.

The coastal commercial fisheries produce finfish and invertebrates to supply the urban markets and for export. The vessels fish in lagoons, on reefs, and in coastal pelagic areas by handlining, trolling, spearing (both spear guns and weighted spears), netting and hand collection. Small outboard-powered vessels are mainly used, but some commercial fishing (i.e. for *beche-de-mer*) is done from non-powered canoes, or without a vessel (i.e. spearfishing or trochus collection from shore). There is sporadic fishing for live reef fish employing hook/line, holding tanks, and large transport vessels with live wells. Fishing for live bait for pole-and-line tuna fishing occurs in lagoons using underwater lights and a large lift-net, with the baitfish kept alive on vessels in bait wells.

Commercial fishing for finfish, which are highly perishable, is largely confined to urban areas and locations with direct transport links to urban areas. Many export products (e.g. *beche-de-mer*, trochus) are non-perishable and the fisheries they support are found in most areas of the Solomon Islands. In an attempt to overcome the constraints of transportation on coastal commercial fishing, fisheries centres were established in a number of rural areas in the late 1980s and early 1990s, but for various reasons many have not survived.

Two of the important coastal commercial fisheries are trolling for pelagic fish around fish aggregation devices (FADs) and diving for sea cucumber.

- McCoy (2013) describes the FAD fishery at Fishing Village near Honiara: Fishing activities are limited primarily by the weather and currently focus on a FAD that is about two to three hours steaming time from Honiara, depending on ocean conditions. The vessels used are shallow-draft fibreglass “canoes” built locally in Honiara with specifications that have evolved over time. Most are 6.5 to 7 m in length, with a small shelter in the bow. The relatively narrow beam enables them to move efficiently through the water with a 40 horsepower outboard motor in calm seas. Limited carrying capacity is sacrificed to enable easy beaching and haul-out of the water since there are no real protected anchorages along the coast in or near Honiara. Typical fishing trips depart from Honiara at 2 a.m. and arrive back at 2 or 3 p.m. in time to catch the late afternoon consumer rush. The head of the MFMR marketing division noted that histamine problems are not unknown. The amount of ice that might be carried is limited by the small size of the vessels. Ice chests commonly used for marketing are large and heavy, and would be difficult to carry without hindering fishing activities. According to some

fishermen at the Fishing Village market, fuel costs for a day's round-trip to the FAD with a 40 horsepower outboard are currently about SBD 1 500 (USD 219).

- Pakoa (2014) describes fishing for sea cucumber at an isolated atoll of the Solomon Islands: Solomon Islands has been one of the leading sea cucumber exporting countries in the previous two decades. The people of Ontong Java were first taught how to catch and process sea cucumbers into beche-de-mer by the Japanese prior to World War II. Ontong Java then became the largest producer of beche-de-mer in Solomon Islands. Traditional outrigger sailing canoes were used to reach distant fishing areas, and sea cucumbers were collected by hand and free diving. Weighted spears (bomb or torpedo) on lines or long spears were used to harvest sea cucumbers in deep water. A sea cucumber bomb or torpedo spear consists of a weighted harpoon with a monofilament line attached to it and then dropped into deep water. A long spear is a long bamboo or wooden pole with a metal barb attached at one end. Young males around the ages of 12 to 24 were considered to be the best sea cucumber divers, and were capable of freediving to depths greater than 20 meters. The use of underwater breathing apparatus to collect sea cucumber is prohibited in Solomon Islands although illegal use has been reported.

In the Solomon Islands, there is a large variety of subsistence fishing techniques. Fishers mainly use non-powered canoes or swim from the shore, with common fishing methods including hook/line, hand collection, various types of traditional netting, and spearing by both wading and diving. Typical characteristics of subsistence fisheries are: specialized knowledge often passed down through generations; labour-intensive operations sometimes involving the entire community; sharing of the catch amongst the community; social restrictions/prohibitions; and gender-specific activities. The traditional fishing lore of the country (i.e. knowledge and practices) is extremely diverse and varies considerably between islands and ethnic groups.

Buga and Vuki (2012) describe kite fishing, a very interesting subsistence fishing technique of the Solomon Islands:

This method of fishing uses the principles of trolling. The largest fish caught using this method are the garfish and barracuda. A kite is made from sago palm leaves. Attached to the edge of the kite is a string made of braided bush strings or from modern nylon strings. At the end of the string is a lure made of spider web with no hooks attached to it. The kite is then flown by paddling across the water. The spider web lure drags on the water's surface and when the fish see it they attack it. Their teeth stick to the wet, sticky spider web. The fisher knows a fish is caught when the line is tight and the kite falls into the water.

12.3.2.4 Main resources

The composition of the 2015 tuna catch (for all gear types) in the waters of the Solomon Islands is given in Table 12.8. Groups that are common in the purse-seine catch other than tunas are sharks, billfish, rainbow runner and triggerfish. Groups that are common in the longline catch other than tunas are sharks, billfish, opah, wahoo and dolphinfish.

In terms of the status of the fish resources given in the above tables, the four major species of tuna in the Solomon Islands mix freely with those of the neighboring countries in the western and central Pacific. Recent information from the Scientific Committee of the WCPFC (WCPFC, 2016) shows that for:

TABLE 12.8
Composition of the 2015 tuna catch in Solomon Islands waters (all gear)

	Albacore	Bigeye	Skipjack	Yellowfin	Total
Catch (tonnes)	12 335	5 622	79 644	38 764	136 365
Percentage of catch	9.0%	4.1%	58.4%	28.4%	100.0%

Source: FFA (2015a).

- **skipjack** – the stock is currently only moderately exploited and fishing mortality levels are sustainable;
- **bigeye** – recent analysis indicates that overfishing is occurring for the bigeye tuna stock and that to reduce fishing mortality to that at maximum sustainable yield, a large reduction in fishing mortality is required;
- **yellowfin** – the current total biomass and spawning biomass are higher than at levels associated with maximum sustainable yields. Therefore, yellowfin tuna is not considered to be in an overfished state;
- **South Pacific albacore** – there is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries. It should be noted that longline catch rates are declining, and catches over the last 10 years have been at historically high levels and are increasing.

The coastal fisheries catch a large variety of finfish and invertebrate species. A study by FFA (Richards *et al.*, 1994b) showed that approximately 180 species of reef finfish from 30 families are caught from shallow-water by the domestic fishery. Catches are dominated by the families Lutjanidae (snappers), Serranidae (groupers and rock cods), Lethrinidae (emperors), Scombridae (mackerels) and Carangidae (trevallies). Important commercial invertebrate species are beche-de-mer, trochus, green snail, giant clams, crabs and lobsters. The subsistence fisheries take a much larger diversity of marine animals and plants, with the most important groups being finfish and molluscs.

A study in Roviana Lagoon in the Solomon Islands (Albert *et al.*, 2015) gives the composition of the catch in 2011 (Table 12.9).

In the Solomon Islands, there are 22 known species of sea cucumber (*Holothuria atra*, *H. fuscogilva*, *H. nobilis*, *H. fuscopunctata*, *H. coluber*, *H. scabra*, *H. pervicax*,

TABLE 12.9
Composition of the catch of a Solomon Islands coastal fishery

	Dropline	Trolling	Net	Handline	All methods
Acanthuridae	0.0	0.0	0.0	0.0	0.0
Balistidae	0.0	0.0	0.0	8.5	2.2
Carangidae	32.7	56.1	24.5	6.9	31.4
Chaetodontidae	0.0	0.0	0.0	0.3	0.1
Chanidae	0.0	0.0	4.1	0.0	1.1
Clupeidae	0.0	0.0	18.4	0.3	4.9
Haemulidae	0.0	0.0	0.0	0.6	0.2
Holocentridae	0.0	1.2	0.0	0.6	0.5
Labridae	0.9	0.0	0.0	5.0	1.6
Lethrinidae	2.7	1.2	0.0	42.0	12.0
Lutjanidae	5.5	0.0	4.1	19.9	7.7
Monodactylidae	20.0	0.0	8.2	1.6	7.8
Mullidae	0.0	0.0	22.4	0.3	5.9
Nemipteridae	0.0	0.0	0.0	0.6	0.2
Scaridae	0.0	0.0	2.0	0.0	0.5
Scombridae	4.5	30.5	8.2	0.3	11.4
Serranidae	2.7	0.0	0.0	10.4	3.4
Sphyraenidae	21.8	7.3	4.1	1.6	9.1
Teraponidae	0.9	0.0	0.0	0.0	0.2
Other	8.3	3.7	4.0	1.1	7.6

Source: Albert *et al.* (2015).

H. edulis, *Actinopyga mauritiana*, *A. lecanora*, *A. palauensis*, *Stichopus chloronotus*, *S. hermanni*, *S. vastus*, *S. horrens*, *Pearsonothuria graeffei*, *Bohadschia vitiensis*, *B. argus*, *B. similis*, *Theleota rubrolineata*, *T. ananas* and *T. anax*), along with a few undescribed species that are being exploited in various provinces in the Solomon Islands (Ramofafia, 2005, cited in Pinca *et al.*, 2009b)

In terms of the status of coastal fishery resources, there has been little new stock assessment information in the last 20 years, with the exception of recent work on invertebrates (e.g. sea cucumbers (Box 12.2)). In general, fish and invertebrate species that are sought after, and located in areas readily accessible to many fishers, tend to be heavily exploited or over-exploited.

12.3.2.5 Management applied to main fisheries

BOX 12.2

Condition of sea cucumbers in the Solomon Islands

The health of sea cucumber stocks in the Solomon Islands has steadily declined over time. Average sizes for most species are small, indicating that most sea cucumbers recorded are likely to be below the size at reproductive maturity. This means that most of the population is unable to reproduce and that stocks will continue to decline unless these small individuals are protected from fishing and left on the reef to contribute to population replenishment. Mean densities are low, with several species not recorded at some sites. Sea cucumbers are relatively sedentary animals, with males and females needing to be in close proximity to one another for successful reproduction. Low density effectively reduces the chances of successful fertilization of gametes, which leads to breeding failure. A sea cucumber population that consists of primarily immature individuals and young adults will have a reduced recruitment potential compared to a population that consists of many large adults. Weakened breeding capacity of stocks leads to population declines and local extinctions. At this point, the sea cucumber stocks at the sites assessed across Solomon Islands are considered to be threatened and vulnerable to extinction.

Source: Pakoa (2014).

The offshore fisheries in the Solomon Islands are managed on national, subregional, and regional levels:

- On the national level, the management measures for the offshore fisheries of the Solomon Islands are detailed in the Solomon Islands Tuna Management and Development Plan 2015, which was prepared pursuant to Section 17 of the Fisheries Management Act 2015.
- On the subregional level, the Solomon Islands cooperates with the other countries that are members of the Parties to the Nauru Agreement, which is described below.
- On the regional level, the Solomon Islands is a member of the Western and Central Pacific Fisheries Commission (WCPFC) that was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. The Solomon Islands and the other 26 members of the commission enact tuna management measures at the annual WCPFC meeting. From the Solomon Islands perspective, the most important recent measure is the Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean.

A crucial aspect of the management of the offshore fisheries in the Solomon Islands is the Parties to the Nauru Agreement (PNA) and its Vessel Day Scheme. The early history of the PNA is given by Tarte (2002):

In February 1982 the Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest was opened for signature. The Nauru Agreement had been negotiated by seven Pacific island states – the Federated States of Micronesia, Kiribati, Solomon Islands, Nauru, Palau, Papua New Guinea and Solomon Islands. This group of countries (later joined by Tuvalu) is known collectively as the Parties to the Nauru Agreement (PNA). The conclusion of the Nauru Agreement marked the beginning of a new era in Pacific Island cooperation in the management of the region’s tuna stocks. It was an important milestone in the exercise of coastal states’ sovereign rights over their 200-mile EEZs. The PNA group accounts for much of the tuna catch in the Pacific island region. In 1999, it produced 98 percent of the tuna catch taken from the EEZs of Pacific Island Forum Fisheries Agency members; 70 percent came from three PNA members: Papua New Guinea, the Federated States of Micronesia and

BOX 12.3

PNA Vessel Day Scheme

In 2000, a study suggested that the PNA purse-seine management scheme that was then based on vessel numbers be replaced by a scheme based on purse-seine fishing days. The transition was actually made seven years later. In 2007, the Parties to the Nauru Agreement began implementing the Vessel Day Scheme (VDS), transitioning from permitting a total number of purse-seine vessels in the region (205) to permitting a total allowable effort (TAE) in number of purse-seine fishing days (44 703 days for 2012; 44 890 days for 2016). Given the volume, value and multi-jurisdictional nature of the fishery, it is arguably one of the most complex fishery management arrangement ever put in place. Its key features are as follows:

- System of tradable fishing effort (days) allocated to the eight Parties
- Limit on total effort (the TAE) ~ 45 000 days
- TAE is allocated to Parties based on zonal biomass and historical effort as PAEs (Party Allowable Effort)
- Fishing days are sold to fleets for fishing in each EEZ
- There is a minimum benchmark price for VDS days sold to foreign vessels
- Fishing days are monitored by a satellite-based Vessel Monitoring System (VMS)
- VMS monitoring is supported by observers on board all vessels
- Days are tradable between Parties
- Scheme costs are financed by levies on vessels

Due to the complicated nature of the new VDS system and the various constraints of the government fisheries agencies of the region (e.g. under-funded, under-staffed), it was expected there would be problems in the introduction of the scheme. This is not to say that the VDS has not produced substantial benefits for PNA countries. The system is creating competition for a limited number of days, thereby increasing the value of each day. In practice, the value of a fishing day before the VDS was roughly USD 1 350, but this increased to about USD 5 000 in July 2011 and days were being sold in 2016 for over USD 12 000.

On a different and less tangible level, another benefit is that the VDS moves fisheries management in the region to a desirable rights-based system. That is, fishing rights (such as vessel days) can be defined, allocated, and traded. Consistent with this transition to a rights-based approach, a VDS-style arrangement for management of the tropical longline fishery is being implemented by PNA.

Source: Havice (2013); Campling (2013); Gillett (2014a); Clark and Clark (2014).

Kiribati. The group also accounted for 94 percent of the access fees paid to the FFA Pacific Island states. By controlling access to these fishing grounds, the PNA group collectively wields enormous influence and power.

The most important fishery management tool of the PNA is the Vessel Day Scheme (VDS), which is described in Box 12.3.

Management arrangements for the coastal commercial export fisheries consist mainly of temporary and long-term bans, mostly enforced at the point of export.

In general, the areas where coastal subsistence fishing is undertaken are covered by traditional management arrangements. Most of the inshore marine areas in the Solomon Islands are customarily owned and managed by local villages, tribal groupings and communities. There is a wide diversity of fishery management provisions between areas, but most involve traditional authorities, often a hereditary chief, who make management decisions after considering the views of their resident stakeholders. In the last 20 years, many communities have been assisted by an external management partner, such as the local branch of an international NGO.

Management objectives

The objectives of fisheries management in the Solomon Islands must be consistent with those of the Fisheries Management Act 2015. The objectives of that act are “to ensure the long-term management, conservation, development and sustainable use of Solomon Islands fisheries and marine ecosystems for the benefit of the people of Solomon Islands”.

The Solomon Islands Tuna Management and Development Plan 2015 states: “In pursuit of the overall objectives of the National Tuna Fisheries Management Plan, six specific goals have been identified. These goals provide the MFMR and allied stakeholders with practical and achievable management targets and represent how all the support institutions may contribute, in whole or in part, to realizing national and municipal expectations of the benefits that the resources can provide. Each specific goal has a clear and deliberate purpose and the achievement of each will contribute directly to the overall objectives of tuna fisheries management as set out in the Plan. The essential purpose of each of the six goals is outlined below (with further details in section 12.6.2):

- To ensure that fish stocks are maintained at sustainable levels to support profitable fisheries.
- To manage fisheries within recognized principles of the ecosystem approach to fisheries management.
- To maximize employment opportunities for Solomon Islanders.
- To increase investment in fisheries and government income from the tuna fishery sector.
- To ensure good governance, management and compliance systems are in place.
- To enhance Solomon Islands’ influence in regional and international management organizations.

For the various coastal commercial fisheries, the objective of management interventions by MFMR is generally to guard against over-exploitation of the resources.

The management of subsistence fisheries is mostly by traditional reef custodians through customary marine tenure. The management objectives vary considerably from area to area, but many include the goal of assuring the continued flow of fishery foods to coastal communities.

Management measures and institutional arrangements

The Solomon Islands Tuna Management and Development Plan 2015 has several types of management measures. The two main measures are the limiting of fishing days by the Vessel Day Scheme (Box 12.3) and closing of areas (Table 12.10).

TABLE 12.10
Area-based management of the Solomon Islands Tuna Management and Development Plan

Area	Permitted methods and licence types
Shore – 3 nautical miles (NM)	Artisanal fishers and small-scale fishing operations supplying local markets
3 NM – 12 NM	Permitted methods and licence types as above, plus: <ul style="list-style-type: none"> • small-scale industrial fishing, pole-and-line, troll and handline
Archipelagic waters	Permitted methods and licence types as above, plus: <ul style="list-style-type: none"> • locally registered fishing vessels landing their catch for onshore processing and using the following methods: purse seine, pole-and-line, troll and handline
12 – 30 NM	Permitted methods and licence types as above, plus: <ul style="list-style-type: none"> • foreign vessels chartered by local companies landing their catch for onshore processing and using the fishing methods listed above.
30 – 60 NM	Permitted methods and licence types as above, plus: <ul style="list-style-type: none"> • foreign longline vessels, including those chartered by locally based foreign, not landing catch to onshore processing • foreign purse-seine vessels operating under the Federated States of Micronesia Arrangement and foreign vessels operating under bilateral agreements using the fishing methods described above
60 – 200 NM	Permitted methods and licence types as above, plus: <ul style="list-style-type: none"> • purse-seine vessels operating under the US Treaty

The management arrangements for the coastal commercial export fisheries consist mainly of temporary and long-term bans. The 2006 national closure of the beche-de-mer fishery is an example of a national temporary ban. Gold-lip pearl shell, turtle shell and crocodiles are under a long-term ban. The MFMR typically formulates the measures and enforcement is done by non-fishery government officials at the point of export. Some coastal communities have other management arrangements for managing the coastal commercial fisheries that occur in their areas. The residents of Ontong Java atoll, for example, have alternating annual closures for beche-de-mer fishing and trochus fishing.

For coastal subsistence fisheries, there is a wide diversity of fishery management provisions across the country. The measures often involve limiting access by outsiders to the fishing areas, and various types of input restrictions on the fishing activities of local residents. Common restrictions include periodic harvesting bans in specific areas and bans on gear types. The management arrangements at Foueda Island off Malaita (Box 12.4) are an example of traditional management (Buga and Vuki, 2012).

BOX 12.4

Management measures at Foueda Island

The barrier reef, which covers about 10 square kilometres, is owned by different people in the village. The different tribes own different sections of the reef, the boundaries of which are marked by rocks, lagoon passages or deep pools. In order to manage the reef sustainably and to provide food security for the people, past generations put in place regulations governing the utilization of reefs. From mid-July to September, a deeper area of the barrier reef is banned to all fishers. It is said that a killer shark often visits this area and can kill people, although the story could also be a way to ensure that people respect the fishing ban. If there is going to be a feast, the owners of the different reef sections usually ban fishing in their areas. The ban may begin 5 to 6 months before the feast to ensure that there will be fish when the feast takes place. Fishers are occasionally caught night diving at these areas, and are either warned not to re-offend or are made to pay compensation. During the taboo period, people fish in the lagoon and offshore. The different tribes also have totems that are sea creatures such as sharks, giant clams, stingrays

and moray eels. The totem of the people of Foueda is the octopus. The Foueda people believe that octopus was a favourite food of their ancestors, who were brave warriors and gained victory over their enemies. It is believed that when these ancestors died they turned into octopuses. Octopuses have special protection on Foueda reefs, and because of these ancient beliefs the people will not eat octopus. Because of these restrictions, there is an abundance of octopus on reefs around the artificial island of Foueda. The owners of reefs on Foueda have ultimate authority over the reef and its surrounding waters. The owners decide who may fish in the area and what types of fishing gear and methods may be used. When people fish in the area with nets, the owners of the reef sections check the nets to ensure that the fishers only catch enough for themselves. If the owner of the reef finds that a fisher has caught too many fish, the owner will lift the bottom of the net to free the fish trapped in it.

Source: Buga and Vuki (2012).

The main institutions in the Solomon Islands involved in fisheries management are covered in section 12.7.

12.3.2.6 Fishing communities

The concept of “fishing communities” has limited applicability to the Solomon Islands. Nearly all households in coastal villages are involved in coastal fishing activities. It could therefore be stated that all coastal villages in the Solomon Islands are “fishing communities”.

12.3.3 Inland sub-sector

The Solomon Islands includes many large islands. There is, therefore, a relatively large inland population with no direct access to marine food resources. This results in the Solomon Islands having a significant subsistence freshwater fishery, albeit much smaller than the marine fishery.

Although there is no official report, recent studies have estimated annual inland fishery production to be about 2 300 tonnes per year, valued at about USD 3.8 million. Some of the catch may be sold, but the vast majority is for subsistence purposes.

The main fishing and landing areas are small streams near villages and the banks of the larger rivers, mainly on the larger islands. The smaller islands and atolls generally have no sizeable freshwater bodies and consequently no freshwater fishing activity.

All inland fishing is carried out using very small-scale gear such as baited lines, spears, a variety of traditional woven traps, hollow poles, snares and knives.

Information is scarce on the resources that support the inland fisheries as no comprehensive survey has been carried out. Anecdotal information and survey reports focused on single islands suggest that flagtails, gobies, eels and freshwater shrimps are important native species.

Mozambique tilapia, an introduced species, presently inhabits many rivers, streams and swamps in the Solomon Islands. Many people have become accustomed to eating it and enjoy its taste. On Rennell Island, communities have come to depend heavily on the tilapia in Lake Tegano as their main source of dietary protein (MFMR, 2010).

The management applied to inland fisheries in the Solomon Islands is poorly documented. In general, it could be considered similar to that for coastal subsistence fisheries, which is oriented to protecting village food supplies. Decisions are characteristically taken by traditional authorities and involve exclusion of outsiders, and various types of bans on community members.

12.3.4 Aquaculture sub-sector

A New Zealand-sponsored project summarized the aquaculture situation in the Solomon Islands (Lindsay, 2007):

There has been a wide range of species cultured within the Solomon Islands, including giant clams, penaeid shrimps, freshwater prawns, pearl oysters, sea weed, sea cucumbers, hard and soft corals, milkfish, sponges and the capture/culture of post-larval animals. To date, the aquaculture industry has had limited contribution to the livelihoods of the rural sector. Since the political unrest within the nation the commercial aquaculture operations have been closed with little private sector interest in restarting operations. Coral culture (hard and soft) has

provided small-scale sustained economic benefits through the successful development of community based farms that service the private sector aquarium companies. Similarly, seaweed, although still in its development stage, has provided positive indications that the industry may become viable in the long term.

At present aquaculture is limited to mariculture activities in seaweed and some culture for the marine ornamental trade. There was a small amount of prawn production in the 1980s and 1990s (*Macrobrachium* and penaeid prawn), but farms have since been inactive.

TABLE 12.11
Solomon Islands seaweed production¹¹

Year	Weight (tonnes)	Value (SBD)	Value (USD)
2010	888.0	3 244 032.00	413 252
2011	902.2	2 323 763.63	320 961
2012	873.8	3 191 128.40	451 361
2013	1476.5	5 167 868.50	718 757
2014	1520.3	5 611 457.96	735 446

Source: MFMR (unpublished data).

The production of seaweed and the value (farm-gate prices) are given in Table 12.11. According to a recent SPC study (Gillett, 2016):

- the CITES export database has some information on the export of live (presumably cultured) coral – 20 947 pieces of live coral were exported in 2013;
- there are reports of minor amounts of other types of aquaculture activities in 2014, including tilapia, milkfish, giant clams and freshwater prawns;
- the total aquaculture production of the Solomon Islands in 2014 was estimated to be 1 530 tonnes plus 20 000 pieces worth USD 773 263 at the farm gate.

The most significant attempt to promote aquaculture in the Solomon Islands was the establishment of the Coastal Aquaculture Centre in a joint project between the Government of the Solomon Islands and the International Centre for Living Aquatic Resource Management (ICLARM, now WorldFish). It promoted mainly the culture of juvenile giant clams for the live aquarium trade. The clams were grown out by small-scale farmers who then sold their production to exporters. In the late 1990s, efforts were made to explore markets for giant clam sashimi in Taiwan Province of China and Hong Kong. The Centre also initiated a black-lipped pearl oyster collection programme with a view to investigating pearl culture, experimental culture of beche-de-mer, and a project to investigate green snail and trochus resources, the latter with Japanese assistance. The Centre ceased operation in early 2000 due to violence associated with the ethnic tensions.

The Solomon Islands Tilapia Aquaculture Action Plan 2009–2014 gives the aquaculture goals of Solomon Islands:

- Identify and prioritize the aquaculture commodities required to meet the national need for food and livelihood.
- Establish viable aquaculture enterprises and provide the training necessary to expand the sector.

¹¹ Weight reported in this table refers to dry weights.

- Strengthen the national capacity to establish and manage aquaculture at all levels. Attract investment in aquaculture.
- Develop competition (especially for export markets).
- Provide technical support for key industry stakeholders, e.g. farmers, the private sector, NGOs and donors.
- Develop responsible policies for aquaculture and gazette the supporting regulations.

Other than the above efforts to promote its development, there is no active management of the aquaculture sub-sector in the Solomon Islands.

12.3.5 Recreational sub-sector

Although subsistence fishing may have a large social component and be enjoyed by the participants, there is little recreational fishing as a leisure activity for local residents. Several of the resorts offer fishing activities for their overseas guests, and some local expatriates in Honiara occasionally go fishing on the weekends – mainly trolling for coastal pelagic fish, such as Spanish mackerel, barracuda and tunas.

There is no active management of the recreational sub-sector.

12.4 POST-HARVEST SECTOR

12.4.1 Fish utilization

In general, offshore fishing is export oriented. The local purse seiners and pole-and-line vessels supply the cannery in the Solomon Islands, with less than 5 percent of their catch being exported unprocessed. Catches taken by foreign-based purse seining are exported to overseas canneries. Longlining (presently all foreign based) is oriented to producing sashimi for Asia and North America.

A considerable amount of tuna caught by foreign-based seiners is transhipped in the Solomon Islands. McCoy (2013) states that Honiara is one of the major purse-seine transshipment ports for distant-water purse-seiners in the Pacific Islands region. In 2011, 148 560 tonnes, or nearly 10 percent of the total catch by all purse seiners in the western Pacific, was transhipped by vessels at the anchorage fronting Honiara. The presence of transshipping vessels results in an extensive trade in non-target bycatch, smashed or damaged target tuna that are otherwise unmarketable, and some small target tuna. The fish are termed *salt fish* in English by Solomon Islanders due to their preservation in refrigerated brine and the resulting taste and texture (Box 12.5).

Coastal commercial fishing produces mainly fresh products (finfish, invertebrates) for urban consumption, and non-perishable products (beche-de-mer, trochus) for export. Box 12.6 gives information on the processing and sale of sea cucumbers in the Solomon Islands. Some perishable fishery products (e.g. lobster tails) are sporadically exported, while aquarium items are exported much more regularly.

As the name implies, subsistence fisheries (both coastal and inland) are focused on production of food for household consumption. Significant amounts of fish are, however, given away to friends and relatives. Often attempts are made to market any valuable species captured if a market exists (e.g. lobster to a resort). In some communities, production in excess of immediate needs is salted or dried for future use.

12.4.2 Fish markets

Fish canned in the Solomon Islands is exported to regional markets (e.g. Fiji, Kiribati). Currently, the Solomon Islands has duty-free access to the European Union (EU) market for its canned tuna. The loins that are produced in the SolTuna processing plant are sent to Europe and the United States of America.

The non-processed tuna that is exported has as its final market (after processing, mainly in South East Asia or American Samoa) mostly the United States and Europe, with small amounts going to a large number of countries.

BOX 12.5

Salt fish trade in Honiara

In Honiara, most of the salt fish is purchased or bartered onboard the purse seiners and brought ashore for sale. Subsequent transactions may occur between the initial buyer onboard and vendors onshore before reaching the retail consumer, typically at the Honiara Central Market. A guesstimate can be made of the annual amounts of salt fish for sale at the Central Market based on the average number of vendors and the high-volume months from the transshipment data. Using an average of 40 vendors selling an aggregate 280 sacks per day, the annual market supply is estimated to be from 440–500 tonnes. The figures may be somewhat understated as they do not account for unknown quantities of salt fish that are delivered directly from the transshipping vessels to roadside markets. The 440–500 tonnes represent a possible retail market value of around SBD 3.53 million to SBD 3.82 million (USD 515 000–USD 560 000). These very rough figures indicate that the retail price of salt fish is from SBD 7.60 to SBD 8.00 per kilogram. In United States of America dollar terms, this is currently slightly less than half the current estimated market price for cannery-grade frozen skipjack. Using the average number of transshipments in Honiara, it is estimated that each transshipment results in around 2 tonnes of salt fish delivered onshore. This figure may be somewhat less if an estimated 30–35 tonnes of salt fish sourced from National Fisheries Development Company vessels in Noro is included in the annual market supply.

Source: Modified from McCoy (2013).

BOX 12.6

Processing/sale of sea cucumbers in the Solomon Islands

Processing sea cucumbers into beche-de-mer involves gutting, boiling and drying, and is done by fishers, middlemen and also exporters. Dedicated sea cucumber processors process all their catch to a fully dried stage. Processing campsites are often set up near fishing grounds, sometimes on uninhabited islands where families can be based for some time to complete the processing of beche-de-mer products. In recent times, agents (i.e. middlemen) in rural areas prefer to purchase unprocessed sea cucumbers from fishers and process these themselves to a final stage. The link between processors and middlemen has ensured production of good quality products as opposed to products processed by fishers themselves. On Ontong Java, sea cucumber processors operate small retail outlets that provide credit to sea cucumber fishers so that they can purchase basic necessities; cost is recovered from the value of the next sea cucumber catch. These arrangements lock the fisher and the processor together into a continuous cycle of fishing to pay off the credit. Dried products are packed in copra sacks and sold to agents or shipped to an exporter based in Honiara. Well-processed beche-de-mer has a relatively long storage life and the product may be stockpiled before being sold or exported. In areas near the main commercial centres of Honiara, Gizo, Munda and Auki, fresh or partly processed products are sold directly to processing and exporting companies.

The main domestic market for fish is in Honiara, but other markets exist in the towns of Gizo, Buala, Tulagi, Auki, Kirakira and Lata.

The Honiara Central Market is a large public market built with Japanese aid in the mid-1990s and administered by the City Council. The market extends beyond its original modern shed structures and concrete flooring to encompass vendors offering a variety of agricultural produce, reef and pelagic fish, prepared food, building materials and other products. Another more informal fish market is located about 5 km to the east of the Central Market at Fishing Village. The Fishing Village market is convenient for people on the many mini-buses, taxis, and private vehicles that use the highway fronting the market area. The market has grown in recent years to include vegetable and prepared food vendors (McCoy, 2013).

The market for beche-de-mer is in China, with smaller amounts going to South East Asian countries. The markets for trochus shell are the processing plants in Solomon Islands, Europe and Asia, with the processed buttons going to fashion manufacture for consumers in Europe, North America and Japan. Lobster tails are primarily for Australia and the aquarium products for North America.

12.5 SOCIO-ECONOMIC CONTRIBUTION OF THE FISHERY SECTOR

A recent SPC study (Gillett, 2016) attempted to quantify the fishery-related benefits received by the Solomon Islands and other Pacific Island countries. The study gave the available information on the contribution of fishing to GDP, exports, government revenue, employment and nutrition. Unless otherwise noted, the information in this section is from that study.

12.5.1 Role of fisheries in the national economy

The Statistics Division of the Ministry of Finance and Treasury calculates the official GDP of the Solomon Islands. The SPC study examined the official methodology and, using its independent estimate of the value of fisheries production, re-estimated the fishing contribution.

- The official estimate showed a 2014 fishing contribution to GDP of USD 25.5 million, or 2.5 percent of GDP.
- The contribution of fishing to GDP was re-estimated by the SPC study for the year 2014. It showed a contribution of USD 73.3 million, or 7.2 percent of GDP.
- The SPC study examined the methodology used to make the official estimate and concluded that the value of the catch used in the official estimate was very low.

Using unpublished data from the Ministry of Fisheries and Marine Resources and the Ministry of Finance, the SPC study showed that in 2014 the Government of Solomon Islands received about USD 28 million in access fees for foreign fishing. Access fees represented about 7.2 percent of government revenue for that year.

12.5.2 Trade

According to Solomon Islands customs data, exports of fishery products in 2014 were worth SBD 168.6 million (USD 54.7 million), which represented about 12 percent of all the country's exports. The vast majority of fishery exports were tuna products. The major non-tuna commodities were trochus, items for the aquarium trade, seaweed and shark fins.

For FAO data reported in Part 1 of this profile, the value of fishery exports for 2014 was USD 48.5 million and fishery imports was USD 2.4 million.

12.5.3 Food security

Bell *et al.* (2009b) used information from household income and expenditure surveys (HIES) conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES were designed to enumerate consumption based

on both subsistence and cash acquisitions. For the Solomon Islands, the per capita fish consumption (whole weight equivalent) was 45.5 kg per capita per year in urban areas (fresh fish made up 80 percent of this amount) and 31.2 kg per capita per year in rural areas (90 percent fresh fish). The national fish consumption rate was 33.0 kg per capita per year.

Two older estimates show annual per capita consumption of fish in the Solomon Islands in the 1990s:

- A 1992 survey found that 31 percent of households consumed fresh fish each day and that 82.4 percent of meals containing animal protein were based on fish. The consumption of fish was estimated to be 45.5 kg (Skewes, 1990);
- Preston (2000) estimated 32.7 kg for 1995.

The vast majority of fish consumed in the Solomon Islands comes from the country's coastal fisheries. Some information is available on fish supplies that originate from elsewhere:

- Based on the 2005/2006 HIES, both in urban and in rural areas, processed fish, particularly Second Grade Taiyo canned tuna, represents almost 50 percent of all expenditure on fish (Weeratunge *et al.*, 2011).
- The salt-fish trade in Honiara (described in Box 12.5) is estimated to put about 440–500 tonnes of fish annually on the Honiara market. That is equivalent to each of the 70 000 residents of Honiara consuming about 6.7 kg of salt fish per year (McCoy, 2013).

12.5.4 Employment

There were two recent national censuses: 1999 and 2009. The report of the 2009 census (NSO, 2010) showed the following “changes in paid employment” in the 10 years between the two surveys:

- 1999: total jobs in fishing 3 367 (2 935 males and 432 females)
- 2009: total jobs in fishing 5 736 (5 076 males and 660 females)
- Changes during the period: 70.4 percent increase in paid employment in fishing (72.9 percent increase for males and 52.8 percent increase for females).

Non-formal employment in the fisheries sector is extremely important in the Solomon Islands, but the available data is fragmented. One of the most comprehensive statements is contained in a report by the Asian Development Bank:

The number of subsistence fishers in the Solomon Islands can be crudely estimated by looking at the total population – about 570 000 in 2012 – and assuming 82 percent as the rural population. By dividing this by the average number of household members in rural households (5.2 persons), the minimum number of subsistence fishers can be derived. A minimum of 88 000 people are estimated to be engaged in fishing, assuming one household member is a fisher. This, however, is a conservative estimate. If the inputs of women and other adult men are considered in the estimate, the number of subsistence fishers would double to 175 000 (ADB, 2014).

TABLE 12.12
Tuna-related jobs in 2015

Type of job	Number
Local crew	274
Foreign crew	21
Processing / packing	1 470
Other	448
Total	2 213

Men and women have very different roles in their participation in the fisheries sector. Citing numerous references, Weeratunge *et al.* (2011) give information on the gender aspects of fisheries employment in the country (Box 12.7).

FFA tracks tuna-related employment in the region, including for the Solomon Islands. Unpublished FFA data shows the number and type of jobs in the Solomon Islands' major tuna fishing and processing companies in early 2015 (Table 12.12).

BOX 12.7

Gender aspects of fisheries employment in the Solomon Islands

Fishing is a predominantly male activity (90 percent of men) with at least one female household member (50 percent of women) engaged in fishing. However, there can be significant variations among provinces and villages. Women are engaged in trading of garden and fish products, including cooked food, as well as weaving, production of shell money, and employment in industrial fish-processing plants. In the main fish-canning factory in Noro, 80 percent of the 500 workers are women. In many fishing communities, men are involved in logging, fish trading, and stone and wood carving as well as other employment such as running small businesses (such as grocery stores, fuel depots, copra mills) and pastors. Home-based tasks, such as household chores, child care, gathering firewood and fetching water are largely women's work while house repair and maintenance, canoe building and repair, and cutting firewood (except firewood collection from mangroves) are predominantly male tasks. In rural Solomon Islands the gender division of labour in fisheries is bounded to some extent by space — men fish in the reefs and offshore, while women and children predominantly fish the nearshore zone on reefs close to villages, lagoons and mangroves. Men are also engaged in diving and spear fishing; women glean for invertebrates and harvest mangrove fruit and seaweed. Mariculture activities are conducted by both men and women. In some Western Province villages, mariculture includes farming giant clams and corals and both women and men can be engaged in the cultivation of seaweed. In terms of fishing assets, a qualitative assessment in the Western Province showed that men predominate in canoe ownership; however, some women own canoes and others access canoes of kin. Both men and women own their fishing lines and hooks, although men tend to own a larger number of lines. Ownership of fishing spears, engines, nets, boats, sails and diving gear (masks and fins) is largely confined to men. Some women own swimming goggles and use these for gleaning.

Source: Weeratunge *et al.* (2011).

12.5.5 Rural development

An older assessment by the United Nations Development Programme (UNDP, 2002) indicated that most future employment opportunities in the Solomon Islands would be in the informal rural sector. Fisheries development in rural areas has a major role in providing such employment. This concept remains valid today.

One of the major mechanisms for rural fisheries development has been the fisheries centres. About 25 of these facilities were established in rural areas to serve as market outlets for fish caught by rural fishers. It was planned that the centres would sell fishing gear and provide training in new fishing techniques and improved catch handling. Although they were plagued with problems (especially during the ethnic tensions), several of the centres continue to function and are vital to the government's attempts to develop rural fishery resources.

Commercial fisheries development in rural areas is extremely challenging. A review of the situation in the Solomon Islands and Papua New Guinea is summarized in Box 12.8.

Most of the current aquaculture production is supported by donors with an interest in rural development, and many of the aquaculture operations are therefore located in rural areas. As an example, the Coral Gardens programme of the Foundation of the Peoples of the South Pacific International aims to alleviate poverty and reverse ecological damage through mariculture initiatives, such as coral culture in Marau Sound, the Nggela Islands and Langalanga Lagoon in Malaita.

BOX 12.8

Development of coastal commercial fisheries in Papua New Guinea and the Solomon Islands

From the 1970s, governments and aid donors started projects to provide infrastructure, equipment and/or training for rural fishers to kick-start commercial food fisheries. Most of these activities, however, collapsed soon after the withdrawal of support from the government or funding agencies. The types of support given in the projects have changed somewhat over the decades, partly due to lessons learned from prior projects, and partly in response to changing policy directions in aid, particularly the shift in emphasis from government provision of extension services to a focus on enabling private sector-driven development through partnerships with village fishers and established fisheries businesses. Considering all the investment, why have cash-earning food fisheries not taken off in most rural coastal and island areas to date? The main reason would appear to be that such fisheries are usually not profitable without high external inputs. Unlike high-value, easy-to-store-and-transport shells and dried marine products, fresh-chilled and frozen fish have low value to weight and are tricky to store and transport in good condition. The costs and difficulties involved in getting fish from rural areas out to markets, and getting fuel and mechanical repairs into rural coastal areas, usually outweigh the prices fetched by the fish. When the project funding stops, the fisheries often stop soon after.

Source: Modified from Barclay and Kinch (2013).

12.6 TRENDS, ISSUES AND DEVELOPMENT**12.6.1 Constraints and opportunities**

Major constraints for the fisheries sector include the following:

- Many of the inshore fishery resources, especially those close to the urban markets, are fully or overexploited.
- Small-scale fishers have difficulty in economically accessing the relatively abundant offshore fishery resources.
- Although the tuna cannery and tuna fleet are vitally important for the national economy and for the welfare of the people employed, those operations are at times unprofitable.
- There are considerable difficulties associated with marketing fishery products from the remote producing areas to the urban areas with the best marketing opportunities.

Opportunities in the fisheries sector include:

- upgrading the cannery to meet EU sanitary requirements for fish;
- increasing domestication of the purse-seine fishery;
- in-country processing of a greater proportion of the tuna catch taken by foreign fleets within the Solomon Islands' EEZ;
- expansion of the marine aquarium fishery;
- greater use of management partnerships (community, government, NGO) in the management of coastal fisheries;
- increasing the effectiveness of MFMR by enhancing staff capability.

The tuna industry is a crucial aspect of the fisheries-related development opportunities of the Solomon Islands. The Solomon Islands Tuna Management and Development Plan 2015 contains an analysis of the challenges and opportunities that affect the tuna sector:

Challenges:

- Limited, expensive infrastructure – Infrastructure, such as ports, roads and transport services, is limited, and consumables such as electricity, water and fuel are expensive and supply is unreliable.
- Poor communications – Phone networks and internet service are poor by developed world standards.
- Low volumes, high prices for fuel and other inputs – Many industry inputs are imported, and in relatively low volumes.
- Dependent on shared stocks – Tuna stocks in the EEZ are highly migratory and shared with other countries, so cooperative management is required. Difficulties in reaching consensus can arise when countries have differing objectives when utilizing the same stocks.
- Climate impacts – Fish catchability varies somewhat in El Niño/La Niña events. Climate change is expected to impact Solomon Islands fisheries.
- Perception of governance – There are perceptions among potential investors of inadequate governance and inconsistencies in the application of government policy.

Fisheries-specific opportunities:

- International requirement for food security – Increasing international demand for food is resulting in high demand for fish such as tuna from the Solomon Islands and for long-term access to fisheries.
- Key fish stocks in good shape – Scientific advice confirms that stocks of most of the main species of tuna are all considered to be healthy and not overfished at current fishing levels.
- Significant catches available – Solomon Islands has generally reliable, moderately large tuna fisheries with good catch rates. It is close to the main fishing grounds in the WCPO.
- Onshore development opportunities – Unlike some PNA members Solomon Islands has good potential ports and abundant land, water, and low wage labour available to support onshore developments such as fish processing.
- Market access – As a least-developed country, the Solomon Islands is exempt from the 24 percent duty on imports into the EU under the “Everything but Arms” initiative.

12.6.2 Government and non-government sector policies and development strategies

With respect to strategies, the Ministry of Fisheries and Marine Resources Corporate Plan for 2015–2018 articulates four focal areas and related goals for MFMR:

- Focal area 1: Resource and ecosystem management. Goal: Sustainable fisheries resource management and promote livelihood opportunities through effective conservation and management of oceanic and coastal ecosystems.
- Focal area 2: Private sector development and investment. Goal: Promote private sector development, investment and secure market access to achieve higher economic returns and social benefits from the use of marine resources.
- Focal area 3: Fisheries compliance (the operational arm of fisheries management). Goal: The effective management of national and shared fish stocks through a strengthening of fisheries compliance and enforcement.
- Focal area 4: Governance and institutional development. Goal: Improved fisheries governance supported by a strengthening of the institutional framework of the sector

The Solomon Islands Tuna Management and Development Plan 2015 gives an indication of the policies and strategies in the offshore fisheries sector. The six specific goals cited in the plan provide some insight into MFMR’s current thinking on the policies/strategies:

- To ensure that fish stocks are maintained at sustainable levels to support profitable fisheries. To safeguard Solomon Islands' tuna resources against over-exploitation and the risk of biological decline, so that the Solomon Islands may continue to benefit from its tuna resources in perpetuity.
- To manage fisheries within recognized principles of ecosystem approach to fisheries management. To address the protection of the tuna fish stocks and the ecosystem environment that supports these stocks, in line with international agreements and conventions.
- To maximize employment opportunities for Solomon Islanders. Whilst recognizing the importance of income generation from distant water fisheries, to ensure that priority is given to employment generation and value addition from the production and processing of tuna.
- To increase investment in fisheries and Government income from the tuna fishery sector. To ensure facilitate the generation of employment through promotion of the Solomon Islands investment strategy.
- To ensure good governance, management and compliance systems are in place. To strengthen the efficiency and resourcing of fisheries compliance activities that can help to eliminate piracy, reduce illegal fishing and effectively support the implementation of the harvest control rules.
- To enhance Solomon Islands' influence at regional and international management organizations. To endorse the principles of regional cooperation by participating in relevant RFMOs and ensure that required data and information is provided according to requirements of respective RFMOs for the benefit of sound tuna fisheries management.

For the inshore fisheries, the Solomon Islands National Development Strategy (NDS) 2011–2020 contains several relevant provisions. Govan *et al.* (2013) summarized the provisions:

- **Development:** Calls for sustainable enhancement of fisheries productivity to address food security and sustainable economic development of inshore fisheries while reducing reliance on coastal capture fisheries.
- **Resource management:** Calls for effective coordination between national, provincial and community levels to facilitate sustainable development of inshore fisheries and shift from "open access" to "managed" fisheries in partnership with resource owners and fishing communities to improve food security, sustainable marine resource management and economic productivity.
- **Ecosystem and integrated management approaches:** In collaboration with the Ministry of Environment, seeks a sustainable approach to natural resources management addressing biodiversity, forestry, fisheries and marine resources and waste management, including through community governance regimes, and sensitizing the population on the dangers of environmental degradation through awareness campaigns.

At their summit in March 2012, the leaders of the Melanesian Spearhead Group (MSG) of countries (Fiji, New Caledonia, Papua New Guinea, Solomon Islands and Vanuatu) agreed to develop a roadmap for the protection of inshore fisheries (Box 12.9). That roadmap gives some insight into the Solomon Islands' future policies and strategies in inshore fisheries management.

In terms of strategies used by non-government organizations (NGOs) involved in fisheries in the Solomon Islands, NGOs experienced a slow learning curve starting from the conservation and protected area approaches in the 1990s, of which the Arnavons Marine Conservation Area is perhaps the only surviving example (Govan *et al.*, 2013). Early conservation approaches in the Solomon Islands do not seem to have found constructive ground for collaboration between government and civil society, with failures attributed to both government and NGO-only approaches. From 2003, the

BOX 12.9

MSG Roadmap for inshore fisheries

The “Melanesian Spearhead Group Roadmap for Inshore Fisheries Management and Sustainable Development 2015–2024” is a management framework and subregional roadmap for sustainable inshore fisheries, developed by the MSG Secretariat in cooperation with representatives of the fisheries departments of its members and with technical assistance from SPC. The regional roadmap provides overarching guidance for MSG members and enumerates the actions they have agreed to take to address the management of inshore fisheries in Melanesia.

The vision of the roadmap is “sustainable inshore fisheries, well managed using community-based approaches that provide long-term economic, social, ecological and food security benefits to our communities”.

The objectives of the road map are: 1. Development of an effective policy, legislation and management framework for the management of inshore resources, in accordance with other relevant international agreements, to empower coastal communities to manage their marine resources. 2. Education, awareness raising and the provision of information on the importance and management of inshore fisheries. 3. Capacity building to sustainably develop and manage inshore resources with particular reference to experience in MSG members. 4. Adequate resources to support inshore fisheries management and best available science and research. 5. Secure long-term economic and social benefits to coastal communities from the sustainable use of inshore resources. 6. Establishment of effective collaboration with stakeholders and partners. 7. Restoration and maintenance of beche-de-mer stocks to maximize long-term economic value to coastal communities.

The roadmap was adopted by the leaders of Fiji, New Caledonia, Papua New Guinea, Solomon Islands and Vanuatu in June 2015.

Source: SPC (2013b).

NGOs adopted a modified approach based on community involvement and meeting community aspirations, which combined with the growing local capacity to work in a participatory fashion. Anthropological and community development work dating back to the 1990s in the Roviana Lagoon also showed early results, with a network of village closed areas emerging in 2001. In the last 8 years, there has been much greater collaboration between government and non-government stakeholders as suggested by memorandums of understanding and joint government/NGO field teams.

12.6.3 Research

Historical fisheries research is given in a bibliography of Solomon Islands fisheries (Gillett, 1987b). Research specific to particular fisheries appears in profiles of Solomon Islands fishery resources (Skewes, 1990) and of inshore fisheries resources (Richards *et al.*, 1994b).

Most of the recent fisheries research carried out in the Solomon Islands has been undertaken through cooperation with overseas partners. Research priorities tend to be oriented to economically important export commodities, protected species, marine protected areas, and those resources deemed important by donors. Some of recent fishery-related research subjects and the associated partners include:

- aquaculture – with WorldFish and NGOs
- tuna – with SPC’s Oceanic Fisheries Programme

- reef fish and invertebrates – with SPC’s Coastal Fisheries Programme
- fish marketing – with the New Zealand-sponsored “Hapi Fis, Hapi Pipol” programme
- aquaculture and its role in food security in the Solomon Islands – the Australian Centre for International Agricultural Research
- spearfishing – with FAO
- assessment of the biodiversity and status of coral reefs, seagrass beds, oceanic cetaceans, reef food fish, commercial invertebrates and associated habitats – with The Nature Conservancy.

12.6.4 Education and training

Education and training related to fisheries in the Solomon Islands is undertaken in a variety of institutions:

- Academic training in biological, economic and other aspects of fisheries is given at the University of the South Pacific in Suva, Fiji, and to a lesser extent at the University of Papua New Guinea.
- Training in the practical aspects of fisheries and certification of vessel officers are provided at the Solomon Islands College of Higher Education.
- Training courses, workshops and attachments are frequently organized by the regional organizations: SPC in New Caledonia and FFA in the Solomon Islands. The subject matter has included such diverse topics as fish-quality grading, stock assessment, seaweed culture, fisheries surveillance and on-vessel observing.
- Regional workshops (e.g. Code of Conduct for Responsible Fisheries, IUU fishing, coastal fisheries management, the ecosystem approach to coastal fisheries management, fishery statistics, an annual roundtable meeting on World Trade Organization agreements, etc.) are conducted by FAO.
- Courses and workshops are also given by NGOs and by bilateral donors, such as those by Japan.
- Some Solomon Islanders have received advanced degrees in fishery-related subjects at overseas universities, especially those in Australia.

12.6.5 Foreign aid

By far the largest fisheries-oriented foreign aid initiative in the Solomon Islands in recent years is the “Mekem Strong Solomon Islands Fisheries” programme (Box 12.10).

Other important donors in the fisheries sector (and major initiatives) are the World Bank (Solomon Islands component of the Pacific Regional Oceanscape Programme); EU (rural fisheries enterprises, seaweed culture, the wharf at Noro); Overseas Fishery Cooperation Foundation (renovation of fisheries centres); Japan International Cooperation Agency (fisheries wharf, cold storage and social facilities); and The Nature Conservancy (fisheries centre and live reef fish management plan).

12.7 INSTITUTIONAL FRAMEWORK

Under the authority of the Fisheries Management Act 2015, the main government institution in the fisheries sector is the Ministry of Fisheries and Marine Resources (MFMR). According to the Ministry of Fisheries and Marine Resources Corporate Plan for 2015–2018, its role is to regulate the orderly development and quality management of Solomon Islands fisheries and marine resources and to ensure the Solomon Islands receives maximum economic and social benefits from the sustainable use of its fisheries and marine resources. MFMR currently has 157 staff and is organized and managed based on a number of technically focused divisions, each headed by a deputy director:

- The head of the ministry is the Minister who is mandated by the constitution to oversee all things concerning the fisheries and marine resources of the country.

BOX 12.10

Mekem Strong Solomon Islands Fisheries programme

The Mekem Strong Solomon Islands Fisheries (MSSIF) programme is a partnership between New Zealand and Solomon Islands. It is implemented by the Solomon Islands Ministry of Fisheries and Marine Resources, with support from the New Zealand Ministry of Foreign Affairs and Trade. The partnership arrangement signed in 2009 noted that New Zealand's support is expected to continue until at least 2018. The goal of MSSIF is 'the sustainable development and management of fisheries resources to ensure long-term benefits for the people of Solomon Islands'. To achieve this goal, the objective of MSSIF is 'to strengthen the capacity of Solomon Islands fisheries sector to achieve improved livelihood, food security, and economic benefits'. Key focus areas include offshore fisheries development, inshore fisheries development and institutional capacity development. New Zealand's support for Solomon Islands fisheries is considered a long-term partnership approach. Support is delivered via the following modalities:

- Financial support for MFMR operations (provided by way of a grant funding arrangement).
- Advisors working in-country to assist with capacity development and programme implementation.
- Technical specialists retained and funded through MSSIF, providing input on specific issues, e.g. seaweed industry development, or monitoring and evaluation.
- Funding for non-government organizations and community-based organizations to implement programmes that support MFMR priorities, also arranged and funded by MSSIF.

Source: MFAT (2014).

- The Executive Management (the Permanent Secretary, Director of Fisheries, Undersecretary Technical and Under-secretary Corporate Services) are responsible for the administration, human resources and financial matters of the ministry.
- The Inshore Fisheries Division is responsible for research, marketing and community-based resource management of all inshore and coastal fisheries and marine resources and for the development of aquaculture.
- The Provincial Fisheries Division is responsible for development of fisheries in all provinces, providing support to provincial fisheries officers and administration of all fisheries centres in the provinces.
- The Policy, Planning and Project Management Division is made up of the policy and planning section and the project management section and is responsible for development of fisheries policy and management and implementation of fisheries investment projects.
- The Corporate Services Division includes the accounts and administration sections and is responsible for administration, human resources and financial matters.
- The New Zealand Aid-funded programme, Mekem Strong Solomon Islands Fisheries, and the World Bank-funded Pacific Regional Oceanscape Programme are support programmes that sit within the ministry to support targeted activities and capacity development in MFMR.

Apart from MFMR, the institutional framework of organizations and agencies involved with fisheries is complex. Cohen (2011) states that a vast array of agencies can be involved in facilitating and supporting on-the-ground action. In the Solomon Islands, 10 such agencies have been identified as providing direct support to co-management of marine resources. They interact in a national network of agencies called the Solomon

Islands Locally Managed Marine Area network (SILMMA). SILMMA is a group of projects and practitioners, including NGOs, government and communities, who have joined together and are working to improve the success of their conservation and fisheries management efforts. At least another 33 agencies are involved in providing scientific and technical support for marine resource management and conservation in Solomon Islands. They include four national NGOs, seven universities, four regional organizations, nine provincial governments, six international NGOs, four national government agencies, two development agencies and three private enterprises.

12.7.1 Regional and international institutional framework

The major regional institutions involved with fisheries are the Forum Fisheries Agency (FFA), located in Honiara and the Pacific Community (SPC) in Noumea. Other players are the Parties to the Nauru Agreement (PNA) Office in Majuro, the Pacific Islands Forum Secretariat (PIFS) in Suva, the Secretariat of the Pacific Regional Environment Programme (SPREP) in Apia, and the University of the South Pacific (USP) in Suva. The characteristics of those institutions are given in Table 12.13.

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean entered into force in June 2004, and established the Western and Central Pacific Fisheries Commission (WCPFC). The Solomon Islands is a member of the commission, along with 26 other countries. The WCPFC has its headquarters in Pohnpei, Federated States of Micronesia, and has held 13 annual meetings to date.

12.8 LEGAL FRAMEWORK

The main law dealing with fisheries in the Solomon Islands is the Fisheries Management Act 2015, which “makes provisions for the conservation, management, development and sustainable use of fisheries and marine resources of Solomon Islands, to monitor and control fishing vessels within and beyond the fisheries waters, to repeal the Fisheries Act 1998 and to make consequential amendments to the Provincial Government Act 1997 and the Town and Country Planning Act”. The 139-page document has 13 parts:

- Preliminary
- Objective and principles
- Administration
- Fisheries conservation, management and sustainable use
- Fisheries access and management agreements
- Licensing
- Requirements for fishing and other activities
- Monitoring, control and surveillance
- Disposal, release and forfeiture of seized items
- Jurisdiction, procedure, fines and liabilities
- Summary administrative proceedings
- Evidence
- Miscellaneous.

Some of the key provisions in the act are as follows:

- The Director may cause to be prepared Fisheries Management Plans at national, provincial and community levels for any fishery in the fisheries waters and shall undertake consultations set out in the Second Schedule. A Fisheries Management Plan (a) at the national level shall be approved by the Minister; (b) at the provincial level shall be approved by the Director and the Provincial Executive; and (c) at the community level shall be approved by the Provincial Executive and a management committee representing the customary rights holders. In each Fisheries Management Plan, there are (i) management measures; (ii) licensing, enforcement powers and authorities; and (iii) fines, penalties and sanctions.

TABLE 12.13
Pacific Island regional organizations involved in fisheries

	FFA	SPC	Other regional organizations with fishery involvement
Main area of emphasis	Providing management advice on tuna fisheries and increasing benefits to Pacific Island countries from tuna fishing activities.	Most aspects of coastal fisheries and scientific research on tuna. Fisheries are only one aspect of SPC's work programme, which also covers such issues as health, demography and agriculture.	PNA – subregional grouping of countries where most purse seining occurs; SPREP – environmental aspects of fisheries; USP – School of Marine Studies (SMS) involved in a wide range of training; PIFS – major political initiatives, some natural resource economics; leads trade negotiations with EU, which have a major fisheries component
Inter-regional relationships	The FFA/SPC relationship has had ups/downs over the years. It was most difficult in the early 1990s, but tremendous improvement in mid/late 1990s. An annual colloquium has helped the relationship. Staff who have moved between the two organizations have made a noticeable improvement in understanding. Much of the success/benefits achieved by FFA/SPC cooperation depends on the personalities of FFA's Director/Deputy and SPC's Director of the Division of Fisheries, Aquaculture and Marine Ecosystems.		At least in theory, all regional organizations come under the umbrella of PIFS. Their activities are coordinated to some degree by the Council of Regional Organisations in the Pacific (CROP), which has a Marine Sector Working Group that meets at least once per year, but is limited by lack of resources for follow-up. FFA originally provided secretariat services to the PNA, but the PNA broke away from FFA in 2010. Currently, there are some sensitivities in the relationship, but it appears to be improving.
Main strengths	Direct contact with its governing body many times per year results in a high degree of accountability. Mandate of tight focus on tuna eliminates considerable dissipation of effort.	Noumea being a pleasant place to work, there is considerable staff continuity. The Oceanic Fisheries Programme often sets the standard for tuna research in the world. Documentation of work is very good.	Because PIFS is under the national leaders, it is considered the premier regional organization. PNA has achieved considerable success and credibility in such areas as raising access fees, 100 percent observer coverage, eco-certification, high seas closures, and controls on FADs. USP is centrally located in the region and SMS has substantial infrastructure. SPREP has close ties to NGOs active in the marine sector.
Membership	Australia and New Zealand, plus Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu	Includes the major metropolitan countries, all Pacific Island countries, and the French/UK/US territories; the most inclusive of any regional organization.	PNA: the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. USP: Cook Islands, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. SPREP: 21 Pacific Island countries and territories, plus Australia, France, New Zealand and United States of America PIFS: same as FFA

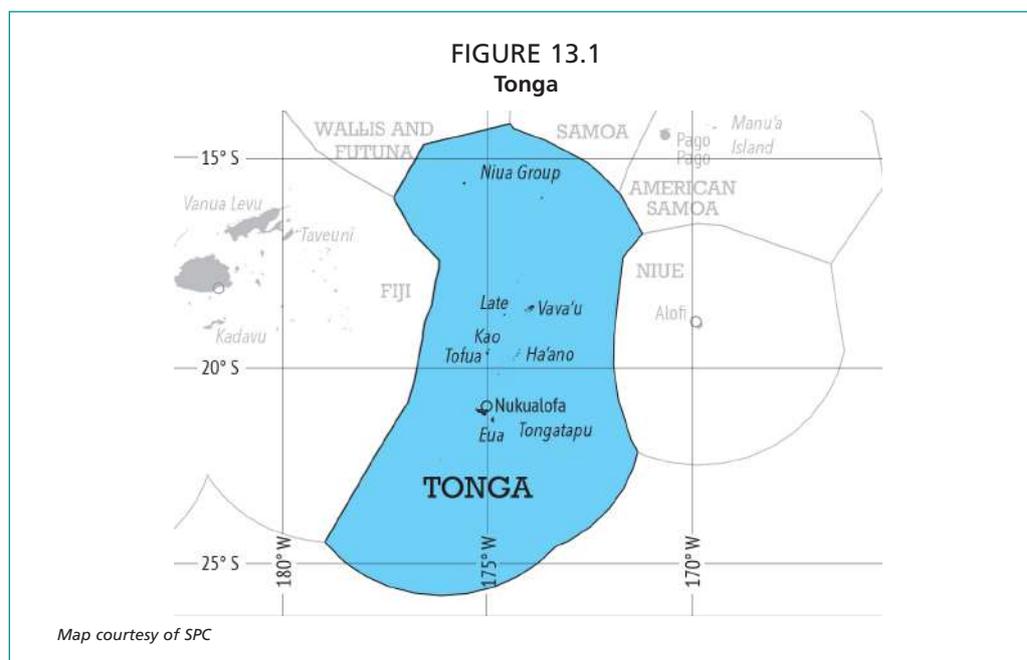
Source: Adapted from Gillett (2014a).

- The Permanent Secretary shall ensure the development of, for transmission to the Minister, (a) a Fisheries and Marine Resources Management and Development Policy; and (b) a Corporate Plan and Annual Operational Plans.
- A Fisheries Licensing Committee is established to make recommendations to the Director on the grant, renewal, suspension and revocation of licences and authorisations to be issued pursuant to the Act. The Permanent Secretary shall appoint to the Fisheries Licensing Committee such persons within the ministry and, as appropriate, officials from other government ministries with a complementary mandate to cooperate in the management or enforcement of matters within the scope of the act.
- A Fisheries Advisory Council is established whose members shall be appointed by the Minister and whose function shall be to advise the Minister and make recommendations at the request of the Permanent Secretary on matters relating to fisheries conservation, management, development and sustainable use.
- A community fisheries management plan may be drawn up for communities by or on behalf of customary rights holders for a customary rights area or areas in consultation with the Director and Provincial Executive.

Several provinces have fisheries ordinances. According to Govan *et al.* (2013), provincial ordinances include the:

- Western Province Resource Management Ordinance 1994
- Western Province Coastal and Lagoon Shipping Ordinance 1991
- Guadalcanal Wildlife Management Area Ordinance 1990
- Isabel Province Wildlife Sanctuary (Amendment) Ordinance 1991
- Isabel Province Resource Management Ordinance
- Temotu Environment Protection Ordinance 1989
- Makira Preservation of Culture and Wildlife Ordinance
- Choiseul Province Resource Management Ordinance 1997
- Makira Ulawa Province Fisheries Ordinance
- Guadalcanal Fisheries Ordinance 2009
- Choiseul Province Fisheries and Marine Environment Ordinance 2011
- Western Province Fisheries Ordinance 2011.

13. Tonga



REPORTING YEAR

This profile was written in 2017, based on data mostly from 2014.

PART 1. OVERVIEW AND MAIN INDICATORS

13.1 GENERAL GEOGRAPHIC AND ECONOMIC INDICATORS

TABLE 13.1
General geographic and economic indicators - Tonga

Land area ¹	747 km ²
Water area ²	700 000 km ²
Population (2016) ³	100 651
GDP of Tonga (2014) ⁴	USD 432 097 000
Fisheries contribution to GDP (2014) ⁵	USD 9 785 000
Fisheries contribution as a % of GDP (2014) ⁶	2.3

¹ Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

² Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

³ 2016 Population and Housing Census from Tonga Department of Statistics Office website: tonga.prism.spc.int

⁴ Reported in Gillett (2016) from the Tonga Statistics Department (2015). Financial year 2013/2014.

⁵ Reported in Gillett (2016) from the Tonga Statistics Department (2015). Financial year 2013/2014.

⁶ Reported in Gillett (2016) from the Tonga Statistics Department (2015). Financial year 2013/2014.

13.2 FAO FISHERIES STATISTICS

TABLE 13.2

FAO Fisheries statistics on total production, employment and trade – Tonga

2014		
Production (tonnes)	Aquaculture	0
	Capture	1 837
	Total	1 837
Employment (thousands)	Aquaculture	0.07
	Capture	N/A
	Total	N/A
Value of trade (USD 1000)	Fisheries exports	6 422
	Fisheries imports	1 847
	Total	8 269

Source: FAO Statistics and Information Branch of the Fisheries and Aquaculture Department. N/A: Data is not available.

PART 2. NARRATIVE

13.3 PRODUCTION SECTOR

13.3.1 Introduction

The geography of Tonga exerts a large influence on fishing in the country. Tonga is made up of some 150 islands (about 36 are inhabited), as well as many smaller islets and reefs. The islands, which have a collective land area of about 747 km², are distributed in three main groups: Tongatapu (location of the capital and administrative centre, Nuku'alofa) and neighbouring islands in the south; the Ha'apai group located centrally; and the Vava'u group to the north. Other islands extend the archipelago further north and south beyond the main groups.

Up to the early 1960s, domestic demand for fish was almost wholly met through catches from the country's reefs and lagoons. Subsequently, however, increases in population and fishing effort, and the growth of the cash economy, have led to overfishing in many inshore areas. Some traditionally important fish, such as mullet, have been reduced to a small fraction of their earlier abundance, and inshore invertebrates such as beche-de-mer, lobsters and giant clams have undergone severe declines. These problems are found throughout Tonga but are most acute close to population centres or in easily accessible fishing areas.

Insufficient production from coastal fisheries led to several strategies to increase fish production for both domestic use and for export. These schemes, which mostly started in the 1970s and 1980s, included outer-islands fish collection, promotion of offshore⁷ tuna fishing and deep-slope demersal fishing, and attempts to develop aquaculture.

In the past decade, there have been two major efforts to improve the quality of fisheries governance in the country. These were:

- an Australian-funded initiative over several years to enhance the ability of the government's fisheries agency⁸ through advisors, targeted initiatives, scholarships, and office infrastructure;
- nurturing the ability of communities to manage their nearby fishery resources, made possible by a change in the Fisheries Management Act.

Fisheries statistics can be presented in different forms to cater for different purposes. In the statistics published by FAO (Part 1 of this profile), the presentation follows the international conventions and standards used by FAO and its Member States for

⁷ In this profile, "offshore" is defined as the area outside the zone normally frequented by small, usually undecked, coastal fishing vessels and is generally greater than 12 nautical miles from the nearest land.

⁸ In mid-2016, the Fisheries Department was separated from the Ministry of Agriculture, Food, Forests and Fisheries to form the Ministry of Fisheries. During another period, from the early 1990s to the mid-2000s, the government fisheries agency was also a separate ministry.

reporting catches, which are given by the flag of the catching vessel. Accordingly, the fishery production of Tonga in 2014 published by FAO (Part 1) was 1 837 tonnes, almost all of which was from marine capture fisheries.

In Table 13.3 below, Tonga fisheries production is given as per FAO reporting standards, but using estimates of production from other sources. The production shown in the various categories is from “Tonga-flagged vessels” even though (a) some vessels are not “flagged” (e.g. canoes and skiffs), and (b) some fishing activity does not involve a vessel (e.g. reef gleaning). The offshore category in the table is defined as the catch from Tonga-flagged industrial-scale fishing operations that are carried out anywhere (i.e. inside or outside the Tonga zone).

TABLE 13.3
Tonga fisheries production in 2014 (as per FAO reporting standards)

	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Tonga-flagged offshore
Volume (tonnes)	0.3	1	3 900	3 000	320
Value (USD)	15 054	3 226	18 064 516	10 053 763	n/a

Units: tonnes unless otherwise stated

The amounts of production given in the above table differ from those shown in Part 1. The table consists of production estimated from a variety of sources (see SPC study below). For the offshore category, the amount given is that reported by the Tonga Fisheries Department to the Western and Central Pacific Fisheries Commission (Fisheries Department, 2015a). As that document is publicly available and can be widely scrutinized, it was presumably prepared with considerable care.

A recent study by the Pacific Community (SPC) presents the fisheries statistics of Tonga in a different way. In that study, they are placed in different categories, which is useful for other purposes, such as administration of the foreign fishing that occurs in Tonga waters. A summary of fishery production from the SPC study is given in Table 13.4.

TABLE 13.4
Fisheries production in Tonga waters, 2014

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Offshore locally based ⁹	Offshore foreign-based ¹⁰
					Both Tonga- and foreign-flagged vessels	
Volume (tonnes)	0.3	1	3 900	3 000	1 363	1 891
Value (USD)	15 054	3 226	18 064 516	10 053 763	4 177 419	5 058 065

Source: Gillett (2016).

Some comment is required to explain the difference between the information in this table and that in Part 1 of this profile:

- Catches can be given by the flag of the catching vessel (as in the FAO statistics given in Part 1), or by the zone where the catch is made (the “offshore foreign-based” and “offshore locally based” columns above). These two different ways

⁹ In the SPC study, “offshore locally based” is the catch in Tonga waters from industrial-scale tuna fishing operations that are (a) based at a port in Tonga, and (b) generally harvested more than 12 nautical miles offshore.

¹⁰ “Offshore foreign-based” is the catch in the Tonga zone from catch from industrial-scale tuna fishing operations that are based at ports outside Tonga. Under the international standardized System of National Accounts (SNA, 2009), those catches do not contribute to the GDP of Tonga.

of allocating catch each have their purposes. Attribution by flag is important for consistency with international conventions, while attribution by zone is important for determining fishing contributions to GDP, and managing revenue from licence fees for foreign fishing in a country's zone.

- For the Tonga-flagged offshore vessels, there is a difference in what was reported to FAO and what was reported to the Western and Central Pacific Fisheries Commission (WCPFC).
- The estimates of production in the categories of coastal fishing, freshwater fishing and aquaculture above were made by a study carried out by SPC in 2015, which included a site visit to Tongatapu and examination of a large number of fishery and economic studies covering the last two decades. It is likely that the basis of the information in the FAO statistics in Part 1 above was a more informal conjecture by a nominated person in the Tonga Fisheries Department.

13.3.2 Marine sub-sector

13.3.2.1 Catch profile

There is good catch data for the tuna fisheries, and to a lesser extent for the deep-slope fisheries. Catch data for the coastal fisheries is limited to that obtained during inspections of fish being sold on Saturday mornings at the main fish market and some roadside stalls on Tongatapu (Tupou-Taufa, 2014).

The catch by Tonga-flagged offshore fishing vessels (all longliners) is given in Table 13.5 below.

TABLE 13.5
Recent longline effort and catch

Year	Effort		Main target catch (tonnes)				Total
	Total # hooks	Albacore	Bigeye	Yellowfin	Pacific bluefin	Other	
2010	531 100	57	24	47	0	38	166
2011	701 100	34	18	171	0	54	277
2012	977 400	20	10	140	0	80	250
2013	778 600	13	7	126	0	77	223
2014	823 400	25	22	195	.13	77.87	320

Source: Fisheries Department (2015a).

Historically, longline effort by Tonga-flagged vessels, in terms of number of hooks per year, rapidly increased from the mid-1990s and peaked at more than 10 million hooks during 2002. This “tuna boom” was followed by a steady decline due to deteriorating economic conditions. The annual catch per unit effort of Tonga-flagged vessels in recent years has remained relatively steady. The albacore catch rates in the Tonga zone are generally greatest during the cool season of the year, April–August (Fisheries Department, 2015a).

Apart from longlining, there have been trials of other types of tuna fishing in Tonga: pole-and-line tuna fishing in the 1970s and some exploratory fishing by purse seiners in the early 1990s, but the economic feasibility of both types was poor. Trolling for tuna by small skiffs relatively close to shore is carried out, with increased activity during periods when fish aggregating devices (FADs) are in place.

Tonga is the leading exporter of deep-slope bottomfish in the Pacific Islands. Box 13.1 below summarizes the history of the fishery.

In recent years in the deep-slope fishery, both the number of trips and the catch have been declining, but the catch per trip has been increasing steadily. This is because the efficiency of the smaller number of boats has been increasing, with changes such

BOX 13.1

Development of deep-slope bottomfishing in Tonga

Before the 1970s, little was known about the snappers and other bottomfish that inhabit the deep waters of the reef slope and seamounts of Tonga. Exploratory fishing in the 1970s by FAO and the South Pacific Commission showed that favourable catches of several snapper species could be made in water up to 400 m deep. After it was demonstrated that these fish were present in substantial quantities, a comprehensive fisheries development programme, undertaken with United Nations Capital Development Fund and United Nations Development Programme assistance, targeted at snappers was carried out by what is now known as the Ministry of Fisheries. The programme included designing boats appropriate for Tonga's fishermen, teaching boatbuilding, training fishermen in snapper fishing techniques, and commencing a biological research programme to ensure conservation of the fish stocks. To date, 41 snapper boats have been constructed by the Ministry of Fisheries, but only a dozen or so of these boats remain active in the snapper fishery.

Source: Gillett (2009c).

as the use of more hooks (MAFFF, 2014). There were 47 tonnes of snapper and other deep bottomfish exported in 2014, which was 7 percent of the total quantity of marine products exported. In that year, about 43 tonnes (93 percent) of the total snapper were exported to Honolulu and the rest were exported to New Zealand and to mainland United States of America. Approximately 94 percent of the snapper exported was fresh, dominated by the longtail snapper, *Etelis coruscans* (MAFFF, 2015).

The information given above relates to Tonga's tuna and deep-slope demersal fisheries. Much more speculation is required to identify trends in the coastal fisheries of the country due to lack of effective coverage by a statistical system.

It is thought that production from coastal fisheries for sale (about 3 900 tonnes) is somewhat greater than that for subsistence purposes (about 3 000 tonnes), but there is considerable uncertainty (Gillett, 2016).

The main general trend in coastal fisheries appears to be the increasing exploitation of coastal resources, especially those close to urban markets. Other changes affecting coastal fisheries appear to be:

- the increasing number of communities placing restrictions on fishing by outsiders in areas adjacent to those communities;
- growing realization that coastal communities must assume much of the responsibility for managing coastal fisheries, with the central government taking a supporting role;
- an increase in the transport of the production of coastal fisheries in Vava'u and Ha'apai to domestic markets in Tongatapu;
- periodic booms in sea cucumber harvesting, followed by lengthy government bans;
- an increase in deployment of FADs by the Fisheries Department, with the idea they will displace some inshore fishing effort to offshore areas.

13.3.2.2 Landing sites

The offshore fishing vessels that are based in Tonga offload their catch at Nuku'alofa, the main urban area. In the past, some of the larger longliners delivered their catch directly to the cannery in Pago Pago, American Samoa. The offshore fishing vessels

operating in the Tonga zone that are based outside of Tonga deliver their catch to Suva and Levuka in Fiji and Pago Pago in American Samoa (Fisheries Department, 2015a).

Deep-slope bottomfishing vessels deliver their catch to Nuku'alofa, and to a lesser degree, to Neiafu in Vava'u.

The catch from small-scale commercial fishing is delivered to several locations on Tongatapu (especially in the Nuku'alofa urban area), to the town of Neiafu in Vava'u, and to the town of Pangai in Ha'apai. Much of the landings at the latter location are for onward shipment to markets in the Nuku'alofa urban area.

Subsistence fishery landings occur at coastal villages throughout the country, roughly in proportion to the distribution of the population.

13.3.2.3 Fishing practices/systems

Tuna fishing within the Tonga zone has been dominated by longlining since the 1950s. The historic tuna fishery (1952–1982) in the Tonga zone was undertaken mainly by the distant-water longline fleets of Japan, Republic of Korea and Taiwan Province of China. Prior to 2004, the longline fleet consisted of around 15–25 local and locally based foreign vessels. Following the implementation of a moratorium on foreign fishing in 2004, the size of the fleet declined, consisting of only three vessels at the end of 2011.

Foreign tuna longliners have been allowed to fish in Tonga waters since 2011 as part of Tonga's programme to increase tuna fisheries production. In 2014, a total of 19 foreign-flagged longline vessels had a valid licence to fish in Tonga fishery waters. The vessels were from Taiwan Province of China (14 longliners), China (3) and Fiji (2). Thirteen of those vessels were less than 100 gross registered tonnes, with one being larger than 200 GRT (Fisheries Department, 2015a).

Tonga is the leading producer of deep-slope bottomfish in the Pacific Islands region. A description of deep-slope bottomfishing in Tonga is given in Box 13.2.

BOX 13.2

Deep-slope bottomfishing in Tonga

A typical fishing trip starts when the fishing crew loads ice, food and fuel onto a vessel – which range from 9 to 15 m in length. They depart Nuku'alofa and travel perhaps 75 nautical miles or more to a spot selected by the captain. Although the ocean surrounding the islands of Tonga is several thousands of metres deep, there are over 100 seamounts, or underwater mountains which rise up relatively close to the surface. These seamounts are where the snappers are found and are the location that fishing captains seek as their fishing spots. A snapper boat anchors on a seamount and the crew use four large hand-operated fishing reels to lower their lines to the bottom. To each line are attached 12 to 30 hooks, baited with either saury, skipjack or squid. The actual fishing is hard work. At a depth of 300 m, it takes a crewman about 8 minutes to crank up the hooks. During a good fishing day, four hours could be spent grinding on the large reels. In nice weather, from four to five days are spent on the fishing grounds, followed by a day of motoring back to port. Most vessels arrive in Nuku'alofa late Friday night.

Source: Gillett (2008a).

The Tonga Fisheries Sector Plan 2016–2024 (Anon. 2016) states that historical deep-slope bottomfishing catches in Tonga exceeded 400 tonnes/year at the outset of the fishery and declined to a low point of 88 tonnes in 1996. Current catches have remained relatively stable at an average of 190 tonnes per year with a fleet of 14–25 vessels. Most of the snapper component of the deep-slope bottomfishing catch is exported and most goes to the United States of America.

Small-scale coastal commercial fishing in Tonga uses a wide variety of gear. A survey of fish arriving in Tongatapu from Vava'u and Ha'apai (Lautaha and Cohen, 2004) showed that almost half of the fish that arrived was caught by diving, 34 percent by handlining, and around 10 percent by droplining. The rest was caught using various other methods, including netting and gleaning. These results could be considered as indicative of the current types of small-scale commercial fishing in the country.

Spearfishing is very important in Tonga. A recent report (Aisea, 2016) indicates that the technique produces more fish from inshore areas in Vava'u and Ha'apai than any other method. An FAO survey (Gillett and Moy, 2006) provides some information on this fishery in the country. The use of underwater torches for night spearfishing appears to have originated in the 1960s. A beche-de-mer boom in Tonga (from roughly mid-1980s to mid-1990s) and associated diving with hookah¹¹ and scuba apparently increased the skills and interest of individuals in using this gear, while a beche-de-mer ban in the mid-1990s created a pool of unemployed divers. There are several types of spearfishing in Tonga: predominantly subsistence, small-scale commercial, recreational, and operations that involve many divers on a large vessel. The gear used for spearfishing in the country is not very sophisticated. Fins, mask and snorkel (often very worn) appear to be used by all divers. Sling spears are far more common than spear guns. Wetsuits are not often used. The Tongatapu spearfishing vessels (mostly 6–8 m in length) are all outboard-powered. Most are made of wood and have a small cabin.

Subsistence fishing techniques are similar to those used for small-scale commercial fishing: diving, handlining and netting. Gleaning by women is especially common. A study of women's fishing activities in Tonga (Walton, 1998) showed that the major activities of Tongan women in harvesting marine resources have traditionally been reef gleaning for shellfish, holothurians and echinoderms.

13.3.2.4 Main resources

In 2014, the catch for the Tongan longline fleet was about 61 percent yellowfin, 8 percent albacore, and 7 percent bigeye. In previous years, albacore was targeted, but the focus has switched to the higher-value yellowfin and bigeye tuna for fresh fish export markets. Dolphinfin is presently the most common non-target species (Fisheries Department, 2015a).

Deep-slope bottomfishing historically has targeted six species: crimson jobfish, *Pristipomoides filamentosus*, golden eye jobfish, *P. flavipinnins*, long-tail snapper, *Etelis coruscans*, short-tail red snapper, *E. carbunculus*, comet grouper, *Epinephelus morhua* and convict grouper, *E. septemfasciatus*. Those six species constitute around 80 percent of the catch. The species composition has changed over time in association with changes in targeting and depth of fishing. The long-tail snapper is now the dominant species, comprising more than 50 percent of the catch (MAFFF, 2014).

With respect to coastal commercial fishing, in the past the Ministry of Fisheries had the Inshore Fisheries Statistics Programme, which gave the major reef-fish species landed at the domestic markets (Bell, 1994). These include: unicorn and surgeon fishes (Acanthuridae), squirrelfishes (Holocentridae), wrasses (Labridae), emperors and sea-brems (Lethrinidae), seaperches (Lutjanidae), goatfishes (Mullidae), sweetlips (Plectorhynchidae), parrotfishes (Scaridae + Sparisomidae), rabbitfishes (Siganidae), halfbeaks (Hemiramphidae), sea-pikes (Sphyrnaeidae), drummerfishes (Kyphosidae), rock-cods (Epinephelidae), silver-biddy (Gerridae), triggerfishes (Balistidae), bullseyes (Priacanthidae) and majors (Abudefdufidae).

¹¹ Hookah – a colloquial, but widely used term for a surface-supply diving apparatus, usually involving the supply of breathing air from a small compressor unit via a free-floating air supply hose to a mouth-held, demand-breathing gas supply device.

Quantitative information on the species composition in the Tongatapu spearfishing catch is given in Vaikona *et al.*, 1997 (Table 13.6).

In an older study (World Bank, 1999b), residents of six coastal communities in Tonga were asked to name the three subsistence fishery resources of most importance

TABLE 13.6
Major species caught by spearfishing

	Tongan name	English name Scientific name	Percentage in catch Category
Night diving	Hohomo	Parrotfish <i>Scarus</i> spp.	19%
	'Ume	Unicornfish <i>Naso unicornis</i>	17%
	Ma'ava	Rabbitfish <i>Siganus argenteus</i>	17%
	Olomea	Parrotfish <i>Scarus</i> spp.	10%
	Pone	Surgeonfish <i>Acanthurus</i> spp.	7%
	Others		30%
			100%
Day diving	Pone	Surgeonfish <i>Acanthurus</i> spp.	38%
	Hohomo	Parrotfish <i>Scarus</i> spp.	13%
	Feke	Octopus	9%
	Ngatala	Grouper <i>Epinephelus</i> spp.	8%
	Ta'a	Squirrelfish <i>Ostichthys</i> spp.	5%
	Others		26%
			100%

to them. Eight resources were most often cited: finfish, octopus, lobster, bêche-de-mer, *Turbo* spp., giant clams, seaweed and *Anadara*.

In terms of the status of the above resources, there is little quantitative stock assessment information available, with the exception of that for tuna and deep-slope bottomfish.

In relation to tuna, recent information from the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC, 2016) shows that for:

- **skipjack** – the stock is currently only moderately exploited and fishing mortality levels are sustainable;
- **bigeye** – recent analysis indicates that overfishing is occurring for the bigeye tuna stock and that to reduce fishing mortality to that at maximum sustainable yield, a reduction in fishing mortality is required;
- **yellowfin** – the current total biomass and spawning biomass are higher than at levels associated with maximum sustainable yields. Therefore, yellowfin tuna is not considered to be in an overfished state;

- **South Pacific albacore** – there is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries. It should be noted that longline catch rates are declining, and catches over the last 10 years have been at historically high levels and are increasing.

The Tonga Deepwater Fisheries Management Plan 2014–2016 (MAFFF, 2014) reviews the range of estimates for maximum sustainable yield (MSY) from that fishery. Given the uncertainty in the various estimates, a working MSY of about 250 tonnes (200 tonnes for seamounts and 50 tonnes for the banks) is considered appropriate. Recent catches are below this level.

Current stock assessment information, such as that above for tuna and bottomfish, is not available for the other important fishery resources of Tonga.¹² There is a widely held perception that many of the coastal fish and invertebrate species are overexploited, especially the high-value species and those located close to urban areas.

13.3.2.5 Management applied to main fisheries

Tonga's tuna fisheries are managed on regional and national levels.

- On the regional level, Tonga is a member of the Western and Central Pacific Fisheries Commission (WCPFC) that was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Tonga and the other 26 members of the commission enact tuna management measures at the annual WCPFC meeting. From Tonga's

¹² In November 2016, SPC completed a comprehensive survey for sea cucumber in Tonga, but the results are not yet available.

perspective, the two most important measures are the: (1) Conservation and Management Measure for South Pacific Albacore; and (2) Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in The Western and Central Pacific Ocean.

- On the national level, the tuna fisheries are managed by the Tonga National Tuna Fisheries Management and Development Plan (2015–2017). The stated overall goal of the plan is “to manage Tonga’s tuna fisheries resources through an ecosystem-based, precautionary and rights-based approach in order to maximize the benefits to Tonga people while ensuring the biological and economic sustainability of the fishery”. The main management measures are (a) a total allowable catch for South Pacific albacore tuna, currently set at 2 500 tonnes in the longline fishery, and (b) a limit on the total number of longline fishing vessel licences (including local, locally based and foreign licences), currently set at 15 vessels.

Deep-slope bottomfishing is managed by the Tonga Deepwater Fisheries Management Plan 2014–2016. The plan’s two main measures are that: (1) the catch is limited to 200 tonnes annually of export species; and (2) vessels are limited in length to 23 m.

A national sea cucumber fishery plan was developed in 2007. The plan contained size limits, prohibited some species from export and prohibited the use of underwater breathing apparatus for harvesting sea cucumber. The plan also prescribed controls on the number of processing and export licences, an annual open season and total allowable catch quotas for certain species. SPC (2015) states that the management plan was not adhered to, leading to the collapse of the fishery. There is currently a total ban on the fishing and export of sea cucumbers.

The Marine Aquarium Fishery Management Plan uses three main management measures, namely: (1) a limit on the number of operators in Tongatapu to five, (2) a limit of 100 000 on the number of fish exported by each operator, and (3) a ban on the export of live rock.

The management of Tonga’s small-scale coastal fisheries is undergoing a major change, from the largely unregulated open-access fishing of the past to a community-based system. Box 13.3 describes this transition.

BOX 13.3

Fisheries management by special management areas

During the 20th century, all Tongans had equal access to the coastal fishery resources of the country. The government’s efforts to manage and conserve those resources were based on a centralized approach in which the Fisheries Division would attempt to regulate fisheries from its head office in Tongatapu and stations in a few parts of the country. In many cases, especially in the outer islands and remote communities, the net result of well-intentioned central management of coastal fisheries in Tonga was the absence of management. In the mid-1990s, the idea arose that coastal communities should be given powers to regulate fisheries in their nearby marine areas. That concept gained momentum and in the early 2000s a change in Tonga’s fisheries legislation allowed for fisheries management by local communities, through Special Management Areas (SMAs). Since that time, the Fisheries Division has worked with coastal communities to establish 11 SMAs – and there is the intention to establish SMAs throughout the country.

Source: Gillett (2016).

One of the requirements for a community to have an SMA is the development of a coastal community management plan, with the following components: vision, objectives, status/trends in the fishery, statement/analysis of the problems, management strategies, and monitoring and evaluation. The main management measures in the plans are usually the exclusion of outsiders from nearby fishing areas and the establishment of a no-take zone.

Management objectives

In general, management objectives are required to conform to the Fisheries Management Act 2002. That law requires that measures promote the objectives of optimum utilization and achievement of economic growth, human resource development, employment creation and sound ecological balance.

Several of Tonga's fisheries have more specific objectives, as indicated in the respective management plans. The Tonga National Tuna Fisheries Management and Development Plan lists the following objectives:

- Ensuring that the utilization of Tonga's tuna longline fisheries resources is compatible with the sustainable development measures.
- Maximizing economic benefits, and ensuring ownership of the fisheries resources, to the people of Tonga from optimum utilization of its tuna resources, including fishing, processing and value-adding.
- Ensuring that any tuna legislation facilitates support for national priorities and interests, and all necessary requirements of regional and international binding frameworks and measures.
- Exploring alternative management arrangements that generate economic benefits.
- Providing clear and transparent licensing procedures.
- Ensuring that non-target species are not discarded or dumped.
- Promoting the use of mitigation measures to minimize bycatch of endangered threatened and protected species.
- Contributing to capacity building, technology transfer and the food security of Tongan subjects.

The objectives of managing Tonga's deep-slope bottomfishery are to:

- conserve the fish resources by limiting the amount of fishing;
- encourage the economic efficiency of vessels and maximize export revenue;
- protect a number of seamounts (and banks) as a safety valve for stock sustainability and for protecting juvenile fish.

For the SMAs described above, each community develops its own objectives. Common management objectives are to: improve fish catch, improve livelihoods, increase fish abundance and decrease environmental degradation. Objectives are largely established by the community, with the main role of the staff of the Ministry of Fisheries being to point out unrealistic objectives.

Institutional arrangements

The main institutions involved with fisheries management are the Ministry of Fisheries and the Fisheries Advisory Committee. The Fisheries Management Act 2002 states that the Fisheries Advisory Committee comprises (*sic*):

- (a) the Secretary of Fisheries as the Chairman
- (b) the Secretary for Lands or his nominee
- (c) the Secretary for Labour, Commerce and Industries or his nominee
- (d) one member representing commercial fisheries interests nominated by the Tongan Fish Exports Association
- (e) one member representing women's interests nominated by the Minister
- (f) two members representing local fishermen nominated by the Minister
- (g) one member representing coastal communities nominated by the Prime Minister

(h) such other persons not exceeding two whom the Secretary may think fit to appoint.

The Fisheries Management Act 2002 specifies that the Minister shall, in consultation with the Fisheries Advisory Committee, determine the total allowable catch or total allowable level of fishing with respect to any stock of fish, subject to the provisions of the act, or as provided in a fisheries management agreement.

In practice, the major fisheries (tuna, deep-water bottomfish, beche-de-mer, aquarium fish) have management plans that establish committees dedicated to the specific fishery. For example, the tuna management plan states “stakeholders are to be represented in the Tuna Management Committee, which will advise the Secretary and the Minister on the management of the tuna resources”.

13.3.2.6 Fishing communities

The concept of “fishing communities” has limited applicability to Tonga. Nearly all households in coastal villages are involved in coastal fishing activities. It could therefore be stated that all coastal villages in Tonga are “fishing communities”.

13.3.3 Inland sub-sector

The lack of large freshwater bodies in Tonga results in the freshwater catches being extremely small. Catches of fish in fresh water appear limited to tiny amounts of introduced tilapia in small lakes in the northern island groups of the country. It is reported that a small stream on 'Eua Island has freshwater shrimp. With limited factual basis, Gillett (2016) deems that Tonga’s inland fishery production in 2014 was one tonne, worth USD 3 226.

There is no management of the small inland fishery sub-sector.

13.3.4 Aquaculture sub-sector

Aquaculture research and development work in Tonga has typically fallen into two main categories:

- Production aquaculture, i.e. culturing of organisms intended to result in the production of edible or saleable products for domestic consumption or export. This category includes the substantial volumes of work done over the years on farming of mullet, milkfish, tilapia, seaweed, mussels, edible oysters and pearl oysters, as well as some work on giant clams.
- Reef re-seeding, i.e. the mass production of juveniles for restocking of depleted wild fisheries. This is a relatively new thrust that includes some of the work done on giant clams as well as more recent work on trochus and green snail.

Almost 20 years ago, the FAO/AusAID Tonga fisheries sector review stated: “Aquaculture research and development work has taken place in Tonga for more than 40 years. During that time numerous projects, some of which have been very substantial, have been carried out, but so far very little of this work has been translated into commercial or production aquaculture” (Preston, 1998). Currently, significant aquaculture production in Tonga is limited to small amounts of giant clams and pearls. There is also the farming of milkfish, seaweed, coral and sea cucumber but on a very small or experimental basis. The aquaculture production of the country in 2014 has been estimated to be about 1 291 pieces, with a farm-gate value of USD 15 054 (Gillett, 2016).

The aquaculture sub-sector is managed through the Aquaculture Management Act 2003 (MAF, 2010). That law requires that there be a Management and Development Plan for the nation’s aquaculture industry. In addition, the act requires that there be an Aquaculture Advisory Committee to advise the Minister on matters related to aquaculture, such as policy, planning, management and development. The terms of reference for the committee’s workings and members are provided for by the act. The Aquaculture Management Act states that persons, businesses or communities

undertaking aquaculture must be licensed. It further states the requirements for renewing and refusing licences or authorizations, and a system for resolving grievances.

The act stipulates that the Minister will prepare and keep the Management and Development Plan under review. The Management and Development Plan must be gazetted and be a guide and control mechanism to supplement the act for aquaculture. The Management and Development Plan states that aquaculture should be based on these six objectives:

- The aquaculture industry will contribute to the economic development and social well-being of the people of Tonga.
- The aquaculture industry will be environmentally sustainable.
- The aquaculture industry will be managed in a manner that considers and balances economic and social gains against environmental costs.
- The aquaculture industry will be managed within a transparent and explicit regulatory framework.
- There will be broad community consultation on aquaculture developments that have the potential to impact on specific communities.
- Aquaculture products grown for human consumption will be safe and disease free.

13.3.5 Recreational sub-sector

Although subsistence fishing may have a large social component and be enjoyed by the participants, there is little recreational fishing as a leisure activity for villagers. There are fishing clubs in Tongatapu and Vava'u. Most members of those clubs are expatriate residents of Tonga. Commercial game fishing (mostly open-ocean trolling) is a popular tourist activity, especially in Vava'u where several commercial sport-fishing vessels are registered.

There is no active management of the recreational sub-sector, with one exception: the Fisheries Act states: “No fishing vessel shall be used for reward or hire for sport fishing in the fisheries waters without a commercial sport-fishing vessel licence issued by the Secretary”.

13.4 POST-HARVEST SECTOR

13.4.1 Fish utilization

In general, offshore fishing is export oriented. The high-quality fresh bigeye and yellowfin is typically exported to Japan and the United States of America. Most of the albacore was formerly sent to overseas canneries, but an increasing amount is sold domestically due to high fish prices. The bycatch from the offshore fisheries is consumed locally, except for dolphinfish which is exported to the United States of America.

In the coastal fisheries:

- for deep-water bottomfishing, about two thirds of the catch is exported, with the remainder mostly going to restaurants in Tongatapu and Vava'u. About 90 percent of the bottomfish go to Hawaii, with the rest to New Zealand and to mainland United States of America;
- beche-de-mer is shipped to China;
- aquarium fish and associated coral products are shipped to the United States of America;
- inshore finfish and invertebrates are largely consumed by the harvesting household, but there is a significant trade between Ha'apai and the markets in Tongatapu, as well as export of seafood for relatives overseas.

Aquaculture production of giant clams is for the aquarium trade in the United States of America and cultured pearls are mainly for the tourists who visit Tonga.

13.4.2 Fish markets

Domestic fish markets are found in the urban areas of the country. The Nuku'alofa area has one major fish market and several smaller ones, and significant roadside sales. Some fishing companies distribute fish to restaurants.

Sites dedicated to fish sales exist in Neiafu, Vava'u, and Pangai, Ha'apai.

13.5 SOCIO-ECONOMIC CONTRIBUTION OF THE FISHERY SECTOR

A recent study by SPC (Gillett, 2016) attempted to quantify the fishery-related benefits received by Tonga and other Pacific Island countries. The study gave the available information on the contribution of fishing/fisheries to GDP, exports, government revenue and employment. Unless otherwise noted, the information in this section is from that study.

13.5.1 Role of fisheries in the national economy

The Tonga Statistics Department makes the official estimate of the fishing contribution to GDP. The SPC study examined the official methodology and, using its independent estimate of the value of fisheries production, re-estimated the fishing contribution.

- The official contribution showed a FY 2013/2014 fishing contribution to GDP of TOP 18.2 million (USD 9.8 million), or 2.3 percent of GDP (Statistics Department, 2015; M. Masila, personal communication, September 2015).
- The contribution of fishing to GDP was re-estimated by the SPC study for the year 2014. It showed a contribution of TOP 35.7 million (USD 19.2 million), or 4.4 percent of GDP.

In 2014, Tonga received TOP 1 167 816 (USD 627 858) in access fees for foreign fishing. The total government revenue in FY 2013/2014 was TOP 301.5 million (USD 162.1 million). The 2014 access fees therefore equate to about 0.4 percent of all government revenue for FY 2013/2014.

13.5.2 Trade

The Statistics Department (2015) indicates that a total of TOP 12.5 million (USD 6.7 million) of fishery products¹³ were exported in 2014. This represents about 44.2 percent of all Tonga's exports for that year.

In Part 1 of this profile, FAO import/export data for 2014 show that the value of fishery product exports was USD 6.4 million and imports were USD 1.8 million.

13.5.3 Food security

The SPC work examined several studies related to fish consumption in Tonga (i.e. finfish and edible invertebrates), including fisheries surveys, dietary surveys and household income and expenditure surveys. Most of the estimates of annual per capita fish consumption for the country lie in the range of 25.2 to 35.0 kg per year, which is low compared to most Pacific Island countries.

The recent Tonga Fisheries Sector Plan (Anon., 2016) states that more accurate records of fish imports are required to precisely identify the imports. However, canned fish (mackerel, tuna and sardines) appears to constitute the most important group in terms of food security. Approximately 1 400 tons (2008–2012) of canned fish is imported per year at an average price of USD 1.8 per kg, for an annual value of approximately USD 2.5 million. Information suggests that the competitive price, convenience and nutritional value of canned fish make these products highly competitive as the price of local fish precludes regular consumption by many households.

¹³ This includes "coral and similar materials".

13.5.4 Employment

The 2011 census (Statistics Department, 2012) has a considerable amount of information on fisheries employment. Table 13.7 below shows the main type of work in the week prior to the census for the 64 597 people in Tonga aged 15 years and older. As expected, involvement with fisheries work is greatest on small islands and least in urban areas.

TABLE 13.7
Involvement with fishing by geographic area (15 years +)

	Total	Tongatapu	Vava'u	Ha'apai	'Eua	Ongo Niua	Urban	Rural	Greater Nuku'alofa
	64 597	47 475	9 117	4 121	3 042	842	15 812	48 785	23 229
Fishing mainly for sale	859	552	136	141	20	10	108	751	259
Fishing for own consumption	437	202	87	123	7	18	34	403	84
Fishing as a % of population (15 years+)	2.0%	1.6%	2.4%	6.4%	0.9%	3.3%	0.9%	2.4%	1.5%

Source: Statistics Department (2012).

TABLE 13.8
Tuna-related employment in Tonga (number of people employed)

	2009	2010	2011	2012	2013	2014
Processing and ancillary	20	14	17	6	15	12
Local crew	30	17	9	6	7	33
Total	50	31	26	12	22	45

Source: FFA (2015b).

The Forum Fisheries Agency (FFA) has a programme that collects data on tuna-related employment in a standard form. FFA (2015b) contains information on the employment of people from Tonga in the tuna industry (Table 13.8). A total of 45 Tongans were employed in the tuna industry in

2014. Across the Pacific Island countries in 2014, a total of 17 663 people were employed as crew on tuna vessels or in tuna processing and ancillary work (FFA, 2015b). Tuna-related employment in Tonga therefore represents 0.26 percent of regional employment in the tuna industry.

13.5.5 Rural development

The Ministry of Fisheries maintains offices and staff in several locations outside the main urban area of Nuku'alofa: in Vava'u, Ha'apai, 'Eua and Niua-tapu. One of the major objectives of these outposts is to promote fisheries development through a variety of ways, including market facilitation, advice on fisheries management, deployment of offshore FADs and provision of ice-making equipment.

13.6 TRENDS, ISSUES AND DEVELOPMENT

13.6.1 Constraints and opportunities

Major constraints for the fisheries sector include the following:

- Many of the inshore fishery resources, especially those close to urban markets, are fully or overexploited.
- In most of the coastal communities of Tonga, the open-access nature of adjacent fishing areas creates a negative incentive to conserve resources for the future. The “first-come-first-served” regime now prevailing is an incentive to harvest as much as possible, as fast as possible.
- Small-scale fishers have difficulty in accessing economically the relatively abundant offshore fishery resources.
- The development of a tuna industry is difficult from a high-cost location.

- There are considerable difficulties associated with marketing fishery products from the remote areas where abundance is highest to the urban areas where the marketing opportunities are greatest.
- Aquaculture is, to some degree, stuck in the phase of the Ministry of Fisheries growing organisms in tanks.

Opportunities in the fisheries sector include:

- expanding the Special Management Area concept (communities acquiring management control over adjacent inshore fisheries) to other coastal communities in Tonga;
- making the transition from the Ministry of Fisheries raising organisms in tanks to efforts to create a viable aquaculture industry;
- increasing the effectiveness of the Ministry of Fisheries by creating incentives to promote private sector development;
- taking advantage of the new leadership of the Ministry of Fisheries and well-educated staff.

13.6.2 Government and non-government sector policies and development strategies

The most recent articulation of the government's policies and development strategies in fisheries is found in the Tonga Fisheries Sector Plan 2016–2024 (Anon., 2016). That document contains a section linking the National Strategic Planning Framework's objectives to the fisheries sector. It gives the policies in four areas:

Sustainable community fisheries:

- Strong inclusive communities, by engaging districts/villages/communities in meeting their prioritised service needs and ensuring equitable distribution of development benefits.
- Cultural awareness, environmental sustainability, disaster risk management and climate change adaptation, integrated into all planning and implementation of programmes.

Sustainable commercial fisheries:

- Dynamic public and private sector partnership as the engine of growth, by promoting better collaboration between government and business, appropriate incentives, and streamlining of rules and regulations (through the National Fisheries Council, Special Management Areas, fisher and exporter associations, development of an aquaculture investment policy, adaptive management of fisheries).
- Safe, secure and stable society, by maintaining law and order (activities on compliance, safety at sea).

Public and private investment:

- Appropriate, well-planned and maintained infrastructure that improves the everyday lives of the people and lowers the cost of business, by the adequate funding and implementation of the National Infrastructure Investment Plan.

Improved fisheries governance:

- Better governance, by adopting the qualities of good governance, accountability, transparency, anti-corruption and rule of law.

13.6.3 Research

A very large number of fisheries research projects have been carried out in Tonga. Most areas of Tonga and most types of resources have been covered by various research endeavors. The older research is listed in a bibliography of Tonga fisheries (Gillett,

1994). The results of many research projects are summarized by resource in profiles of Tonga fisheries (Bell, 1994). Research projects in the 1990s are summarized in a FAO/AusAID review of the Tonga fisheries sector (Gillett *et al.*, 1998). The latter document contains sections on:

- past and present fisheries research in Tonga
- planned fisheries research
- prioritization of fisheries research
- the mechanism by which important research needs are translated into research activities
- specific suggestions for improving current resource monitoring
- research activities required by community-based management
- the involvement of the ministry in tuna research
- procurement of data from commercial operators
- suggestions for improving fisheries research in Tonga.

Current fisheries research in Tonga by the Ministry of Fisheries includes topics related to sea cucumbers, tuna, aquaculture, deep-slope bottomfish, bluenose and community-based management. Major issues in fisheries research are the translating of research needs into research activities, analysis of data collected by research projects, and funding for research. Much of the recent research in Tonga has been carried out in cooperation with SPC.

13.6.4 Education and training

Education related to fisheries in Tonga is undertaken in a variety of institutions:

- Academic training in biological, economic and other aspects of fisheries is given at the University of the South Pacific in Suva, and to a lesser extent at universities in New Zealand, Australia, Japan and the United Kingdom.
- The Tonga Maritime Polytechnic Institute has courses relating to small-boat safety and certification of vessel officers.
- Training courses, workshops and attachments are frequently organized by the regional organizations: SPC in New Caledonia and FFA in the Solomon Islands. The subject matter has included such diverse topics as fish-quality grading, stock assessment, seaweed culture, fisheries surveillance and on-vessel observing.
- Courses and workshops are also given by NGOs and by bilateral donors, such as those by Japan.

13.6.5 Foreign aid

The largest donor initiative in Tonga's fisheries sector in the last two decades was the Tonga Fisheries Project sponsored by Australia. This multi-year project was completed in 2008 and covered institutional strengthening of the Fisheries Division, renovation of the Fisheries Division offices, offshore/coastal fisheries management and fisheries legislation.

New Zealand is currently sponsoring another high-profile project, the provision of a fisheries policy advisor.

A subject that is presently attracting considerable donor support is the establishment of Special Management Areas (SMAs), as described in Box 13.3 above. The following donors are supporting SMAs in Tonga: the Asian Development Bank, Waitt Foundation, Seacology, SPC, Global Environment Facility and Pacific Development and Conservation Trust.

FAO has several fisheries initiatives in Tonga, including a review of SMAs that was completed in late 2016.

Historically, Japan has been the major donor supporting aquaculture in Tonga. The Japanese International Cooperation Agency (JICA) funded the construction of the Tongan Mariculture Centre, and its refurbishment after damage by a major cyclone.

JICA has also provided aquaculture experts, training, materials and operating support to Tonga through in-kind technical assistance programmes.

The fisheries-related assistance of many donors is channelled through the regional organizations. This is covered in section 13.7.1 below.

13.7 INSTITUTIONAL FRAMEWORK

During the past two decades the government fisheries agency has been at different times the Fisheries Division, the Ministry of Fisheries, and the Fisheries Department. In mid-2016, the fisheries sector was separated from the Ministry of Agriculture, Food, Forests and Fisheries to form the current Ministry of Fisheries.

The Ministry of Fisheries is headed by the Minister of Fisheries. The senior civil servant in the Ministry is the Chief Executive Officer.

The Ministry of Fisheries is currently¹⁴ made up of five divisions:

- Fisheries Science Division (comprising offshore fisheries, coastal fisheries and aquaculture)
- Compliance Division
- Economics and Management Division
- Administration Division
- Chief Executive Officer Division

Other institutions that are important to fisheries in Tonga are the Fishing Industry Association of Tonga (which represents the larger fishing companies), and the Tonga National Fishing Association (which represents mainly the smaller fishing operations).

Many of the managed fisheries have advisory boards. For example, there is a Deepwater Fishery Management Committee established by the Tonga Deepwater Fisheries Management Plan. There is an Aquaculture Advisory Committee to advise the Minister on policy, planning, management and development of aquaculture.

Important internet links related to fisheries in Tonga include:

- www.tongafish.gov.to – the website of the Tonga Ministry of Fisheries, which contains information on legislation, management plans, applications for licences, publications, and contact details for key fisheries officials
- <http://www.spc.int/coastfish/en/countries/tonga.html> – information on Tonga fisheries and links to other sites
- www.tonganfishers.org – the website of the Fishing Industry Association of Tonga (FIAT).

13.7.1 Regional and international institutional framework

The major regional institutions involved with fisheries are the Forum Fisheries Agency (FFA), located in Honiara and the Pacific Community (SPC) in Noumea. Other players are the Parties to the Nauru Agreement (PNA) in Majuro, the Pacific Islands Forum Secretariat (PIFS) in Suva, the Secretariat of the Pacific Regional Environment Programme (SPREP) in Apia, and the University of the South Pacific (USP) in Suva. The characteristics of those institutions are given in Table 13.9.

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean entered into force in June 2004, and established the Western and Central Pacific Fisheries Commission (WCPFC). Tonga is a member of the commission, along with 26 other countries. The WCPFC has its headquarters in Pohnpei, Federated States of Micronesia, and has held 13 annual meetings to date.

¹⁴ In late 2016 there was a plan to reorganize the divisions in the Ministry, but at the time of writing this profile that work was not finalized.

TABLE 13.9
Pacific Island regional organizations involved in fisheries

	FFA	SPC	Other regional organizations with fishery involvement
Main area of emphasis	Providing management advice on tuna fisheries and increasing benefits to Pacific Island countries from tuna fishing activities.	Most aspects of coastal fisheries and scientific research on tuna. Fisheries are only one aspect of SPC's work programme, which also covers such issues as health, demography and agriculture.	PNA – subregional grouping of countries where most purse seining occurs; SPREP – environmental aspects of fisheries; USP – School of Marine Studies (SMS) involved in a wide range of training; PIFS – major political initiatives, some natural resource economics; leads trade negotiations with EU, which have a major fisheries component
Inter-regional relationships	The FFA/SPC relationship has had ups/downs over the years. It was most difficult in the early 1990s, but tremendous improvement in mid/late 1990s. An annual colloquium has helped the relationship. Staff who have moved between the two organizations have made a noticeable improvement in understanding. Much of the success/benefits achieved by FFA/SPC cooperation depends on the personalities of FFA's Director/Deputy and SPC's Director of the Division of Fisheries, Aquaculture and Marine Ecosystems.		At least in theory, all regional organizations come under the umbrella of PIFS. Their activities are coordinated to some degree by the Council of Regional Organisations in the Pacific (CROP), which has a Marine Sector Working Group that meets at least once per year, but is limited by lack of resources for follow-up. FFA originally provided secretariat services to the PNA, but the PNA broke away from FFA in 2010. Currently, there are some sensitivities in the relationship, but it appears to be improving.
Main strengths	Direct contact with its governing body many times per year results in a high degree of accountability. Mandate of tight focus on tuna eliminates considerable dissipation of effort.	Nooumea being a pleasant place to work, there is considerable staff continuity. The Oceanic Fisheries Programme often sets the standard for tuna research in the world. Documentation of work is very good.	Because PIFS is under the national leaders, it is considered the premier regional organization. PNA has achieved considerable success and credibility in such areas as raising access fees, 100 percent observer coverage, eco-certification, high seas closures, and controls on FADs. USP is centrally located in the region and SMS has substantial infrastructure. SPREP has close ties to NGOs active in the marine sector.
Membership	Australia and New Zealand, plus Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu	Includes the major metropolitan countries, all Pacific Island countries, and the French/UK/US territories; the most inclusive of any regional organization.	PNA: the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. USP: Cook Islands, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. SPREP: 21 Pacific Island countries and territories, plus Australia, France, New Zealand and Untied States of America. PIFS: same as FFA

Source: Adapted from Gillett (2014a).

13.8 LEGAL FRAMEWORK

The main laws related to fisheries and aquaculture in Tonga are the Fisheries Management Act 2002 and the Aquaculture Management Act 2003.

The main features of the Fisheries Management Act 2002 are as follows:

- The Minister shall, subject to this Act, be responsible for conservation, management, sustainable utilization and development of fisheries resources in the Kingdom and the fisheries waters.
- The Minister shall establish a Fisheries Management Advisory Committee which shall advise him on matters relating to the conservation, management, sustainable utilization and development of fisheries in the Kingdom.

- The Minister shall, in consultation with the Fisheries Advisory Committee, determine the total allowable catch or total allowable level of fishing with respect to any stock of fish subject to the provisions of this Act or as provided in a fisheries management agreement.
- The Secretary shall progressively prepare and keep under review plans for the conservation, management, sustainable utilization and development of fisheries in the fisheries waters and ensure the implementation of such fishery plans.
- The Secretary shall maintain or cause to be maintained a Fishing Vessels Register. No fishing vessel shall be operated in the fisheries waters and no Tongan ship shall be used in or outside the fisheries waters for fishing unless such vessel or ship has been registered on the Fishing Vessels Register.
- The Minister may by Order published in the Gazette, declare any area of the fisheries waters and corresponding subjacent area to be a Special Management Area for purposes of coastal community management, application of certain conservation and management measures, subsistence fishing operations or other specified purpose.
- The Minister may, in consultation with the Committee, designate any local community in Tonga to be a coastal community for the purposes of community-based fisheries management and may prescribe the rights and responsibilities of such coastal community in respect of the Special Management Areas or part thereof.
- No person shall export any fish or fish product without a fish export licence issued in accordance with this Act.

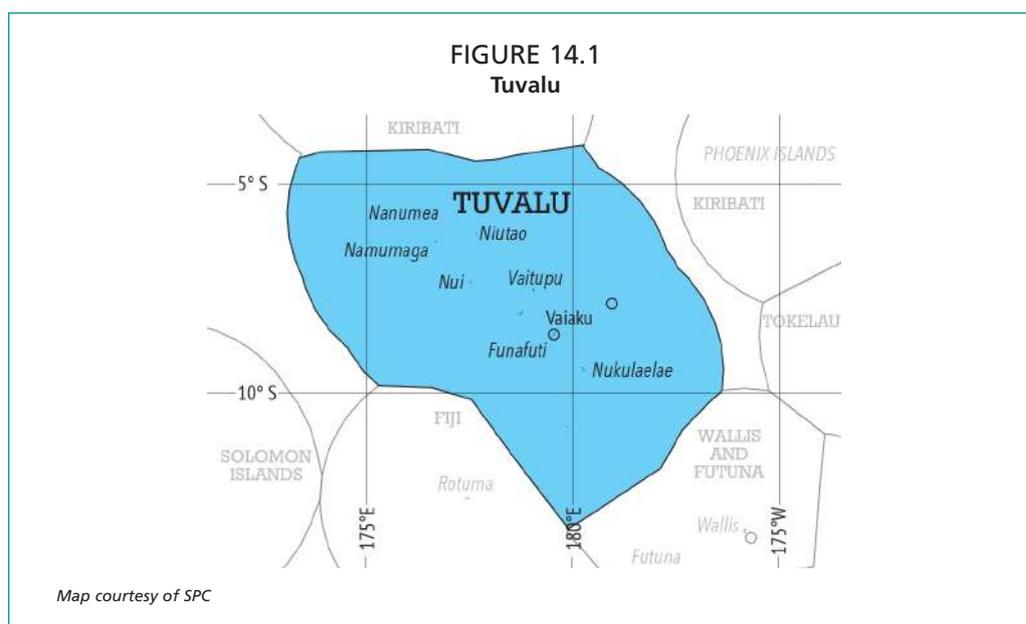
The main features of the Aquaculture Management Act 2003¹⁵ are as follows:

- Responsibility of the Minister: The Minister shall be responsible for the control, management and development of aquaculture and any related activity, whether on land or in any aquatic area including marine areas.
- Aquaculture management and development plan: The Minister shall prepare and keep under regular review a plan for the management and development of aquaculture which shall be published in the Gazette.
- Codes of practice: The Minister may, in consultation with the Aquaculture Advisory Committee, issue and publish codes of practice. The Minister shall ensure that a copy of every code of practice is available for inspection by the public during business hours and copies of the whole or any part of that code shall be provided, upon payment of the prescribed fee. The failure to comply with a code of practice shall be taken into consideration in the grant or disqualification of any authorization under this Act.
- Aquaculture Advisory Committee: There shall be established an Aquaculture Advisory Committee to advise the Minister on policy, planning and guidelines for the regulation, management and development of aquaculture; and any matter on which the Minister or the Secretary is required to consult the Advisory Committee under this Act.
- Aquaculture to be conducted in accordance with this Act: Aquaculture and related activities shall only be conducted: by persons who hold an aquaculture development licence or other authorization issued in accordance with this Act; within aquaculture areas; and in accordance with this Act and any regulations or orders made under this Act.

¹⁵ A minor amendment to the Aquaculture Management Act 2003 was made in 2005, the Aquaculture Management (Amendment) Act 2005. This involved simply inserting the words “or the Waste Management Act 2005” in one section.

- Licence conditions: An aquaculture development licence:
 - shall be valid for the period stated in the licence which shall not exceed 10 years;
 - shall not be used for any purpose other than those purposes specified in the licence; and
 - shall be subject to any general terms and conditions which may be prescribed generally or in respect of the relevant type of aquaculture by regulations;
- Environmental impact assessment: Holders of an aquaculture development licence or other authorization shall take all reasonably practical measures to avoid or minimize pollution and any harmful environmental impact caused by aquaculture or related activity, including the discharge of effluent and the disposal of sludge.
- Exotic fish: The Secretary may by Notice in the Gazette designate any species of exotic fish and such designation of exotic fish shall be published. No person shall introduce or import, possess, culture, sell or export any exotic fish without the written authorization of the Secretary.

14. Tuvalu



REPORTING YEAR

This profile was written in 2017, based on data mostly from 2014.

PART 1. OVERVIEW AND MAIN INDICATORS

14.1 GENERAL GEOGRAPHIC AND ECONOMIC INDICATORS

TABLE 14.1

General geographic and economic indicators - Tuvalu

Land area ¹	26 km ²
Water area ²	900 000 km ²
Population (2011) ³	11 206
GDP of Tuvalu (2014) ⁴	USD 31 567 000
Fisheries contribution to GDP (2014) ⁵	USD 2 976 000
Fisheries contribution as a % of GDP (2014) ⁶	9.4

¹ Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

² Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

³ 2011 Population Census from Tuvalu Department of Statistics website: tuvalu.prism.spc.int

⁴ Reported in Gillett (2016) from Nyasulu (2013): Report on National Accounts Statistics Mission, May 7 to 23, 2013.

⁵ Reported in Gillett (2016) from Nyasulu (2013): Report on National Accounts Statistics Mission, May 7 to 23, 2013.

⁶ Reported in Gillett (2016) from Nyasulu (2013): Report on National Accounts Statistics Mission, May 7 to 23, 2013.

14.2 FAO FISHERIES STATISTICS

TABLE 14.2
FAO Fisheries statistics on total production, employment and trade – Tuvalu

2014		
Production (tonnes)	Aquaculture	2
	Capture	7 379
	Total	7 381
Employment (thousands)	Aquaculture	N/A
	Capture	N/A
	Total	N/A
Value of trade (USD 1000)	Fisheries exports	8 317
	Fisheries imports	86
	Total	8 403

Source: FAO Statistics and Information Branch of the Fisheries and Aquaculture Department. N/A: Data is not available.

PART 2. NARRATIVE

14.3 PRODUCTION SECTOR

14.3.1 Introduction

The geography of Tuvalu has a large effect on the country's fishing activities. The islands of Tuvalu, all low-lying atolls, are Nanumea, Nanumanga, Niutao, Nui, Vaitupu, Nukufetau, Funafuti, Nukulaelae and Niulakita. Even by Pacific Island standards, Tuvalu is quite isolated. There is presently only an air service from Fiji and only Funafuti has a usable landing strip. Some of the other islands lack even a pass in the reef to allow the government passenger/cargo boat to enter the lagoon. Tuvalu's small land area of only 26 km² limits the prospects for agriculture or other forms of terrestrially based development. The country therefore places much hope for future economic growth on its fishery resources.

There is a large distinction between the two major categories of fisheries in the country: (1) the small-scale subsistence and commercial fisheries of the lagoons, reefs, slopes and nearby ocean areas, and (2) the industrial⁷ tuna fisheries that occur in the offshore areas⁸ of the Tuvalu fishery waters.

Subsistence activities dominate Tuvalu's small-scale fisheries. A wide variety of techniques are used throughout the group to collect fish, crabs and other invertebrates that are consumed, shared or informally bartered. Fisheries centres were established on several outer islands with the intention of providing their fishers with income-earning opportunities, but attaining financial viability was challenging. On the main island of Funafuti, commercial fishing is limited to a small fleet of 4–5 m outboard-powered skiffs that mostly fish by trolling for tuna and line fishing for reef fish.

Catches by domestic small-scale fishing in Tuvalu are quite small compared to the activities of the industrial foreign-flagged fleets in Tuvalu waters. The catches by those fleets (mostly tuna) are almost 100 times greater than those by small-scale fishing and the money generated from access fees is a critically important source of government revenue.

Fisheries statistics can be presented in different forms to cater for different purposes. In the statistics published by FAO (Part 1 of this profile), the presentation follows the international conventions and standards used by FAO and its Member States for reporting catches, which are given by the flag of the catching vessel. Accordingly, the fishery production of Tuvalu in 2014 published by FAO (as given in Part 1) was 7 381 tonnes, all of which was from marine capture fisheries.

⁷ In this profile, "industrial fisheries" are defined as fishing activities carried out by vessels that are generally greater than 18 m and that normally operate more than 12 nautical miles from the nearest land.

⁸ In this profile, "offshore" is defined as the area outside the zone normally frequented by small, usually undecked, coastal fishing vessels and is generally greater than 12 nautical miles from the nearest land.

In Table 14.3 below, the Tuvalu fishery production statistics include the catch by Tuvalu-flagged vessels (as reported to FAO), the catch by canoes and skiffs (which do not carry a flag) and the catch from fishing activities that do not involve a vessel (e.g. reef gleaning). The offshore category in the table is defined as the catch from Tuvalu-flagged, industrial-scale fishing operations that are carried out anywhere (i.e. inside or outside the Tuvalu zone).

TABLE 14.3
Tuvalu fisheries production in 2014 (as per FAO reporting standards)

	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Tuvalu-flagged offshore
Volume (tonnes)	1	2	300	1 135	6 887
Value (USD)	820	1 639	747 951	1 120 287	n/a

The amounts of production given in the above table differ from those shown in Part 1. The table consists of production estimated from a variety of sources (see SPC study below). For the offshore category, the amount given is the same as the amount the Tuvalu Fisheries Department reported to the Western and Central Pacific Fisheries Commission (Fisheries Department, 2015b). As that document is publicly available and can be widely scrutinized, it was presumably prepared with considerable care.

The fishery statistics of Tuvalu are presented in a different way in a recent study by the Pacific Community (SPC). The SPC study reports on the amount of catch in the Tuvalu exclusive economic zone (EEZ), regardless of vessel flag. In the study, the catches are placed in different categories, which is useful for other purposes, such as the administration of the large amount of foreign fishing that occurs in the waters of Tuvalu. A summary of the fishery production from the SPC study is given in Table 14.4 below.

TABLE 14.4
Fisheries production in Tuvalu waters, 2014

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Offshore locally based ⁹	Offshore foreign-based ¹⁰
					Both Tuvalu- and foreign-flagged vessels	
Volume (tonnes)	1	2	300	1 135	0	96 898
Value (USD)	820	1 639	747 951	1 120 287	0	131 951 751

Source: Gillett (2016).

Some comment is required to explain the difference between the information in this table and that in Part 1 of this profile:

- Catches can be given by the flag of the catching vessel (as in the FAO statistics given in Part 1), or by the zone where the catch is made (the “offshore foreign-based” and “offshore locally based” columns above). These two different ways of allocating catch each have their purposes. Attribution by flag is important for consistency with international conventions, while attribution by zone is important for determining fishing contributions to GDP, and (especially for Tuvalu) managing revenue from licence fees for foreign fishing in a country’s zone.

⁹ In the SPC study, “offshore locally based” is the catch in Tuvalu waters from industrial-scale tuna fishing operations that are (a) based at a port in Tuvalu, and (b) generally harvested more than 12 nautical miles offshore.

¹⁰ Offshore foreign-based is the catch in the Tuvalu zone from catch from industrial-scale tuna fishing operations that are based at ports outside Tuvalu. Under the international standardized System of National Accounts (SNA, 2009), those catches do not contribute to the GDP of Tuvalu.

- As mentioned above, for the Tuvalu-flagged offshore vessels, there is a difference in what was reported to FAO and what was reported to the Western and Central Fisheries Commission (which should be the same).
- The estimates of production in the categories of coastal fishing, freshwater fishing and aquaculture above were made by a study carried out by SPC in 2015 (Gillett, 2016), which included a site visit to Funafuti and examination of a large number of fishery and economic studies covering the last two decades. It is likely that the basis of the information in the FAO statistics in Part 1 was a more informal conjecture by a nominated person in the Tuvalu Fisheries Department.

14.3.2 Marine sub-sector

14.3.2.1 Catch profile

During the period 2011–2014, one Tuvalu-flagged purse seiner and from two to six Tuvalu longliners operated. The production by these Tuvalu-flagged, industrial fishing vessels has been quite variable. The purse-seine catches in that period ranged from 4 586 to 10 865 tonnes of tuna. The annual longline catches ranged from 221 to 2 042 tonnes of tuna and other pelagic species (Fisheries Department, 2016a).

In the same period the number of vessels authorized to fish in the Tuvalu zone fluctuated widely (Table 14.5).

TABLE 14.5
Total number of offshore vessels licensed in Tuvalu

	Longline	Purse seine	Pole-and-line	Fish carrier	Bunker	Total
2010	135	158	17	6	4	320
2011	96	125	5	0	4	230
2012	108	100	5	18	2	233
2013	33	146	16	7	3	205
2014	43	187	20	29	6	285

Source: Fisheries Department (2015b).

Catches by the industrial fishing fleets in the Tuvalu zone in the period 2010 to 2014 ranged between 55 845 tonnes (with an in-zone value of USD 73 580 290) and 96 893 tonnes (USD 149 125 560) (Gillett, 2016).

In terms of trends for the industrial fleets, most variations in catch volume correlated with the number of vessels fishing. The number of purse-seine vessel days spent fishing in the Tuvalu zone is the largest determinant of the magnitude of the catch in the zone. El Niño conditions create relatively favorable purse-seining conditions in the tropical central Pacific (e.g. the zones of Kiribati, Tuvalu and Tokelau). In 2014 – a mild El Niño year – there was a record fish catch in the Tuvalu zone of almost 100 000 tonnes (FFA, 2015a).

More speculation is required to comment on any catch trends in small-scale fishing. There is no established statistical system covering this fishing, so even estimating the total catch is difficult. Over the past few decades, numerous studies have attempted to gain some insight into the production from Tuvalu's small-scale fisheries, including studies by SPC, the Asian Development Bank, FAO, bilateral donors and others. Additional fishery production information has been obtained from household income and expenditure surveys. The large uncertainty in the estimates made by each of the studies masks any differences in production estimates between the studies. Many observers of the Tuvalu fishery situation feel that in the past decade, there has been a moderate increase in small-scale fisheries production in the country. A few studies

point to the decreased abundance in recent years of resources commonly targeted by small-scale fishing in Tuvalu (Gillett, 2016).

14.3.2.2 Landing sites

None of the catch from industrial fishing is landed in the country. In recent years, the single Tuvalu-flagged purse-seine vessel has mostly offloaded its fish in Majuro in the Marshall Islands, while the two Tuvalu-flagged longline vessels offload their fish in Suva. The non-Tuvalu-flagged purse seiners fishing in the Tuvalu zone sometimes transship their catch in the Funafuti lagoon (about 80 such operations took place in 2015), but mostly transship in the ports of neighboring countries (e.g. Majuro) or offload at the cannery in American Samoa. The foreign longliners usually offload their catch in Suva, Fiji, or an Asian port (Fisheries Department, 2016a)

The coastal commercial catch is mostly offloaded in the main island of Funafuti, with much smaller amounts offloaded at villages in the outer islands. Subsistence fishery landings occur at coastal villages throughout the country, roughly in proportion to the distribution of the population.

14.3.2.3 Fishing practices/systems

The offshore fisheries catch is made entirely by foreign-based, industrial tuna fishing vessels. In recent years, the volume of fish caught by purse-seine gear in the Tuvalu zone (close to 100 000 tonnes in 2014) is about 100 times greater than that caught by longline gear. Although foreign-based pole-and-line vessels pay access fees to fish in the Tuvalu zone, no such vessels have actually fished in the zone for several years.

Most coastal commercial fishers on Funafuti use a variety of fishing techniques. The decision on which specific technique to use (spearfishing, bottomfishing, netting, trolling) depends on a number of factors, including market conditions, weather and the phase of the moon.

About 10 to 20 small outboard-powered boats on Funafuti fish commercially, mainly coastal trolling for tuna. Another 10 commercial boats fish occasionally by trolling.

Most people in Tuvalu engage in subsistence fishing almost daily to meet their nutritional needs. Men mostly fish from canoes or boats while women glean and collect on the reef flats. Women in some outer islands are more involved in activities such as crab collection, net fishing, night fishing using knives, collecting shells for necklaces and other such activities. In some islands, women rarely go fishing, as is the case for Niutao and Nanumea where there are no lagoons (Vunisea, 2004; Gillett, 2011c).

14.3.2.4 Main resources

The industrial tuna fisheries operating in the Tuvalu zone target tuna. About 95 percent of the purse-seine catch is skipjack, with smaller amounts of yellowfin and bigeye. The longline-fleet catch is about 40 percent yellowfin, 30 percent albacore and 30 percent bigeye.

The species composition of the catches from coastal fisheries in Tuvalu has not been documented. The fishing techniques that produce most of the coastal catch are likely to be trolling and spearfishing. Troll catches are dominated by skipjack and yellowfin, but also include some mackerel tuna and dogtooth tuna (Wilson, 1995). Common species in the Tuvalu spearfishing catch are given in Table 14.6.

Flyingfish are quite important in Tuvalu. Of the 40 species of flyingfish found in the central Pacific, *Cheilopogon* and *Cypselurus* are probably the most common genera in Tuvalu.

TABLE 14.6
Common species in the Tuvalu spearfishing catch

Tuvalu name	English name	Scientific name	Comment
Ume	Long-nosed unicornfish	<i>Naso unicornis</i>	Very important in the spearfishing catch
Maninilakau	Orangespine unicornfish	<i>Naso lituratus</i>	Very important in the spearfishing catch
Pokapoka	Unicornfish	<i>Naso</i> sp.	A black unicornfish
Ponelolo	Lined surgeonfish	<i>Acanthurus lineatus</i>	
Kapalagi	Surgeonfish	<i>Acanthurus</i> sp.	
Ulafi	Parrotfish	<i>Scaridae</i>	
Laea	Parrotfish	<i>Scaridae</i>	
Maiava	Rabbitfish	<i>Siganus</i> sp.	Very important in the spearfishing catch
Malau	Soldierfish	<i>Myripristis</i> sp.	

Source: Gillett and Moy (2006).

14.3.2.5 Management applied to main fisheries

Tuvalu is a member of the Western and Central Pacific Fisheries Commission (WCPFC) which was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. The Convention entered into force in June 2004. Much of Tuvalu's efforts in the management of the tuna fisheries is by participation in the WCPFC, mainly through regional fisheries groups, i.e. membership in the Forum Fisheries Agency (FFA) and the Parties to the Nauru Agreement (PNA). In recent years, Tuvalu has been a more active participant in WCPFC, FFA and PNA where it has promoted its national interests more vigorously. The most significant fisheries management intervention that Tuvalu has participated in is the PNA Vessel Day Scheme (VDS), which is described in Box 14.1. Tuvalu is committed to implementing a vessel day scheme for longline vessels in early 2017.

The VDS is an input-based scheme (i.e. fishing effort is restricted). In recent years some development partners of Pacific Island countries have urged the countries of the region and FFA/PNA to adopt an output-based system (catch quota), but Tuvalu and other Pacific Island countries have opposed such a change based on the success of the VDS, the difficulty of making such a change, and problems associated with quota monitoring.

According to a recent article on Tuvalu fisheries (Preston *et al.*, 2016), the Fisheries Department's practical interventions in support of sustainable management of the tuna fishery in Tuvalu waters include:

- ensuring compliance with the provisions of international fishery treaties to which Tuvalu is a party;
- actively promoting Tuvalu's national interests through regional tuna fishery management arrangements, including WCPFC, FFA, PNA and other mechanisms;
- maintaining fishery licensing and data collection systems for vessels fishing in Tuvalu waters, and monitoring their activities through data collection programmes;
- monitoring, control and surveillance of fishing activities in Tuvalu waters to ensure compliance with licence conditions, and to deter, detect and penalise illegal, unregulated and unreported (IUU) fishing;
- responding to the requirements of major market states in regard to IUU fishing and fishery product food safety.

As for coastal fisheries management, Johannes (2000) provides some background information on fisheries management at the island level, which is still relevant today. Section 1 of Schedule 3 of the national government's Local Government Act permits island councils "to provide for the improvement and control of fishing and related industries" and "to prohibit, restrict or regulate the hunting, capture, killing or sale of animals, reptiles, bird or fish or any specified kind of animal, reptile, bird or fish." In short, "conservation in Tuvalu is largely the responsibility of the people of each island".

BOX 14.1
PNA Vessel Day Scheme

In 2000, an FFA study suggested that the purse-seine management scheme that was then based on vessel numbers be replaced by a scheme based on purse-seine fishing days. The transition was actually made seven years later. In 2007, the Parties to the Nauru Agreement began implementing the Vessel Day Scheme (VDS), transitioning from permitting a total number of purse-seine vessels in the region (205) to permitting a total allowable number of purse-seine fishing days (44 703 for 2012). Given the volume, value and multi-jurisdictional nature of the fishery, it is arguably the most complex tuna fishery management arrangement ever put in place.

Due to the complicated nature of the new VDS system and the various constraints of the government fisheries agencies of the region (e.g. under-funded, under-staffed), there were some problems in the introduction of the scheme. Now that the introductory phase is complete, it is clear that the VDS has produced substantial benefits for PNA countries. The system is creating competition for a limited number of days, thereby increasing the value of each day. In practice, the value of a fishing day before the VDS was roughly USD 1 350, but it increased to about USD 5 000 in July 2011 and was about USD 8 000 in 2014. The PNA Office has indicated that in 2016, a day was worth an average of USD 10 000 and, in some cases, up to USD 16 000.

On a different and less tangible level, another benefit is that the VDS moves fisheries management in the region to a desirable rights-based system. That is, fishing rights (such as vessel days) can be defined, allocated and traded. By limiting the rights (e.g. a cap on vessel days) scarcity is created and value increased. Consistent with this transition to a rights-based approach, a VDS-style arrangement for management of the tropical longline fishery is being developed.

Source: Modified from Gillett (2014a).

Johannes provides a description of actions by the various island councils that could be considered fisheries management measures. As an example, at Nukulaelae Atoll:

- according to Nukulaelae's Control of Faapuku and Kaumu Bye-law of 1984, fishing with nets or spear for faapuku (identified by several fishers as *Epinephelus macropilos*) and kaumu (apparently a small spotted grouper) is prohibited from June through August;
- spawning aggregations of certain reef fish are protected;
- the Council of Chiefs is said to have banned anchoring on the reef – anchoring over corals tends to smash them;
- for alternating six-month periods, the islands on the northern and southern halves of the atoll are closed to collection of seabirds and their eggs, land-crabs and coconut crabs.

Finikaso (2004) states that historically one of the most important marine resource conservation measures in Tuvalu is the “Li’iga” system, which places a total ban on any type of fishing activity in all inshore fishing grounds. This system still survives on the island of Niutao.

With the assistance of the United Nations Environment Programme and SPREP (Secretariat of the Pacific Regional Environment Programme), Tuvalu established its first marine protected area (MPA) in the Funafuti lagoon in 1996. Many of the other islands in Tuvalu have established such areas, with objectives much broader than just fisheries management (e.g. biodiversity conservation).

The activities of the Tuvalu Fisheries Department in support of coastal fisheries management in recent years have included:

- working closely with each of the island councils, which are responsible for by-laws and other regulations controlling local fishery management;
- strengthening relationships between the Fisheries Department, fishers and other stakeholders;
- carrying out fishery resource assessment and monitoring to provide the information needed for management;
- supporting the establishment and enforcement of local conservation areas and other management mechanisms;
- formulating management plans for beche-de-mer, sharks and other resources that are prone to extreme overfishing;
- environmental monitoring to assess and mitigate adverse environmental impacts, including waste management, coastal development and ciguatera fish poisoning.

Management objectives

The Marine Resources Act 2006 gives “general principles” for fisheries management and states that fisheries management plans must include the objectives of the management, but the Act does not stipulate any specific management objectives.

The main objectives in the management of Tuvalu’s offshore fisheries, as stated in the current Fisheries Department Corporate Plan (Fisheries Department, 2016b), are:

- securing and protecting Tuvalu’s national rights and interests within the regional purse-seine and longline Vessel Day Schemes, whose integrity and development have been promoted by Tuvalu through cooperation with other participating coastal States.
- maintaining and improving fisheries revenues to Tuvalu through the optimum allocation and pricing of Tuvalu’s vessel days and associated purse-seine and longline licences.
- increasing, significantly above present levels, at-sea employment for Tuvalu citizens (fishing vessel crew and fishery observers) through the provision of appropriately trained personnel and the fullest application of local crewing licensing conditions.

Objectives for the management of coastal fisheries in Tuvalu are not as well articulated as those for the offshore fisheries – but frequently involve prevention of fishery resource depletion. Specific management objectives often must be determined by examining interventions. Gillett and Moy (2006) analyzed local fisheries management measures in Tuvalu dealing specifically with spearfishing and concluded: “Several of the islands’ restrictions on spearfishing seem to have the objective of reducing fishing pressure, making fish more available to line fishers, and protecting spawning aggregations. There could also be a generational aspect to the management of spearfishing – old men, who mostly fish with lines, disapproving of spearfishing, mostly done by much younger males.”

The objectives of establishing the MPAs appear to be repopulating adjacent areas with important fish and invertebrates, in addition to the goal of conserving biodiversity.

Management measures and institutional arrangements

The Fisheries Department, which is part of the Ministry of Natural Resources and Lands, is the government entity charged with fisheries management at the national level. The primary management focus of the department is on offshore fisheries. More information on the department is given in section 14.7.

Island councils are empowered under the Local Government Act to regulate local fishing activities. Examples of management measures on Nukulaelae Atoll are described above.

Tuvalu has interaction with several regional institutions in the management of its fisheries. The main ones are SPC, FFA and PNA, which are described in section 14.7.1.

14.3.2.6 Fishing communities

The concept of “fishing communities” has limited applicability to Tuvalu. Most households in the country are involved in coastal fishing activities. The Tuvalu 2012 census (UNFPA, 2013) included several questions on whether any member of each household engaged in fishing activities or not. The results show that 75.3 percent of the sampled 1 761 households participate in some kind of fishing.

It could therefore be stated that all villages in Tuvalu are “fishing communities”.

14.3.3 Inland sub-sector

The inland fisheries sub-sector is almost non-existent in Tuvalu. Tilapia, because it is found in fresh and brackish water, is sometimes considered a freshwater fish. The results of a survey on climate change adaptation (NAPA, 2013) contain some information about tilapia in Tuvalu. The report states that tilapia appears to be absent from Nui, Nukufetau and Nukulaelae. It appears to be eaten on Nanumaga, Niutao and Vaitupu, although on most islands tilapia is used for feeding poultry and pigs.

Tilapia was introduced to Tuvalu over 50 years ago by SPC (Gillett, 1989). No attempt is made to manage tilapia fishing.

14.3.4 Aquaculture sub-sector

Uwate (1984) lists older attempts at developing aquaculture in Tuvalu. Past investigations and work have included efforts on baitfish, crabs, milkfish, mollies, mullet, pearl oyster, tilapia and turtles.

Fisheries Department (2008) states there is keen interest in aquaculture in Tuvalu, which is surprising when the opportunities are contrasted with the relatively abundant wild fisheries resources. The Fisheries Department and island communities have in recent years undertaken a number of aquaculture projects and culture trials including:

- construction of a giant clam hatchery
- growth trials of *Euचेuma* seaweed
- surveys of potential broodstock for pearl culture
- construction of ponds for milkfish culture.

None of these have resulted in any viable aquaculture activities in Tuvalu.

In recent years, the only aquaculture activity has been the farming of milkfish on Vaitupu Island. Information on the current production of milkfish at the facility on Vaitupu is not readily available. Various staff of the Fisheries Department indicate that between 200 kg and 1 000 kg were harvested and sold in 2014 (Gillett, 2016).

14.3.5 Recreational sub-sector

Although subsistence fishing may have a large social component and be enjoyed by the participants, there is little recreational fishing as a leisure activity for villagers. A few residents of Funafuti (mostly expatriates) have outboard-powered open skiffs that are occasionally used for recreational fishing.

The recreational sub-sector is not actively managed.

14.4 POST-HARVEST SECTOR

14.4.1 Fish utilization

The fish captured by the offshore foreign-flagged fleets in the Tuvalu zone is utilized outside the country. In general, the tuna captured by purse seiners is for canning, while the tuna captured by longliners is for the Japanese sashimi market (mainly high-

quality bigeye and yellowfin) and for canning (albacore and lower grades of bigeye and yellowfin).

Most of the coastal commercial catch is offloaded in the main island of Funafuti for sale to households on that island, with much smaller amounts offloaded at villages in the outer islands. Some of the outer-islands catch is sent to Funafuti for sale to households. Subsistence fishery catches, as the name implies, are mainly for the domestic use of the household that made the catch, but some are given away to relatives and friends.

The export of fishery products from coastal fisheries in Tuvalu is very small and is covered in section 14.5.2 below.

14.4.2 Fish markets

The purse-seine catch in the Tuvalu zone is mainly for canning, and most of that processing occurs in Bangkok or Pago Pago, American Samoa. This is also the case for the one Tuvalu-flagged purse seiner.

Some of the longline catch is for the fresh fish markets in Asia, and some (mainly from the older vessels) is for canning, mostly in Bangkok or Pago Pago. As the Tuvalu-flagged longliners offload in Suva, the high-quality tuna is air-freighted to markets in Japan, with the lower grades of fish sold and consumed in Fiji.

Fish from coastal fisheries in Tuvalu is sold through a few small markets on Funafuti. There are also several locations where fish is sold informally on the roadside. Sales are often made by the wives of the fishers making the catch.

In the outer islands, the intention was that “community fishery centres” would have an important role in fish marketing. However, the centres have not been entirely successful (Box 14.2).

14.5 SOCIO-ECONOMIC CONTRIBUTION OF THE FISHERY SECTOR

The importance of fisheries to Tuvalu cannot be overstated. Indeed, Tuvalu is often characterized as one of a handful of “fishery-dependent small island states” whose economy, livelihoods, food security and dietary health depend largely on marine resources (Preston *et al.*, 2016).

14.5.1 Role of fisheries in the national economy

A recent study by SPC (Gillett, 2016) attempted to quantify the fishery-related benefits received by Tuvalu. The study gives the available information on the contribution of fishing/fisheries to GDP, exports, government revenue and employment. With respect to estimates of fishing contribution to GDP:

- the last official estimation of Tuvalu’s GDP was done in 2013 (for the year 2012). At that time, it was estimated that fishing made a contribution to GDP of AUD 3.6 million (USD 2.9 million), or 9.4 percent.
- by contrast, the contribution of fishing to Tuvalu’s GDP was re-estimated using a different methodology by the SPC study in 2016 for the year 2014. It showed a contribution of AUD 1.8 million (USD 1.4 million).

The SPC study also examined payments made to the Tuvalu government for fishing access to the Tuvalu zone. Tuvalu Treasury Department data shows that money actually received during the year for access was AUD 13 441 325 (USD 12 001 183) for 2013 and AUD 18 028 933 (USD 14 777 813) for 2014. Tuvalu’s 2015 report to the Scientific Committee of the Western and Central Pacific Fisheries Commission similarly states: “Fishery access arrangements provide a critical source of revenue for the Tuvalu Government. Revenues in 2014 were approximately USD 18 million, which is more than 55 percent of the Government’s recurrent budget” (Fisheries Department, 2015b).

BOX 14.2

Community fishery centres in Tuvalu

The government's most important initiative to support inshore fisheries development in the outer islands has been the construction of Community Fishery Centres, which were intended to provide a marketing, processing and storage facility to absorb the catches of local fishermen. Each centre would provide a more continuous supply of fish to consumers on the island, with any surplus shipped to Funafuti for sale through the national fishing company. The first centre was built in Vaitupu with Japanese aid funding in the early 1990s, and further centres built in Nukufetau and Nanumea in 1997 with Australian aid. These three islands were selected as the most promising locations, due to their relatively large populations and/or their abundant fish resources.

Although it soon became clear that these projects were not financially viable, the government proceeded with the construction of further centres of the Australian design in Nanumaga, Niutao, Nukulaelae and Nui. These were built during 2000 and 2001 and were financed by the government. The problems experienced with the operation of these centres repeats many of the lessons learned in other Pacific Island countries with similar projects over the past 40 years. These have included transport and marketing problems, frequent breakdowns of refrigeration machinery, unexpectedly low and inconsistent supplies of fish, financial mismanagement, and confusion over responsibilities between the local administration and headquarters. Even in the best circumstances – operating with professional managers and handling relatively large volumes of fish for high priced markets – rural fisheries centres in the Pacific Islands have never sustained a profitable operation for any length of time.

Over the last few years, all of the centres have been turned over to the island councils to manage and most of them are presently not functioning. With the new initiative of the national government in turning some of the foreign vessel access fees over to the island councils, there is some chance that a few of the centres will be re-activated.

Source: Updated from Fisheries Department (2008).

14.5.2 Trade

The official trade statistics of Tuvalu (e.g. the bi-annual statistical report) do not recognize as an export of Tuvalu the catch of fish that is not brought ashore in the country. This includes the catches of foreign-flagged vessels in the Tuvalu zone or the catches of Tuvalu-flagged vessels anywhere (i.e. inside or outside the Tuvalu zone). The Tuvalu export statistics are different from the trade statistics published by the International Merchandise Trade Statistics Section (IMTSS) of UNSD, also followed by FAO. The Tuvalu trade statistics are more aligned with the International Monetary Fund Balance of Payments Manual and the System of National Accounts (SNA, 2009). This may explain the discrepancy that can be found between the FAO reported figures and the Tuvalu statistics.

The exports from coastal fishing in Tuvalu are quite small and poorly documented. The available recent information on fishery exports (summarized in Gillett, 2016) shows:

- in the last two decades, beche-de-mer is likely to have been the major commercial fishery export of the country. The last shipment of beche-de-mer was several years ago;
- the manufacture and export of shell handicrafts (especially necklaces) is substantial, and worth about USD 52 000 annually;

- the informal export of fish as passenger baggage on departing flights is estimated to be around 50 kg per flight, which, at the prevailing market price for fish, is worth about USD 17 000 annually.

14.5.3 Food security

The National Master Plan for Fisheries Development 2008–2011 (MNR, 2008) examines a large number of studies of fish consumption in Tuvalu and states that estimates of per capita fish consumption vary from island to island, but are in the range of 100–200 kg per year.

FAO's estimates of "per capita supply of fish" in Tuvalu range between 40 and 50 kg per year in the most recent years. Those estimates are based on the country's fishery production and the net international trade in fish. As all the fish from industrial fishing is exported, Tuvalu's per capita supply of fish equates to the coastal fishery production plus imports divided by the population. The difference between the FAO per capita fish consumption estimates and those in the National Master Plan for Fisheries Development is probably due to the divergent estimates of coastal fishery production.

An SPC study carried out work on several islands in Tuvalu in 2004 and 2005. An examination of the report of the survey (Sauni *et al.*, 2008), suggests that the methodology used to estimate fishery product consumption is likely to be more rigorous than that used in previous fish consumption studies. Table 14.7 below extracts some of the consumption information.

TABLE 14.7
Fishery product consumption (from SPC work in Tuvalu)

	Funafuti	Nukufetau	Vaitupu	Niutao
Quantity fresh fish consumed (kg/capita/year)	135.0 (±12.2)	185.3 (±9.3)	162.5 (±13.2)	117.8 (±12.0)
Quantity fresh invertebrate consumed (kg/capita/year)	n/a	n/a	n/a	n/a
Quantity canned fish consumed (kg/capita/year)	30.0 (±0.9)	1.5 (±0.5)	2.1 (±0.5)	3.0 (±0.9)
Total fishery product consumption (kg/capita/year)	185.0 plus invertebrates ¹¹	186.8 plus invertebrates	164.6 plus invertebrates	120.8 plus invertebrates

Source: Extracted from Sauni *et al.* (2008).

Fish consumption in Tuvalu is very high relative to the rest of the world.

14.5.4 Employment

The most recent source of information on fisheries-related employment in Tuvalu is the Tuvalu 2012 census (UNFPA, 2013). The census questionnaire included several questions on whether any member of each household engaged in fishing activities or not. Households that were involved in any fishing activities were then asked further questions about the fishing methods used, the fishing location and whether the fishing was for subsistence or commercial purposes, or both. The results show:

- 75.3 percent of the sampled 1 761 households participated in some kind of fishing. The table below shows the involvement in various types of fishing;
- 9.2 percent of households in Tuvalu received income from fish sales – 7.2 percent in Funafuti and 11.0 percent in the outer islands;
- commercial fishing activities were not common. Less than 4 percent of households were involved in these activities;

¹¹ It is likely that the annual per capita consumption of invertebrates is around 5 kg

TABLE 14.8
Fishing households' participation in various types of fishing

Purpose of fishing	Collecting on reef flat	Collecting on lagoon flat	Collecting on ocean flat	Reef fishing	Lagoon fishing	Ocean fishing
Mainly subsistence	94.1	92.7	88.0	95.0	92.9	82.7
Mainly commercial	2.6	1.8	1.1	0.9	1.3	3.9
Both	3.3	5.6	10.9	4.1	5.8	13.5

Source: UNFPA (2013); note that these numbers are percent of fishing households.

TABLE 14.9
Tuna-related jobs in Tuvalu

	2009	2010	2011	2012	2013	2014
Processing and ancillary	0	0	0	2	2	2
Crew	213	203	205	246	363	363
Total	213	203	205	248	365	365

Source: Modified from FFA (2015b).

- only 17 percent of total households had a boat, 16 percent owned an outboard motor while 27 percent reported owning a canoe.
- 436 households in Tuvalu (24.7 percent) were not involved in any kind of fishing activities. Of these households, 301 were in Funafuti and 135 were in the outer islands.

FFA tracks employment related to the tuna industry. The table below shows the tuna-related employment in Tuvalu in recent years. The 365 jobs recorded in Tuvalu in 2014 represent about 2.7 percent of the 17 663 tuna-related jobs in all Pacific Island countries for that year (FFA, 2015b).

14.5.5 Rural development

In the fisheries sector, the major rural development efforts of the government have been the community fisheries centres (Box 14.2). Other development schemes on the outer islands have consisted of the promotion of commercial fish drying/salting, improvements in inter-island shipping arrangements, introduction of trochus, and (for some islands) aquaculture trials.

14.6 TRENDS, ISSUES AND DEVELOPMENT

The main trends in the Tuvalu fisheries sector include:

- increasing coastal fishing pressure on the main island of Funafuti due to an expanding population;
- continuing variability in the volume and value of the foreign-flagged tuna catch in the Tuvalu EEZ;
- increasing offshore licensing revenue in real terms;
- increasing funding available to the Fisheries Department from external sources (e.g. New Zealand Aid, World Bank, Global Environment Facility) for fisheries management activities;
- decreasing enthusiasm of donors to promote activities that could increase reef and lagoon fishing effort.

Major issues for the fisheries sector include the following:

- There is considerable complexity in reducing Funafuti inshore fishing effort – the concept that there are limits to inshore fisheries production is new to many Tuvaluans.
- The perception by some government officials that any controls placed on inshore fishing by the Fisheries Department is contradictory to the department's fisheries development role.

BOX 14.2

Constraints to fishing industry development in Tuvalu

Preston *et al.* (2016):

- Tuvalu's isolation, lack of water and labour, high cost of fuel and electricity, unavailability of materials, supplies and equipment, poor telecommunications and infrequent air and sea transportation make it difficult to envisage onshore development such as canneries or loining plants.
- Insufficient funding in the past for the Fisheries Department

Gillett and Reid (2005):

- There should be recognition that the production/export of chilled fishery products requires air freighting, which is both very costly and limited in volume. Unless there are very special conditions, such export is unlikely to be profitable.
- There should be recognition that the production/export of frozen fishery products is relatively expensive from Tuvalu due to high costs of most of the inputs. Cheap local labour is not likely to compensate for these expenses. Unless there are very special conditions, achieving profitability in the export of frozen products will be quite difficult.

FFA (2004):

- The fact that there could be few or no opportunities for fisheries industry development at the present time should be seriously considered.
- The difficult transportation logistics to outside markets, lack of support services, high cost of fuel, poor availability of water, little heritage of major commercial activity, high costs of doing business, limited domestic market for bycatch, and other factors all work against the establishment of a domestic tuna industry like those of many Pacific Island countries.
- While some of these could be addressed by major inputs from the government or donors, such improvement may still not result in the fundamental underlying economics being favourable.

Chapman (2004):

Tuvalu suffers from some deep-seated disadvantages in the areas of investment capital (finance), management and technical skills, technology, marketing infrastructure and shore-based infrastructure. The major natural disadvantages and constraints for fishery industry development can be summarized as the lack of:

- domestic capital to finance relatively large scale commercial projects;
- domestic investors willing to commit finance to risky commercial ventures;
- effective means to transport fish to overseas markets;
- supporting infrastructure, including comprehensive shore facilities and protected anchorages for smaller artisanal craft;
- managerial expertise to successfully guide a commercial venture;
- skills and technology in a range of areas needed to underpin a commercial, export-oriented fishery, including fishing, processing, storage, and shore-based skills such as marketing, accountancy, and repairs and maintenance.

- Safety at sea and the loss of lives of fishers while trolling offshore is a major concern.
- Although Tuvalu is located in one of the most favorable tuna fishing areas in the world, there has been little fisheries industry development in the country.

14.6.1 Constraints and opportunities

A major fisheries-related aspiration in Tuvalu is the development of a domestic tuna industry. However, that desire must be reconciled with the difficulties and expense of operating such an industry from a high-cost location such as Tuvalu. Many fisheries specialists visiting Tuvalu over the years have commented on these constraints (Box 14.3). Although some of those studies are dated, the main conclusions remain largely valid.

Although there are numerous constraints facing the development of a tuna industry in Tuvalu, there may be smaller-scale development opportunities that can be leveraged through concessionary resource access arrangements (Preston *et al.*, 2016).

For small-scale fisheries development, there may be opportunities to improve the flow of fisheries products from the outer islands (where resources are relatively abundant) to the main island of Funafuti (where most of the commercial demand is located). Better management of the beche-de-mer fishery could mitigate the “boom and bust” cycle.

Tuvalu’s National Master Plan for Fisheries Development 2008–2011 lists additional opportunities, some of which are still relevant:

- Invite expressions of interest from fishing companies in a partnership to develop tuna longlining and deep-water bottomfishing in the Tuvalu EEZ.
- Engage with pearl culture and aquarium fish export companies.
- Develop and implement a detailed plan for the upgrading of the community fishery centres.
- Undertake a fish aggregating device (FAD) deployment programme for Funafuti and islands without lagoon fishery resources.
- Develop some simple regulations to conserve the most threatened fisheries resources.
- Establish a giant clam hatchery.
- Develop a shell handicraft project to supply shell-cutting and polishing equipment to each island’s fisheries centre for the production of new types of shell handicraft.
- Establish a Fisheries Advisory Council.
- Support the Tuvalu Fishermen’s Association.

14.6.2 Government and non-government sector policies and development strategies

The major government operational policies in the fisheries sector are given in the Fisheries Department Corporate Plan 2017–2019 (Fisheries Department, 2016b). These include:

1. Sustainable management of the tuna fishery in Tuvalu waters, through:
 - ensuring compliance with the provisions of international fishery treaties to which Tuvalu is a party;
 - actively promoting Tuvalu’s national interests through regional tuna fishery management arrangements;
 - maintaining fishery licensing and data collection systems for vessels fishing in Tuvalu waters, and monitoring their activities through data collection programmes;
 - monitoring, control and surveillance of fishing activities in the Tuvalu waters to ensure compliance with licence conditions, and to deter, detect and penalise illegal, unregulated and unreported (IUU) fishing;
 - responding to the requirements of major market states in regard to IUU fishing and fishery product food safety.
2. Increasing sustainable economic benefits from the tuna fishery, through:
 - effective negotiation of favourable fishery access conditions with foreign interests;
 - development of joint-venture arrangements between the Government of Tuvalu and selected foreign fishing companies with emphasis on shore-based development;

- promoting the employment of Tuvaluans as crew on board fishing vessels operating in Tuvalu waters, through training and licence conditions;
 - reform of the National Fishing Corporation of Tuvalu as a vehicle for the government's commercial fishery interests.
3. Improved management of coastal fisheries in order to maintain livelihoods, food security and dietary health. This involves:
- working closely with the island councils who are responsible for by-laws and other regulations controlling local fishery management;
 - strengthening relationships between the Fisheries Department, fishers and other stakeholders;
 - fishery resource assessment and monitoring, to provide the information needed for management;
 - supporting the establishment and enforcement of local conservation areas and other management mechanisms;
 - formulation of management plans for beche-de-mer, sharks and other resources that are prone to extreme overfishing;
 - environmental monitoring to assess and mitigate adverse environmental impacts, including waste management, coastal development and ciguatera fish poisoning.
4. Supporting the sustainable economic development of Tuvalu's small-scale fisheries, through:
- provision of technical assistance, training and material support to small-scale fishers and fish processors, including for sea safety;
 - deployment and maintenance of FADs for all of Tuvalu's islands.

14.6.3 Research

Many fisheries research projects have been carried out in Tuvalu. The older research is listed in a bibliography of Tokelau and Tuvalu atoll fisheries (Gillett, 1988). The results of many of the research projects are summarized by resource in profiles of Tuvalu's fisheries resources (Wilson, 1995).

Fisheries research in Tuvalu in the past few decades has included coverage of tuna, tuna baitfish, ciguatera, giant clams, trochus, fish nomenclature, marine ethnobiology, aquaculture potential, specimen shells, beche-de-mer, pearl oysters, deep-water bottomfish, seabirds, traditional fishing and turtles.

A review of the Tuvalu Fisheries Department in 2012 stated: "In regard to coastal fisheries, the department had for too long been focusing on small research and development projects, especially in aquaculture, that had delivered no visible economic or social benefits to Tuvalu" (Preston *et al.*, 2016).

The Department currently operates two fishery research/extension vessels:

- FV *Manau*, an 18-metre fibreglass vessel provided by the Japanese Overseas Fishery Cooperation Foundation (OFCF). The *Manau* was originally a fish collection vessel for servicing outer-island community fisheries centres, but it is now used for deployment of FADs, transportation of fisheries staff to the outer islands, and charters.
- *Tala Moana*, a 32-metre steel vessel procured by UNDP using Global Environment Facility (GEF) funds allocated to Tuvalu. The vessel is primarily to support activities in which the department is heavily involved. The *Tala Moana* was delivered in December 2015 and is better suited to passenger transport and outer-island field work than the *b* (Fisheries Department, 2016b).

14.6.4 Education and training

Education related to fisheries in Tuvalu is undertaken in a variety of institutions:

- Academic training in biological, economic and other aspects of fisheries is given at the University of the South Pacific in Suva, and to a lesser extent at universities in New Zealand, Australia, Japan and the United Kingdom.
- Training courses, workshops and attachments are frequently organized by the regional organizations: SPC in New Caledonia and FFA in the Solomon Islands. The subject matter has included such diverse topics as fish-quality grading, stock assessment, statistics, seaweed culture, fisheries surveillance and on-vessel observing.
- Courses and workshops are also given by NGOs and bilateral donors.

14.6.5 Foreign aid

The major bilateral donors in the fisheries sector are Australia, France, Japan, New Zealand and Taiwan Province of China. The major multilateral donors are the European Union (EU) and Asian Development Bank. Assistance has flowed from UN agencies, including FAO, UNDP, ESCAP and UNCDF. The regional organizations serving Pacific Island countries, including FFA, SPC, SPREP, the Pacific Islands Forum Secretariat, and the former SOPAC (now the Geoscience Division of SPC) have also been active in supporting Tuvalu's fisheries sector.

Past projects have been concerned with the provision of shore-based plant and equipment (buildings, ice plant, boat harbours and wharves, fishing gear), resource surveys and research (deep bottomfish, aquaculture), the provision of fishing vessels, and assistance with projects involving marketing, training and statistics.

In the past few years the Fisheries Department has been successful in obtaining support from several major development partners. Preston *et al.* (2016) summarize that support:

- The New Zealand–Tuvalu Fishery Support Programme (TFSP) is providing NZD 1 036 800 in operational funding over the five-year period that commenced on 31 May 2014. The TFSP is also providing two technical advisors to the TFD, and will also support the construction of new office facilities for the department, now expected to be completed in 2017.
- The World Bank Pacific Regional Oceanscape Programme, approved in December 2014, is providing a total of USD 7 910 000 over a six-year period that commenced on 9 June 2015. These funds will support internal capacity development and training, the procurement of equipment and supplies, consultancy services in technical areas, increased surface patrols within the Tuvalu EEZ, and other activities.
- The GEF-funded NAPA2 (National Adaptation Plan of Action for Climate Change, Phase 2) project is providing approximately USD 2.1 million to support fisheries development and food security activities in Tuvalu's outer islands over a four-year period from early 2015. In early 2016, the NAPA2 project also procured a project vessel, the *Tala Moana*, which is being operated by the department, and which is used to support a range of TFD activities.
- The GEF-funded Ridge-to-Reef project, which was approved in mid-2015, supports aquatic biodiversity conservation and establishment of marine protected areas in selected outer islands.

14.7 INSTITUTIONAL FRAMEWORK

The main government fisheries institution is the Fisheries Department of the Ministry of Natural Resources.

The Marine Resources Act 2006 gives the Minister responsible for fisheries the power to administer the fisheries and make regulations as he sees fit. According to the Act, the Minister “may appoint in writing a fisheries officer and such other officials to discharge fisheries related functions”. In practice, the Fisheries Director reports to

the Chief Executive Officer of the Ministry, who reports to the Minister, who in turn reports to Cabinet.

In 2012, the department was reviewed by a New Zealand-funded project (Preston *et al.*, 2016) The review concluded that:

- in regard to coastal fisheries, the TFD had for too long been focusing on small research and development projects, especially in aquaculture, that had delivered no visible economic or social benefits to Tuvalu;
- in regard to oceanic fisheries, Tuvalu had been a passive player in regional fishery management and access negotiations, ‘standing on the sidelines’ and following the consensus instead of promoting its own national interests for greater economic benefit;
- organisationally, the department was ‘about the right size, but the wrong shape’, with too many staff focusing on issues that were not very important, and insufficient attention being paid to ‘big-ticket’ items.

The Fisheries Department is organized into three separate divisions (Oceanic, Coastal and Operations and Development) overseen by an Administration group comprising the Director, Deputy Director, and several staff with cross-cutting duties (Legal Officer, Information Officer and Economist).

Presently, the main focus of the Fisheries Department is on coastal fisheries development and on management of the activities of the foreign fishing vessels that operate in Tuvalu’s EEZ. The Fisheries Department Corporate Plan 2016–2019 (Fisheries Department, 2016b) states that the department’s work falls into a broad range of areas:

- Sustainable management of the tuna fishery in Tuvalu waters.
- Increasing sustainable economic benefits from the tuna fishery.
- Improved management of coastal fisheries to maintain livelihoods, food security and dietary health.
- Supporting the sustainable economic development of Tuvalu’s small-scale fisheries, through public awareness and education in all the above areas.

Some of the important activities to be carried out by the Fisheries Department in the next few years are (Preston *et al.*, 2016):

- completion of field survey work in each island and use of this information, plus that from the fishery data collection programmes and from other sources, to establish island-by-island fishery management and development plans;
- strengthening the management of the Funafuti lagoon fishery, especially through working with the Funafuti Island Council and Fishermen’s Association to enforce the prohibition on fishing in the Funafuti Conservation Area;
- working through PNA and WCPFC to find alternatives to the current three-month FAD closure for the purse-seine fishery, which places a heavy disproportionate burden on Tuvalu;
- establishing IUU and Fishery Product Food Safety Competent Authorities, to satisfy the requirements of the EU and other key market states;
- reforming the National Fishing Corporation of Tuvalu to comply with the requirements of the Public Enterprises (Accountability) Act and to act as an effective vehicle for joint ventures or other fishing enterprises in which the Government of Tuvalu has an interest;
- fulfilling Tuvalu’s commitment to implement the PNA Longline Vessel-Day Scheme.

Other important fisheries institutions in Tuvalu are the Fishermen in Funafuti Association and the “Falekaupule” on each island. The latter is a traditional body responsible for making decisions regarding development and management of fisheries resources and other matters at the island level.

BOX 14.4

Main regional organizations in the Pacific Islands involved with fisheries

- The *Pacific Community (SPC)* is based in Noumea, New Caledonia. It helps its member countries and territories in many fisheries-related areas, including (a) coastal fisheries development and management, and (b) scientific research and compilation of catch data on the tuna resources of the region.
- The *Forum Fisheries Agency (FFA)* is based in Honiara, Solomon Islands. It assists its member countries in matters dealing with the management of the region's tuna resources, including economics, surveillance and legal aspects.
- The *Parties to the Nauru Agreement (PNA)* has an office in Majuro, Marshall Islands. It is a regional grouping of eight Pacific Island countries whose EEZs collectively account for a significant bulk of the region's tuna catch. The PNA's primary focus is to maximize the profitability of the tuna fisheries and ancillary industries within the PNA, develop initiatives to maximize the sustained direct and indirect economic benefits to the Parties, and develop strategic fisheries conservation and management initiatives.

14.7.1 Regional and international institutional framework

Tuvalu has interaction with several regional institutions in the management of its fisheries. Descriptions of the main organizations are given in Box 14.4.

14.8 LEGAL FRAMEWORK

The Fisheries Department Corporate Plan 2016–2019 (Fisheries Department, 2016b) summarizes the fisheries legislation of Tuvalu. The main law dealing with fisheries in Tuvalu is the Marine Resources Act 2006 (MRA), amended in 2012. Key features of the MRA include the following:

- Establishing the objective of ensuring the long-term conservation and sustainable use of the living marine resources for the benefit of the people of Tuvalu.
- The Minister for Fisheries has the authority for the conservation, management, development and sustainable use of the living marine resources in the EEZ of Tuvalu.
- The Minister must take into account 15 stated principles and measures in the conservation, management and development of fisheries.
- The Minister has the power to administer fisheries, make regulations as needed, and appoint a Fisheries Officer and other officials to discharge fisheries related functions.
- The Minister may declare that a fishery important to the national interest is a “designated fishery” with its own management plan.
- All vessels engaged in fishing in Tuvalu must have a valid/applicable permit or a licence under a multilateral access agreement in accordance with the Act.
- The transshipment of fish in the Tuvalu EEZ is regulated.
- Requirements for a Tuvalu fishing vessel operating outside Tuvalu waters are given.

The Marine Resources (Amendment) Act 2012 implements a number of changes to the principal act to accommodate Tuvalu's international, regional and national rights and responsibilities in fisheries conservation, management and development. The Amendment significantly increased the level of penalties for various types of offences under the Act. The MRA was further revised in 2016, partly to respond to issues raised by the European Commission in regard to Tuvalu's control of foreign

fishing vessels operating in its waters. The revised Act was being finalised for submission to the Tuvalu Parliament at the time this publication was prepared.

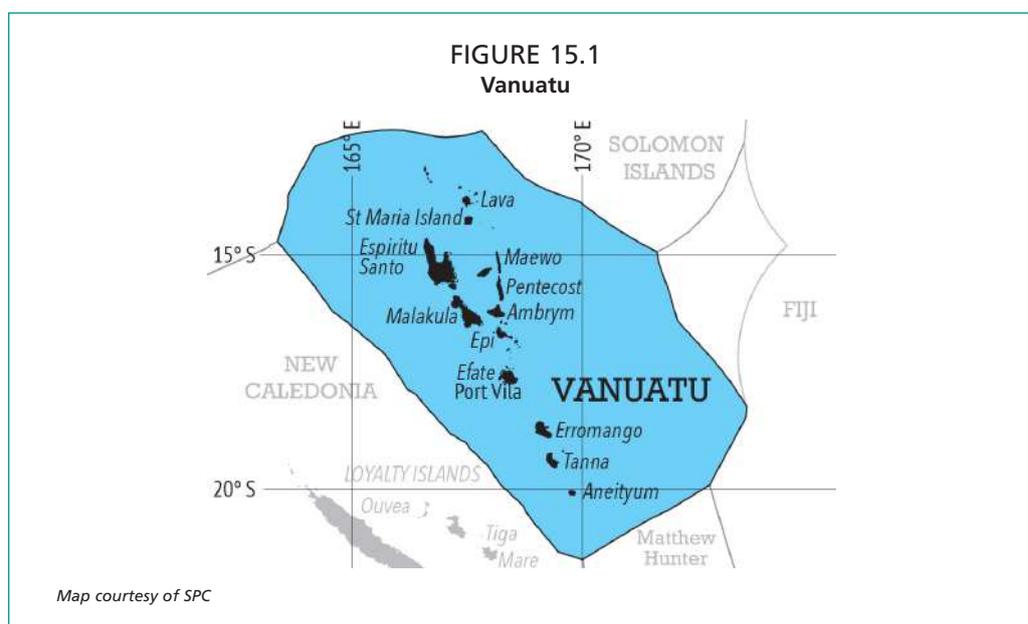
Two regulations have been promulgated under the Marine Resources Act: the Fisheries (Vessel Monitoring System) Regulations (2000), which require the use of automatic location communicators by commercial fishing vessels operating in Tuvalu waters; and the Conservation and Management Measures (PNA Third Implementing Arrangement) Regulations 2009, which contain provisions for implementation of a number of measures agreed by PNA.

14.8.1 Regional and international legal framework

Tuvalu is an active member of the Pacific Island regional organizations involved with fisheries, including the Pacific Community, the Forum Fisheries Agency, and the Parties to the Nauru Agreement.

Tuvalu is a signatory to the WCPFC Convention, the UN Law of the Sea Convention and the UN Fish Stocks Agreement.

15. Vanuatu



REPORTING YEAR

This profile was written in 2017, based on data mostly from 2014.

PART 1. OVERVIEW AND MAIN INDICATORS

15.1 GENERAL GEOGRAPHIC AND ECONOMIC INDICATORS

TABLE 15.1

General geographic and economic indicators - Vanuatu

Land area ¹	12 190 km ²
Water area ²	680 000 km ²
Population (2009) ³	234 023
GDP of Vanuatu (2014) ⁴	USD 739 469 000
Fisheries contribution to GDP (2014) ⁵	USD 4 731 000
Fisheries contribution as a % of GDP (2014) ⁶	0.6

¹ Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

² Secretariat of the Pacific Community, 2004. Map of “The Pacific Islands”. Produced by Sinclair Knight Merz for the Secretariat of the Pacific Community, Noumea, New Caledonia

³ 2011 Population Census from Vanuatu National Statistics Office website: vnso.gov.vu

⁴ Reported in Gillett (2016) from the Vanuatu National Statistics Office (2014) (provisional figure).

⁵ Reported in Gillett (2016) from the Vanuatu National Statistics Office (2014) (provisional figure).

⁶ Reported in Gillett (2016) from the Vanuatu National Statistics Office (2014) (provisional figure).

15.2 FAO FISHERIES STATISTICS

TABLE 15.2
FAO Fisheries statistics on total production, employment and trade – Vanuatu

2014		
Production (tonnes)	Aquaculture	79
	Capture	67 887
	Total	67 966
Employment (thousands)	Aquaculture	0.2
	Capture	100.5
	Total	100.7
Value of trade (USD 1000)	Fisheries exports	77 784
	Fisheries imports	5 587
	Total	83 371

Source: FAO Statistics and Information Branch of the Fisheries and Aquaculture Department. N/A: Data is not available.

PART 2. NARRATIVE

15.3 PRODUCTION SECTOR

15.3.1 Introduction

Vanuatu is a Y-shaped archipelago of about 80 islands, 67 of which are inhabited and 12 of which are considered major. The islands plus associated reefs lie between latitudes 13–21°S and longitudes 166–172°E in the western Pacific Ocean. The archipelago measures approximately 850 km in length. Nearly 80 percent of the population resides in rural areas.

Tourism is the fastest-growing sector and the country's main foreign exchange earner following an increase in visitor arrivals. The agriculture sector remains the traditional economic base of the country, with potential to grow. The fisheries sector was once important in the country's economy through the South Pacific Fishing Company's industrial operations on Espiritu Santo Island, but today the sector is a minor player. Subsistence fisheries, however, remain extremely important in the local economy for household income and food security.

Compared to other Pacific Island countries, inshore marine areas are not extensive in Vanuatu. Inner reef areas are limited to narrow fringing reefs and the area covered by mangroves is quite small. The areas of inner reefs and lagoons have been estimated to be approximately 448 km² and mangroves 25 km² (Amos, 2007).

Tropical cyclones are common in Vanuatu and have a large effect on fisheries in the country. In March 2016, Severe Tropical Cyclone Pam, one of the worst natural disasters in the history of the country, destroyed much of Vanuatu's fisheries infrastructure.

Fisheries statistics can be presented in different forms to cater for different purposes. In the Vanuatu statistics published by FAO (Part 1 of this profile), the presentation follows the international conventions and standards used by FAO and its Member States for reporting catches, which are given by the flag of the catching vessel. Accordingly, the fishery and aquaculture production of Vanuatu in 2014, as published by FAO (Part 1) was 67 966 tonnes.

In Table 15.3 below, the Vanuatu fishery production statistics include the catch by Vanuatu-flagged vessels, the catch by small boats and skiffs (which do not carry a flag) and the catch from fishing activities that do not involve a vessel (e.g. reef gleaning). The offshore category in the table is defined as the catch from Vanuatu-flagged, industrial-scale fishing operations that are carried out anywhere in the western and central Pacific Ocean (i.e. inside or outside Vanuatu waters⁷).

⁷ The Fisheries Act 2014 defines "Vanuatu waters" as the waters of the exclusive economic zone, the territorial sea, the archipelagic waters, and the internal waters.

TABLE 15.3
Vanuatu fisheries production in 2014 (as per FAO reporting standards)

	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Vanuatu-flagged offshore
Volume (tonnes)	43 tonnes and 27 300 pieces ⁸	80	1 106	2 800	33 308
Value (USD)	383 377	232 875	5 584 821	7 429 519	n/a

The amounts of production given in the above table differ from those shown in Part 1. The table consists of production estimated from a variety of sources (see SPC study below), whereas the quantities given in Part 1 are generally those reported to FAO by the Vanuatu Ministry of Marine Resources. The major difference between the table and Part 1 is in the category “Vanuatu-flagged offshore”. The amount listed in Table 15.3 for this category is from the official report of Vanuatu to the Western and Central Pacific Fisheries Commission (Fisheries Department, 2015c) and consists of the catch of Vanuatu-flagged, industrial-scale fishing operations that are carried out anywhere in the western and central Pacific Ocean, whereas the catches in Part 1 are from Vanuatu-flagged vessels globally.

A recent study by the Pacific Community (SPC) presents the fishery statistics of Vanuatu in a different way. The SPC study reports the amount of catch in the Vanuatu EEZ, regardless of vessel flag. In the study the catches are placed in different categories, which is useful for other purposes, such as administration of the foreign fishing that occurs in the waters of Vanuatu. A summary of fisheries production from the SPC study is given in Table 15.4.

TABLE 15.4
Fisheries production in Vanuatu waters

2014	Aquaculture	Freshwater	Coastal commercial	Coastal subsistence	Offshore locally based ⁹	Offshore foreign-based ¹⁰
					Both Tuvalu- and foreign-flagged vessels	
Volume (tonnes)	43 tonnes and 27 300 pieces ¹¹	80	1 106	2 800	568	10 942
Value (USD)	383 377	232 875	5 584 821	7 429 519	1 474 009	26 402 602

Source: Gillett (2016).

Some comment is required to explain the difference between the information in this table and that in Part 1 of this profile:

- Catches can be given by the flag of the catching vessel (as in the FAO statistics given in Part 1), or by the zone where the catch is made (the “offshore foreign-based” and “offshore locally based” columns in the table above). These two different ways of allocating catch each have their purposes. Attribution by flag is important for consistency with international conventions, while attribution by

⁸ The production of several important aquaculture products (e.g. pearls, giant clams) is measured in pieces rather than in weight.

⁹ In the SPC study, “offshore locally based” is the catch in Vanuatu waters from industrial-scale tuna fishing operations that are (a) based at a port in Vanuatu, and (b) generally harvested more than 12 nautical miles offshore.

¹⁰ “Offshore foreign-based” is the catch in the Vanuatu zone from industrial-scale tuna fishing operations that are based at ports outside Vanuatu. Under the international standardized System of National Accounts (SNA, 2009), those catches do not contribute to the GDP of Vanuatu.

¹¹ As noted above, production of several important aquaculture products is measured in pieces rather than in weight.

zone is important for determining fishing contributions to GDP and managing revenue from licence fees for foreign fishing in a country's zone.

- As stated above, the large amount reported for marine capture fisheries in Part 1 includes the catches of Vanuatu-flagged vessels outside the western and central Pacific Ocean, whereas in Table 15.4 the catches are only those in Vanuatu waters.¹²
- There is no fisheries statistical system covering the categories of freshwater fishing, aquaculture and coastal fishing. The estimates above were made by a study carried out by SPC in 2015, which examined a large number of fishery and economic studies covering the last two decades. It is likely that the basis of the information for the three categories in the FAO statistics in Part 1 was a more informal conjecture by a nominated person in the Vanuatu Fisheries Department.
- Aquaculture production in Vanuatu includes non-food items, such as coral for the aquarium trade.

15.3.2 Marine sub-sector

15.3.2.1 Catch profile

The marine capture fisheries have two very distinct components, offshore and coastal:

- Offshore fisheries are undertaken on an industrial scale by locally based longline and purse-seine vessels as well as by foreign-based longline vessels.
- Coastal fishing is primarily carried out for subsistence purposes and for sale on local markets. In addition, some coastal fisheries are export oriented, including trochus, beche-de-mer and aquarium fish.

Commercial tuna fishing began in Vanuatu in 1957 with the establishment of the Japanese South Pacific Fishing Company Limited's longline transshipment base at Palekula, Espiritu Santo Island (see section 15.3.2.2 below on landing sites).

In the offshore fisheries, there is a large distinction between the fishing activity of (a) the fishing vessels that are based in Vanuatu and fish in Vanuatu waters, and (b) the foreign-based vessels fishing in Vanuatu waters, and (c) the fishing vessels on the Vanuatu International Shipping Registry.

a) In 2013, three longliners were based in Port Vila and fished in nearby waters, but they departed in early 2014 (W. Obed, Fisheries Department, personal communication). Gillett (2016) indicates that catches of tuna by "domestic vessels and Vanuatu-based foreign vessels" in Vanuatu waters in 2014 were 568 tonnes.

b) In 2014, the foreign-based offshore catch in Vanuatu waters was 10 942 tonnes (Gillett, 2016). Most of this fishing was by vessels flagged in China and Taiwan Province of China, with some Fiji-flagged vessels (Fisheries Department, 2015c).

c) Of the 140 fishing vessels on the Vanuatu International Shipping Registry in 2014, 85 vessels (3 purse seiners and 82 longliners) fished in the central and western Pacific (Fisheries Department, 2015c). Those Vanuatu-flagged vessels were not based in Vanuatu and most of the fishing by the longliners was outside Vanuatu waters. All of the purse seining was outside Vanuatu waters.

The Fisheries Department (2015c; 2016c) give information on recent trends in tuna catches by Vanuatu-flagged longliners and purse seiners in the western and central Pacific:

- The Vanuatu longline fleet catch is dominated by albacore then bigeye and lastly yellowfin. The longline fleet recorded the highest catch for albacore in 2010;

¹² The Vanuatu International Shipping Registry includes a large number of fishing vessels. The 2011 Annual Report of the Ministry of Agriculture, Quarantine and Livestock, Forestry and Fisheries (MAQLFF, 2011) indicates that 79 Vanuatu-flagged longliners were authorised to fish in the eastern Pacific and in the Atlantic. According to the Fisheries Department (2015c), there are a total of 140 vessels on the register.

at 12 293 tonnes this was an increase from 5 582 tonnes in 2008 and 7 992 tonnes in 2009. The highest catch for bigeye was in 2015, which, at 5 603 tonnes, was an increase from 3 419 tonnes in 2014. Yellowfin catches showed an increase between 2009 (514 tonnes) and 2012 (2 230 tonnes), but were lower in 2013 (1 626.2 tonnes) and again showed a slight decrease in 2014 to 1 626 tonnes. Effort for the longline fishery was reduced in the 2013–2014 period but increased in 2014.

- The purse-seine fleet recorded a slight increase in total catch from 2013 (20 099 tonnes) to 2014 (20 514 tonnes) and then a fall in 2015 (8 344 tonnes). The effort (i.e. total number of sets) also increased, with most of the increase being sets associated with floating objects. During this period, the main tuna species in the catch, skipjack, increased by an additional 2 803 tonnes between 2013 and 2014. The percentage and absolute amounts of yellowfin and bigeye decreased in the same period.

TABLE 15.5
Catches by Vanuatu-flagged offshore vessels (tonnes)

Year	Total longline catch	Total purse-seine catch	Total longline and purse-seine catch
2011	3 521	23 382	26 903
2012	13 382	24 853	38 235
2013	15 239	20 099	35 338
2014	12 794	20 514	33 308
2015	21 244	8 344 ¹³	29 588

Source: Fisheries Department (2016b).

The coastal fisheries in Vanuatu, although dwarfed in size by offshore fishing are extremely important. The Vanuatu 2010 Household Income and Expenditure Survey (HIES) found that more than 75 percent of the adult population practise at least one form of coastal fishing, whether subsistence or commercial. The survey showed that 2 percent of urban households and 12 percent of rural households had income from the sale of fishery products.

For the coastal fisheries of Vanuatu, the estimates of catches vary widely. Studies to estimate production were carried out by external researchers in 1996, 2000 and 2001, but the estimates were very different. Gillett (2009a) used those studies plus (a) the results of the 2006 HIES, (b) export data, (c) estimates of production from recent specialized studies, (d) the results of the recent 2006/2007 agriculture census, and (e) opinions of fisheries specialists. The results indicated a coastal commercial production of 538 tonnes (worth USD 2.2 million) and a coastal subsistence production of 2 830 tonnes (worth USD 5.7 million). An SPC study in 2015 (Gillett, 2016) considered the catch estimates above, a HIES in 2010, a valuation of marine ecosystem services in 2014 (Pascal *et al.*, 2015), export data and several other sources of information. The study concluded that for the year 2014:

- the volume of the production of subsistence fishing was 2 800 tonnes;
- the volumes of coastal commercial fisheries production were made up of finfish/crustaceans, 1 000 tonnes; trochus, 50 tonnes; beche-de-mer, 1.7 tonnes; aquarium products – small volume but worth USD 534 000; and game fishing, 55 tonnes. The estimated total coastal commercial production in Vanuatu in 2014 was 1 106 tonnes, worth USD 5.6 million to the fishers.

One of the most important coastal fisheries in Vanuatu is that for sea cucumbers. Box 15.1 gives a summary of the fishery.

¹³ 2015 data provided is “unraised and provisional”, according to the Fisheries Department (2016b) report.

BOX 15.1

Sea cucumbers in Vanuatu

Sea cucumber resources are a source of income for coastal communities in Vanuatu. The Ni-Vanuatu people do not consume sea cucumbers, so the fishery is entirely a commercial activity. Since the beginning of the 20th century, the dried form of sea cucumbers was one of the principal exports for the former New Hebrides Condominium Government. A by-product of this early trading period is the Pidgin English language spoken today in Vanuatu – Bislama – which derives from the word *beche-de-mer*, or sea cucumber, and developed from early communication between fishers and traders. The trade was at low levels from the 1930s to the 1970s for various reasons: World War II affected most trading activities with the outside world; there was over-harvesting of the resource in some traditional production areas; and other commodities in the Pacific, such as copra, gained in importance. The revival of the trade began in the 1980s, facilitated by the removal of trade barriers to China. Sea cucumber fisheries boomed in this period across the Asia-Pacific region, but the Vanuatu peak export production of 66 tonnes in the early 1990s was followed by a steady decline until, by mid-2000, the fishery was no longer profitable. In Vanuatu, a total ban on the fishery and export for five years was enforced in January 2008.

Source: Pakoa *et al.* (2013b).

The lack of a fisheries statistical system for coastal fisheries prevents the identification of quantitative trends in these fisheries. There is, however, a general perception that the important coastal resources are increasingly overexploited close to urban areas. The trends in the fisheries that produce non-perishable products are different. Carleton (2012) indicates that there is evidence of a peak in the harvest of sea cucumbers in the early 1990s. In that period, trochus production averaged about 125 tonnes per year (Gillett, 1995) but now is about 50 tonnes per year.

The largest fisheries development efforts in Vanuatu were two projects carried out between 1983 and 1996: the Village Fisheries Development Project (VFDP) and the Fisheries Training and Extension Services Project, funded by the European Union, Japan, Canada and New Zealand. The aims of the projects were to initiate fisheries development by subsidizing the cost of boats, fishing gear and fuel to village communities; setting up rural fishing centres in the islands; and providing training on various aspects of fisheries, including fishing techniques, fish processing, boat maintenance, ice-machine maintenance, fish marketing and business management. A fisheries training centre was established in Santo. The training centre is now the Vanuatu Maritime College and a boat-building yard that is run by the Fisheries Department. When the project funding ended, fishing ventures could not be sustained as they were heavily dependent on the subsidies provided by the projects. The fishing centres in the outer islands could not be sustained either, due to lack of national government funds. The country seemed unready for such large-scale projects, and the technologies introduced seemed too complex or not appropriate for communities with largely subsistence lifestyles at the time (Friedman *et al.*, 2008b).

15.3.2.2 Landing sites

With the departure of the locally-based longliners in early 2014, all of the offshore catch in Vanuatu waters and all of the catch by Vanuatu-flagged offshore vessels (longliners and purse seiners) is landed outside Vanuatu. Some of the longline catch in Vanuatu waters is landed in other Pacific Island countries (especially Fiji and the Solomon Islands) and some is landed in Asian ports. Most of the catch by Vanuatu-

flagged purse-seine vessels is transhipped at a port in neighbouring countries to eventually land in Bangkok, Thailand, or Pago Pago, American Samoa.

No discussion of fish landing sites in Vanuatu would be complete without some mention of the history of the large facility at Palekula (Box 15.2).

BOX 15.2 Palekula Base

Vanuatu's involvement in tuna fishing commenced in 1957 with the establishment of the South Pacific Fishing Company Limited (SPFC) base at Palekula, Espiritu Santo Island in the north of Vanuatu. SPFC was established by the Japanese Mitsui & Company with the objective of conducting tuna transshipment operations. The facilities established at the Palekula base were large and occupied some 24 hectares of relatively flat land, which had been initially developed by the United States Navy during World War II.

The SPFC complex consisted of a main wharf, slipways (one 500 tonnes and one 50 tonnes), original cold storage, two bait freezers (5 000 cartons of bait in 10 kg boxes/room), two quick-freeze rooms, unloading area, engine room, large brine block-ice makers with a crusher and loading facility, housing and workshops.

In 1974, much of the plant was upgraded, with a new cold storage facility replacing the old. The new cold storage was in three rooms, each holding from 500 to 600 tonnes of frozen fish. A new 'T' section was added out from the existing main wharf so that larger carrier vessels could come alongside to load. In addition, a new fuelling wharf was put in at this time, which was also used for vessels to tie up to, as well as two large fuel storage tanks and a pump house with pumping equipment.

Over the years, many longliners from different countries worked out of the Palekula Base. At its height of activity between 1971 and 1973, it was estimated that as many as 100 different longliners could visit the base in one year. The average unloading from 1971 to 1973 was around 14 000 tonnes. In the early 1980s, the number of vessels working to the Palekula Base dropped greatly, with around 4 000 tonnes of fish unloaded in 1981. Unfortunately, the transshipment side of the base's operation closed in 1986, when the remaining vessels relocated to American Samoa to take advantage of incentives offered by processors there. At that time, the facility was turned over to the Government of the Republic of Vanuatu. The slipways were still operational and the government continued using them until 1998, when a problem with the books of SPFC caused their closure. There have been numerous attempts to revive the facility (including a major FAO project), but they have been unsuccessful.

Source: Modified from Chapman (2002).

The coastal commercial food fish catch (i.e. deep-water demersal fish) is mainly offloaded in Port Vila. The non-food catch (i.e. trochus shells) is mostly non-perishable and is often landed close to the fishing areas, which are scattered around the country.

Subsistence fishery landings occur at coastal villages throughout the country, roughly in proportion to the distribution of the population.

15.3.2.3 *Fishing practices/systems*

The offshore fishing in Vanuatu waters is currently undertaken only by longlining. In 2014, 51 China-flagged longliners and 14 longliners from other countries fished in Vanuatu waters. In 2015, 49 China-flagged longliners and one Fiji-flagged longliner fished in Vanuatu waters (Fisheries Department, 2016c).

Hickey (2008) describes coastal subsistence fishing in Vanuatu. Nearshore catches are often made on foot from shore, over fringing reef flats, or along reef drop-offs or lagoons from outrigger canoes. Cast nets and gillnets, freediving gear and spear guns, handlines and traditional methods (reef gleaning, spears, traps, etc.) are also typically used. The low investment needed to enter nearshore fisheries ensures accessibility to all and low financial risk.

Amos (2007) describes coastal commercial fishing in Vanuatu. These are small-scale activities that principally target shallow and deep-water bottom snapper species (“poulet”) and pelagics associated with fish aggregation devices (FADs), using trolling and longlining techniques. It also includes the collection of sessile organisms such as trochus, green snails and beche-de-mer.

15.3.2.4 Main resources

The main species caught in the offshore fishery in Vanuatu waters are given in Table 15.6. In 2014, virtually all the tuna was caught by longline gear.

TABLE 15.6

Tuna species in the offshore fishery in Vanuatu waters (tonnes)

	Albacore	Yellowfin	Bigeye	Skipjack	Total
2014	6 176	1 230	181	109	7 696
2015	3 524	1 025	158	146	4 853

Source: FFA (2016).

In terms of the status of offshore resources, the major species of tuna in Vanuatu mix freely with those of the neighboring countries in the western and central Pacific. Recent information from the Scientific Committee of the Western and Central Pacific Fisheries Commission (WCPFC, 2016) shows that for:

- **skipjack** – the stock is currently only moderately exploited and fishing mortality levels are sustainable;
- **bigeye** – recent analysis indicates that overfishing is occurring for the bigeye tuna stock and that to reduce fishing mortality to that at maximum sustainable yield, a large reduction in fishing mortality is required;
- **yellowfin** – the current total biomass and spawning biomass are higher than at levels associated with maximum sustainable yields. Therefore, yellowfin tuna is not considered to be in an overfished state;
- **South Pacific albacore** – there is no indication that current levels of catch are causing recruitment overfishing, particularly given the age selectivity of the fisheries. It should be noted that longline catch rates are declining, and catches over the last 10 years have been at historically high levels and are increasing.

With respect to coastal fisheries, Bell and Amos (1993) list the 22 species that are believed to be the most important finfish in Vanuatu: *Naso lituratus* (orangespine unicornfish), *Kyphosus cinerascens* (highfin rudderfish–topsail drummer), *Epinephelus merra* (honeycomb grouper), *Variola louti* (lunartail grouper), *Scarus blochi* (Quoy’s parrotfish), *Cheilinus undulatus* (napoleonfish–maori wrasse), *Hemigymnus melaptarus* (blackedge thicklip wrasse), *Plectorhynchus gibbosus* (black sweetlips), *P. orientalis* (oriental sweetlips), *Chaetodon lineatus* (lined butterflyfish), *Lethrinus harak* (blackspot emperor), *L. miniatus* (longnose emperor), *Sargocentron tieroides* (pink squirrelfish), *Lutjanus fulvus* (flametail snapper), *L. gibbus* (humpback snapper), *Mulloidichthys flavolineatus* (yellowstripe goatfish), *Siganus canaliculatus* (seagrass rabbitfish), *S. doliatus* (pencil-streaked rabbitfish), *Acanthurus lineatus* (bluebanded surgeonfish–convict tang), *Sphyrnaena genie* (blackfin barracuda), *Valamugil seveli* (bluespot mullet), *Caranx melampygus* (bluefin trevally) and *Gerres oyena* (oyena mojarra).

Invertebrate species are also very important in the inshore commercial and subsistence fisheries. These include trochus, sea cucumbers, rock lobsters, slipper lobster, coconut crab, green snail and various crustaceans.

Vanuatu's deep-water snapper fishery is well documented. There are about 107 species of deep-water fish, best represented by the families Lutjanidae, Serranidae, Epinephelinae and Lethrinidae. Of these, 11 species – comprising three species each of the genera *Etelis*, *Pristipomoides* and *Epinephelus* and a species each of the genera *Aphareus* and *Lutjanus* – are the top targeted species. Total maximum sustainable yield for the resource was estimated to be 300 tonnes annually. However, production to date has remained well below this figure (Friedman *et al.*, 2008b).

Trochus is especially important in Vanuatu. It is a source of cash for remote communities, forms the basis of a small manufacturing industry in Port Vila, has been cultured by the Fisheries Department, and is the object of much management effort. Box 15.3 gives some information on this shell.

BOX 15.3

Trochus

Trochus (*Trochus niloticus*¹⁴) is commercially one of the most important shellfish in the Pacific Islands. It is valued for the inner nacreous layer of the shell, which, along with that of the pearl oysters, is used for the manufacture of “mother-of-pearl” buttons.

Trochus live on coral reefs from the inter-tidal zone down to a usual maximum of about 15 m. The natural distribution of trochus is from Wallis Island in the central Pacific westward to Sri Lanka and from southern Japan southward to New Caledonia and northern Australia. The species has also been transplanted to many new areas of the Pacific Islands where in some cases it now supports substantial fisheries.

The annual harvest of trochus in the Pacific Islands in recent years was about 2 300 tonnes with an export value of about USD 25 million. Although this is not great in purely financial terms, the impact is substantial. Because little or no equipment is used in the collecting of trochus and because the shells may be stored for long periods prior to shipment to market, trochus is one of the few commercial fisheries feasible for remote communities. In several Pacific Island countries, trochus provides an important source of cash income at the village level, especially since the demise of the copra industry.

The collection of trochus for its protein-rich flesh has been a traditional activity in Vanuatu for a long time. However, since the end of the 19th century, the sale of trochus for its shell has become apparent in Vanuatu. French settlers were reported to have harvested trochus shells in Vanuatu at the beginning of the 20th century. At present, trochus is one of the major inshore resources in Vanuatu that generates income for the rural communities.

Source: Gillett (1995); Bell and Amos (1993).

For aquarium ornamentals, the National Marine Aquarium Trade Management Plan (VDF, 2009) gives the six fish groups most commonly targeted: the angelfish (Pomacanthidae), gobies (Gobiidae), tangs (Acanthuridae), damsels (Pomacentridae), groupers (Serranidae) and wrasses (Labridae). Of the Pomacanthidae, the flame angel (*Centropyge loriculus*) has been the most exported fish species, representing 12.5 percent of Vanuatu's average total annual fish exports. Fish represent the bulk of

¹⁴ Also called *Tectus niloticus*.

Vanuatu's marine aquarium exports, contributing about 66 percent of the total annual average export volume, followed by invertebrates (18 percent) and live rock (10 percent).

There are 18 commercial sea cucumber species present on reefs around the country, but stock densities are naturally low. Seven species are the most important commercially: *Holothuria nobilis*, *H. scabra*, *H. atra*, *Actinopyga miliaris*, *A. echinites*, *A. mauritiana* and *Thelenota ananas* (Friedman *et al.*, 2008b).

Coconut crab is an important subsistence and commercial resource for communities in some areas in the Banks-Torres and Santo-Malo regions. For the Torres Islands, coconut crab is the main cash crop, with production ranging from 500 to 700 crabs a month (Friedman *et al.*, 2008b).

In terms of the status of the coastal fishery resources, there has been little new stock assessment information in the last 20 years. Exceptions to this are the recent work done on invertebrates, e.g. green snail, and sea cucumbers (the status of the latter is described in Box 15.4). In general, those fish and invertebrate species that are sought after and are located in areas readily accessible to many fishers tend to be heavily exploited or overexploited.

BOX 15.4

Status of Vanuatu's sea cucumber resource

The big question is: Are the sea cucumber stocks ready for harvest? The answer for now would be no; the resources remain depleted. None of the stocks are present in sufficient abundance and individuals are too small to support an economically viable fishery. Densities for the fast-growing lollyfish at two sites were poor in contrast to healthy densities of 5 600 individuals per hectare and 2 400 individuals per hectare in reef transect and manta tow surveys, respectively. The fishery has been fished continuously in the last 25 years; some slower-growing species, such as black teatfish (*H. whitmaei*), can take up to 10 years to recover; 5 years is barely enough time to see significant change. The 5 years of closure does not provide sufficient time to allow strong population recovery for all sea cucumber species. The populations of sea cucumbers at the two sites in Vanuatu consist entirely of smaller animals, which are either sexually immature or just entering maturity and so have weaker spawning capacity (the majority of sizes recorded were below the common sizes recorded in the other areas of the Pacific). These small sea cucumbers would make low quality products in terms of size (length and width) and meat content (lower weight) and so are worth much less at the market than fully grown sea cucumbers. A sea cucumber consignment that was confiscated is proof of this; the majority of sea cucumbers that were illegally harvested and about to be smuggled out of the country were all under existing size limit regulations.

Source: Pakoa *et al.* (2013b).

Pakoa *et al.* (2013c) indicate that green snail is a declining resource in Vanuatu, but through the enforcement of the 15-year moratorium on commercial harvesting and export of the shell, the resource is beginning to recover. The species has become rare on Efate but has reappeared on reefs at Takara in the north, and Moso, Mangaliliu, Hat Island and Tukutuk Bay on the west of the island.

15.3.2.5 Management applied to main fisheries

Sections 10 and 11 of the Fisheries Act 2014 state that the Minister responsible for fisheries may determine that a fishery is a designated fishery if it (a) is important to the national interest; and (b) requires management and development measures for its effective conservation and optimum utilization. The Director of Fisheries is required to prepare a plan for the management and development of each designated fishery. Each plan must:

- identify each fishery and its characteristics, including the present state of its exploitation; and
- specify the objectives to be achieved in the management of the fishery to which it relates; and
- specify the management and development strategies to be adopted for the fishery to which it relates; and
- provide for a scheme of licensing, if necessary, or other appropriate management measure; and
- specify, if applicable, the licensing regime to be applied, including the limitations, if any, to be applied to local fishing operations and the amount of fishing, if any, to be allocated to foreign fishing vessels; and
- specify the information and other data required to be provided by persons licensed to fish for that fishery; and
- take into account any relevant traditional fishing methods and practices including traditional management systems and strategies.

Tuna fisheries in Vanuatu are managed on regional and national levels.

- On the regional level, Vanuatu is a member of the Western and Central Pacific Fisheries Commission (WCPFC) that was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Vanuatu and the other 26 members of the commission enact tuna management measures at the annual WCPFC meeting. From the Vanuatu perspective, the two most important recent measures are: (1) the Conservation and Management Measure for South Pacific Albacore, and (2) the Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean.
- On the national level, the tuna fisheries are managed by the Tuna Fishery Management Plan (VFD and FFA, 2014). Key features of that plan are: restrictions on the total number of licenses, closed areas to fishing, and a total allowable catch for each of the four major species of tuna.

Management plans have been prepared for several coastal fisheries. These include deep-bottom fish, aquarium fish, coconut crab and sea cucumber. As an example, a summary of a Vanuatu management plan is given in Box 15.5.

BOX 15.5

Deep-Bottom Fish Fishery Management Plan

The Ministry has designated the deep-bottom fish fishery to be important for the national interest and the Director of the Vanuatu Fisheries Department has prepared the Vanuatu National Deep-Bottom Fish Fishery Management Plan. The Plan sets out the formal policy guidelines in the form of strategies and measures for the sustainable development, management, and conservation of the deep-bottom fish fishery. The Plan comprises 10 sections, and includes an introduction, fishery overview, legal and policy framework, issues and challenges faced by the fishery, current and previous management measures applied to the fishery, broad policy directions needed for the fishery, management measures and strategies, policy priority areas, monitoring and evaluation methods, and review and amendment procedures. A key element in the development process of the Plan is consultation. The Plan is a result of a nationwide consultation process that started in 2013. Consultations were conducted on various levels, including national and provincial government, communities and fishers. The Plan has been structured in accordance with the requirement of the Fisheries Act but reflects the views received during the consultation process.

Source: VFD (2016).

The management of the sea cucumber fishery is a special case. In 2008, the fishery was closed for a five-year period, 2008–2013. Upon the completion of that ban, it was extended to 2018, although it was opened between 1 September and 31 December 2015 to compensate for the large negative economic impacts of Cyclone Pam.

The management authority for subsistence fisheries is primarily vested with the traditional reef custodians through customary marine tenure (CMT). CMT is legally recognized in Vanuatu in Chapter 12 of the Constitution, which states:

- All land in the Republic of Vanuatu belongs to the indigenous custom owners and their descendants;
- “Land” is further defined in the Land Reform Act to include “... land under water including land extending to the sea side of any offshore reef but no further”;
- The rules of custom shall form the basis of ownership and use of land in the Republic of Vanuatu.

These articles provide for the customary owners’ rights to manage their land and reefs as they have traditionally done for centuries through the use of taboos and other restrictions on fisher behaviour. Research into traditional resource management in Vanuatu reveals a strong heritage of managing resources through CMT and a combination of traditional beliefs and practices that included privileged user’s rights, species-specific prohibitions, seasonal closures, food avoidance and closed areas. Examples of these practices include the placement of marine closures or taboos for seven years or more upon the death of a chief or any clan member or on the ordination of a traditional leader; seasonal prohibitions on consuming certain fisheries resources following agricultural cycles; respect and avoidance of areas of symbolic significance; and behavioural restrictions for fishers that limit fishing effort, including those associated with totemic restrictions. The Vanuatu Department of Fisheries actively supports these customary practices and recognizes CMT as a viable, decentralized system of resource management that fosters a sense of responsibility amongst communities for managing their own resources well (Hickey and Jimmy, 2008).

Management objectives

The Tuna Fishery Management Plan (VFD and FFA, 2014) has been developed to meet four key objectives:

1. To ensure that the exploitation of the tuna resources that are found in and pass through Vanuatu waters is compatible with the sustainability of the stocks throughout their range.
2. Within the limits of the sustainability objective, to ensure the harvest is taken in a way that maximizes the long-term economic and social benefits received by the people of Vanuatu.
3. To contribute to the food security of ni-Vanuatu.
4. To meet regional and international responsibilities for tuna management.

In Vanuatu’s coastal fisheries, the objectives of fisheries management vary considerably between the various fisheries. Most plans include notions of sustainability and economic benefits for the country. As an example, the Deep-Bottom Fish Fishery Management Plan states that the objectives are to ensure:

- that exploitation takes advantage of potential productivity of fish stocks while ensuring that the conservation of the stocks remains above agreed harvest limit reference points;
- the optimal use of deep-bottom fish resources for long-term sustainable food security, livelihoods and economic development within communities of Vanuatu;
- that an effective monitoring programme is established;
- the promotion and support of co-management principles and community participation in managing the fishery; and

- that the deep-bottom fish fishery contributes to economic development within the urban, suburban and rural areas of Vanuatu.

The management of subsistence fisheries is mostly by traditional reef custodians through customary marine tenure. The management objectives vary considerably from area to area, but many include the goal of assuring the continued flow of fishery foods to coastal communities.

Institutional arrangements

In Vanuatu, the main institution involved with fishery management is the Department of Fisheries. The role of this agency is covered in more detail in section 15.7 below.

15.3.2.6 Fishing communities

The concept of “fishing communities” has limited applicability to Vanuatu. Nearly all households in coastal villages are involved in coastal fishing activities. It could therefore be stated that all coastal villages in Vanuatu are “fishing communities”.

15.3.3 Inland sub-sector

Extensive information on the country’s freshwater fish and invertebrate resources is provided in profiles of Vanuatu’s fishery resource (Amos, 2007). It is reported that the distribution of the various freshwater ecosystems is patchy throughout the Vanuatu archipelago, covering only 1.0 percent of the total land area. Freshwater ecosystems on Vanuatu’s larger islands (e.g. the Jordan River on Santo, Cooks River on Erromango Island and Pankumo River on Malekula Island) have discharges, which form cascades, rockfaces, pools and tidal reaches, and are often characterized as having extensive flood plains. Smaller islands’ ecosystems, on the other hand, have only streams, which are often ephemeral. The profiles cover 18 families of local freshwater fish, 3 families of introduced fish, and several species of shrimps and crabs. According to the profiles, the most important taxa for fishery purposes are: (a) local species of fish – five genera of fish (*Kbulia*, *Lutjanus*, *Gerres*, *Monodactylus*, *Scatophagus*), four species of mullets, and several species of freshwater eels; (b) introduced species of fish – *Cyprinus* and two species of tilapia; and (c) invertebrates – several species of *Macrobrachium*.

An individual with a long historical involvement in Vanuatu fisheries examined the available freshwater fisheries data, discussed the issue of freshwater fishing with other local fisheries specialists, and estimated that recent annual production from freshwater fisheries in the country is about 88 tonnes per year (F. Hickey, personal communication).

The freshwater catch is almost entirely for subsistence use, except for the *Macrobrachium* shrimp, which is sold in urban areas.

Any management of the freshwater fisheries is carried out through customary marine tenure (see above).

15.3.4 Aquaculture sub-sector

In estimates of Vanuatu’s aquaculture production for 2014, FAO data shows production of 80 tonnes. The SPC study (Gillett, 2016) gives production for 2014 of 43 tonnes and 27 300 pieces (giant clam, trochus and green snail), with a farm-gate value of USD 383 377.

The SPC study used information on aquaculture obtained in discussions with the staff of the Fisheries Department, commercial producers and SPC personnel to estimate the 2014 production and value of seven commodities (Table 15.7).

TABLE 15.7
Aquaculture production in Vanuatu in 2014

Commodity	Type production	Current estimated annual production	Annual production value (VUV)	Annual production value (USD)	Comment
Tilapia	Commercial farm	30 tonne	16 500 000	160 960	One commercial farmer; some barramundi produced (VUV 1 200 per kg); farm wiped out by Cyclone Pam in early 2015.
Tilapia	Village ponds	1 tonne	400 000	3 902	About 50 village farms; 70% of production is on Santo.
Prawns	Commercial farm	13 tonne	22 100 000	215 589	One commercial farmer; <i>P. vanamei</i> is produced; most is for domestic market; exports piggyback on beef exports.
<i>Macrobrachium</i>	Village ponds	120 kg	180 000	1 756	3 village ponds; started production in late 2014.
Coral culture	One company	-	-	-	No production since destruction caused by cyclone in 2008.
Giant clam	Government operation	300 pieces	120 000	1 171	Most given to communities at about 3 cm in size; lost all standing production in Cyclone Pam
Trochus	Government operation	25 000 pieces	-	160 960	For restocking purposes; lost all standing production in Cyclone Pam
Green snail	Government operation	2 000 pieces	-	3 902	For restocking purposes; lost all standing production in Cyclone Pam

Source: S. Rena, G. Norton, and R. Jimmy (personal communication, August 2015).

The management of aquaculture in Vanuatu is primarily through provisions in legislation. Vanuatu's Aquaculture Development Plan 2008–2013 indicates that, although there is no provision for aquaculture management in the Fisheries Act, the Minister has power to make regulations. Relevant non-fisheries legislation includes:

- the Environment Act of 2002, which subjects aquaculture development to bio-prospecting regulations, especially for environmental impact assessments, and close monitoring for environmental, social and customary impacts;
- the Animal Importation and Quarantine Act No. 7 of 1997, for animal imports;
- the Animal Disease Control Act No. 29 of 1991, which gives the Quarantine Service the power to intervene in cases of fish disease.

15.3.5 Recreational sub-sector

Sport fishing, or game fishing, is an important component of the Vanuatu fisheries sector. There are currently 20 to 30 game-fishing boats based in the country. Many of these vessels also carry out commercial fishing activities and sell their catch on the local market. Sport-fishing charter boats are now categorized as fishing vessels under the revised Vanuatu Fishing Act of 2004, meaning it is a licensed fishing activity. Some FADs have been deployed on Efate and Santo to attract coastal tuna activities. The main beneficiaries of these FADs are the game-fishing boats (Friedman *et al.*, 2008b).

The management of sport fishing is covered by the Vanuatu Tuna Management Plan. Relevant provisions of the plan include the following:

- Charter sport fishing vessels that sell their catch are considered to be commercial fishing vessels. They will be required to obtain a commercial fishing licence and

must follow the same rules for determining fees and licensing conditions as any other commercial vessel.

- Only local fishing vessels are eligible to fish around FADs. There will be no specific closed area around them for local fishing vessels less than 10 m and sport-fishing/ game-fishing vessels.
- Sport-fishing/game-fishing vessels must comply with provincial by-laws.
- The maximum number of locally based foreign and local fishing licences for sport fishing/game fishing is 55.
- The licence fees to be paid depend on the size of the sport-fishing/game-fishing vessel and the location of the base.

15.4 POST-HARVEST SECTOR

15.4.1 Fish utilization

In general offshore fishing is export oriented. The high-quality fresh bigeye and yellowfin are typically exported to Japan and the United States of America. Much of the albacore is sent to canneries in American Samoa, with some going to canneries in Southeast Asia.

In the coastal fisheries:

- Inshore finfish and invertebrates are largely consumed by the harvesting household, but a significant amount is sold to urban residents and resorts/restaurants. Those commercial establishments pay especially high prices for deep-water demersal fish, lobsters and coconut crab.
- The beche-de-mer is shipped to China.
- The aquarium fish and associated coral products are shipped to the United States of America.
- The trochus is either processed locally to form button blanks or for export to Asia and Europe to form high-quality mother-of-pearl buttons.

15.4.2 Fish markets

Two government-owned urban fish markets with substantial refrigerated fish storage were established in 1983: the Port Vila market, called Port Vila Fisheries Limited (commonly known as Natai) located on the waterfront, and the Luganville Santo Fish Market located adjacent to the public market on the Sarakata River. The role of the fish markets was to sell high-value deep-water fish from rural fisheries centres in the two urban centres, where there was growing demand from the tourism sector and urban markets. Airfreight was relied on for shipment of fish to these urban centres. In the mid-1990s both markets closed. The reasons for the closures are related to government involvement in commercial activities and subsequent divestment (Hickey and Jimmy, 2008)

Currently, there are a few commercial fish markets in the main urban areas of Port Vila and Luganville, plus several locations where fish are informally marketed.

15.5 SOCIO-ECONOMIC CONTRIBUTION OF THE FISHERY SECTOR

A recent study by SPC (Gillett, 2016) attempted to quantify the fishery-related benefits received by Vanuatu and other Pacific Island countries. The study gave the available information on the contribution of fishing to GDP, exports, government revenue, employment and nutrition. Unless otherwise noted, the information in this section is from that study.

15.5.1 Role of fisheries in the national economy

The Vanuatu National Statistics Office makes the official estimate of the fishing contribution to the GDP of Vanuatu. The SPC study examined the official methodology

and, using its independent estimate of the value of fisheries production, re-estimated the fishing contribution:

- The official contribution showed a 2014 fishing contribution to GDP of USD 4.7 million, or 0.64 percent of GDP.
- The contribution of fishing to GDP was re-estimated by the SPC study for the year 2014. It showed a contribution of USD 11.3 million, or 1.5 percent of GDP.

In 2014 Vanuatu received USD 1.8 million in access fees for foreign fishing. Access fees represented about 1.0 percent of government revenue for that year.

15.5.2 Trade

TABLE 15.8
Fishery exports of Vanuatu

	2013 (VUV millions)	2013 (USD millions)	2014 (VUV millions)	2014 (USD millions)
Shell	30	0.3	44	0.4
Live fish	88	0.9	142	1.4
Fish	139	1.4	10	0.1
Total fishery exports	257	2.7	196	1.9
Total exports	3 651	38.0	6 100	59.5
Fisheries exports as a % of total exports	7.0%	7.0%	3.2%	3.2%

Source: VNSO (2015).

The Merchandise Trade Statistics (VNSO, 2015) give the principal exports of Vanuatu. The details relevant to fisheries are extracted and given in Table 15.8.

FAO data for the export of fishery products from Vanuatu was USD 67.1 million in 2013 and USD 77.7 million in 2014 (Part 1 of this profile). The difference between FAO data and that reported by the Vanuatu National Statistics Office is likely to be that the Vanuatu government does not consider the catches of Vanuatu-flagged vessels that are made outside Vanuatu waters (i.e. the catch of flag of convenience vessels) and never brought to Vanuatu as exports of the country.

For 2014, FAO data shows USD 5.5 million of fishery imports (Part 1 of this profile).

15.5.3 Food security

In older studies of fishery resource consumption in Vanuatu:

- Preston (1996b) estimated annual per capita fish supply from coastal fisheries in Vanuatu as 15.9 kg;
- Preston (2000), using 1995 FAO data and considering production, imports and exports, estimated the annual per capita supply as 21.0 kg;
- Gillett and Lightfoot (2001) considered Vanuatu fishery production, imports, exports and population to estimate that annual per capita consumption of fishery products in 2000 was about 25.7 kg.

Bell *et al.* (2009b) used information from household income and expenditure surveys (HIES) conducted between 2001 and 2006 to estimate patterns of fish consumption in Pacific Island countries. The HIES were designed to enumerate consumption based on both subsistence and cash acquisitions. For the whole of Vanuatu, the annual per capita fish consumption (whole weight equivalent) was 20.3 kg, of which 60 percent was fresh fish. For rural areas, the per capita consumption of fish was 20.6 kg, and for urban areas, 19.3 kg.

Factors influencing the future demand for fish are increases in the price of fish (over-exploitation of inshore areas, gradual devaluation of the local currency), growth of the tourism industry, the relative cost of fish substitutes, and changes in dietary preferences.

15.5.4 Employment

The Vanuatu Socio-Economic Atlas (World Bank, 2014) uses information from both the 2009 census and the 2010 household income and expenditure survey (VNSO, 2013). It shows:

- the percentage of households that are involved in any fishing activity: Torba (76.8 percent), Sanma (48.7 percent), Penama (36.1 percent), Malampa (46.1 percent), Shefa (43.3 percent), Tafea (43.1 percent), Port Vila (9.6 percent) and Luganville (17.6 percent);
- the percentage of households that report sale of fish/crops/handicrafts as a main source of income: Torba (61.2 percent), Sanma (67.3 percent), Penama (67.9 percent), Malampa (60.0 percent), Shefa (46.1 percent), Tafea (60.2 percent) Port Vila (2.2 percent) and Luganville (4.4 percent);
- areas with especially high involvement in fishing: Northwest Santo, South Maewo, South Malekula, North Erromango, South Erromango and Aneityum.

The Vanuatu 2010 HIES found that more than 75 percent of the adult population practise at least one form of fishing, whether subsistence or commercial. The survey showed that 2 percent of urban households and 12 percent of rural households had income from the sale of fishery products. The HIES estimates the total income from the sale of fish and seafood was VUV 36 million annually,¹⁵ an average of VUV 7 100 per household per month. The provinces of Tafea, Shefa (rural) and Torba had the highest proportion of income from the sale of fish and seafood, representing almost two-thirds (64 percent) of total income from the sale of fish and seafood. Finfish sales amounted to just over VUV 20 million, and all other seafood combined to about another VUV 15 million.

An article on coastal fisheries and human development in Vanuatu (Hickey, 2008) described the participation of women in Vanuatu fisheries:

Most rural-based women fishers use their catches primarily to ensure household food security. Since no cash is involved, these fisheries are viewed by policy-makers and donors as less important than commercial fisheries. However, women are becoming increasingly involved in commercial fisheries, including for trochus, as well as in adding value to their catches. Many women with access to markets in Vanuatu collect fish, octopus and shellfish, including giant clams, for preparation with traditional puddings covered in coconut cream to produce a value-added product for sale in municipal markets or other popular outlets, such as kava bars. Alternatively, some women in the urban areas simply purchase reef fish from urban outlets for preparation in puddings for sale at various outlets, thereby adding value to these catches.

15.5.5 Rural development

The Fisheries Department's Development & Capture Division promotes artisanal, commercial and subsistence fishing enterprises to improve the livelihood of rural areas. The department maintains extension centres in all six provinces. One of the major objectives of these outposts is to promote fisheries development through a variety of ways, including market facilitation, advice on fisheries management, deployment of offshore fish aggregation devices (FADs) and provision of ice-making equipment.

¹⁵ In 2010, USD 1.00 = VUV 95.24.

15.6 TRENDS, ISSUES AND DEVELOPMENT

15.6.1 Constraints and opportunities

Major constraints for fisheries development include the following:

- Many of the inshore fishery resources, especially those close to the urban markets, are fully or over-exploited.
- Small-scale fishers have difficulty in economically accessing the relatively abundant offshore fishery resources.
- There are considerable difficulties associated with marketing fishery products from the remote areas where abundance is highest to the urban areas where the marketing opportunities are greatest.
- Port Vila is a relatively high-cost location to base an industrial fishing fleet.
- The workforce is inadequately trained.

Opportunities in the fisheries sector include:

- taking advantage of the proximity of Port Vila to good longline fishing grounds;
- establishing closer linkages between the fishing and tourism sectors;
- encouraging more on-shore processing of fish caught by vessels fishing in Vanuatu waters;
- the availability of high-quality technical assistance from SPC and FFA.

15.6.2 Government and non-government sector policies and development strategies

In December 2016, the Vanuatu National Fisheries Sector Policy 2016–2031 (MALFFB, 2016) was signed by the Minister of Agriculture, Livestock, Forestry, Fisheries and Biosecurity. The 39-page document includes a vision, mission, guiding principles, strategic policy objectives, and the details of strategic action in eight areas.

The document states that the policy focuses on improving fisheries governance, sustainable and economically viable fisheries and aquaculture, improved access to finance, improved infrastructure, market access, seafood safety and value-adding, sustainable growth, employment, food security and livelihoods.

- The plan gives the following development strategies for coastal fisheries:
 - Deployment of FADs in all provinces
 - Train fishers in fishing skills and FAD management
 - Establish fisher associations
 - Provide fishing gear and boat support to associations on credit
 - Establish fish preservation support in strategic market locations across the country
 - License all fishing boat operators
 - Provide duty concessions to all boat operators
 - Maintain support and engagement with fisher associations.

Related to the Fisheries Policy is the mission statement of the Fisheries Department:

“The mission of the Fisheries Department of Vanuatu is to ensure sustainable management, development and conservation of fish resources in order to achieve maximum social and economic benefits to Vanuatu for the present and future generations.”

At their March 2012 summit, the leaders of the Melanesian Spearhead Group (MSG) of countries (Fiji, New Caledonia, Papua New Guinea, Solomon Islands and Vanuatu) agreed to develop a roadmap for the protection of inshore fisheries (Box 15.6). That roadmap gives some insight into Vanuatu’s future policies and strategies in inshore fisheries management.

15.6.3 Research

Historical fisheries research in Vanuatu is given in the Vanuatu Fisheries Bibliography (Gillett and Kenneth, 1987). More recent research specific to particular fisheries appears in the profiles of Vanuatu’s fishery resources by Bell and Amos (1993) and Amos (2007).

BOX 15.6

MSG Roadmap for inshore fisheries

The “Melanesian Spearhead Group Roadmap for Inshore Fisheries Management and Sustainable Development 2015–2024” is a management framework and subregional roadmap for sustainable inshore fisheries, developed by the MSG Secretariat in cooperation with representatives of the fisheries departments of the MSG countries and with the technical assistance of the Secretariat of the Pacific Community (SPC). The regional roadmap provides overarching guidance for MSG members and enumerates the actions they have agreed to take to address the management of inshore fisheries in Melanesia.

The vision of the roadmap is “sustainable inshore fisheries, well managed using community-based approaches that provide long-term economic, social, ecological and food security benefits to our communities”.

The objectives of the roadmap are: 1. Development of an effective policy, legislation and management framework for the management of inshore resources, in accordance with other relevant international agreements, to empower coastal communities to manage their marine resources. 2. Education, awareness raising and the provision of information on the importance and management of inshore fisheries. 3. Capacity building to sustainably develop and manage inshore resources with particular reference to experiences in the MSG members. 4. Adequate resources to support inshore fisheries management and best available science and research. 5. Secure long-term economic and social benefits to coastal communities from the sustainable use of inshore resources. 6. Establishment of effective collaboration with stakeholders and partners. 7. Restoration and maintenance of beche-de-mer stocks to maximize long-term economic value to coastal communities.

The roadmap was adopted by the leaders of Fiji, New Caledonia, Papua New Guinea, Solomon Islands and Vanuatu in June 2015.

Source: SPC (2013b).

Friedman *et al.* (2008b) summarized some of the most significant marine research in Vanuatu:

Past research activities in Vanuatu rely on assistance from outside institutions to conduct marine research as there are no such institutions in the country. The 10-year Village Fisheries Development Project conducted a comprehensive study on the deep-water bottomfish resources of Vanuatu. The most comprehensive study on Vanuatu reef resources was carried out in 1988 and 1989 by the Australian Institute of Marine Science. A joint collection of reef fish in 1996 and 1997 by the Australian Museum, Smithsonian Institute and Vanuatu Fisheries recorded many reef fish found down to 30 m. Several studies on traditional marine tenure and community-based management have been conducted in Vanuatu. They include studies on the performance of traditional marine tenure systems in community fisheries management, the evolution of village-based marine resource management in Vanuatu from 1990 to 2001, the government-supported, village-based management of marine resources in Vanuatu, and reef and lagoon tenure in the Republic of Vanuatu and its prospects for mariculture development. Stock assessments of giant clam, beche-de-mer and rock lobster have been executed by Vanuatu Fisheries Department in collaboration with New Zealand’s Bay of Plenty Polytechnic and funded by FFA. Coral reef monitoring activities were initiated in 2000 with funds provided by the Canada South Pacific Ocean Development Programme and FFA. Assessment of the stock of aquarium fish provided baseline data on the aquarium fish resources of Efate. Mariculture

of *Trochus niloticus*¹⁶ and green snail was initiated in 1990 with the support of FAO. Successful production of trochus juveniles led to a trochus reseeding research project commissioned from 1995 to 2000 and funded by the Australian Centre for International Agricultural Research (ACIAR). The aim of this study was to test the viability of stock restoration with cultured shells. Seaweed trials were conducted in various areas in the country in 1999 and 2000, funded by FFA. Present research and development of aquaculture is currently generating a lot of interest from foreign investors and local communities. Trials on genetically improved, farmed tilapia (*Oreochromis niloticus*) initiated by the Fisheries Department in 2000 have been successful and the fish has been widely accepted. The trials were funded by FFA with advice provided by SPC's Aquaculture Section and have sparked local interest in freshwater farming.

15.6.4 Education and training

As part of earlier European Union-funded fisheries development efforts, a Fisheries Training Centre was established in Luganville, Espiritu Santo, in 1991. Island fishers could reside at the centre for a month while they received training in deep-water and pelagic fishing gear and methods, fish handling, outboard engine and boat maintenance, and basic financial management. Hundreds of fishers from throughout the group received training through the centre during the 1990s. However, with the cessation of EU funding in 1996, the government had difficulty in funding the centre and it was decided to eventually allocate it to the newly formed Vanuatu Maritime College (VMC) in 2001. The college trains seafarers for employment on merchant and fishing vessels as well as on cruise ships. VMC includes in its mandate practical fisheries training for rural communities in addition to its primary function of providing training to seafarers. Fisheries training courses are run in rural areas following requests from provincial governments, fishers' associations and/or from the Department of Fisheries (Hickey and Jimmy, 2008).

Higher-level or academic training in fishery-related subjects is generally sought overseas and is undertaken in a variety of institutions:

- Academic training in biological, economic and other aspects of fisheries is given at the University of the South Pacific in Suva, and to a lesser extent at universities in New Zealand, Australia, Japan and the United Kingdom.
- Training courses, workshops and attachments are frequently organized by the regional organizations: SPC in New Caledonia and FFA in the Solomon Islands. The subject matter has included such diverse topics as fish-quality grading, stock assessment, seaweed culture, fisheries surveillance and on-vessel observing.
- Courses and workshops are also given by NGOs and by bilateral donors.

15.6.5 Foreign aid

Vanuatu has enjoyed fisheries sector assistance from a range of multilateral and bilateral donors. Support has historically included the funding of expatriate staff positions within the Department of Fisheries, establishment and operation of rural fishing centres, provision of vessels, FAD materials and equipment, construction of aquaculture facilities, collaborative research costs, and travel costs for training and attendance at meetings.

Important donors have included the governments of Britain, Australia, New Zealand and Japan, as well as the European Union. Other donors have included ACIAR, the International Centre for Ocean Development and the Canadian International Development Agency. Assistance is also obtained from the international organizations

¹⁶ Or *Tectus niloticus*.

of which Vanuatu is a member, including ADB, and FAO, UNDP, ESCAP and other United Nations agencies. The regional organizations serving Pacific Island countries, including FFA and SPC have been active in supporting Vanuatu's fisheries sector.

15.7 INSTITUTIONAL FRAMEWORK

The Vanuatu Fisheries Department (VFD) is the government body charged with the implementation and enforcement of fisheries management laws, policies, regulations and principles. It is part of the Ministry of Agriculture, Livestock, Forestry, Fisheries and Biosecurity (MALFFB).

The VFD has six divisions: Administration, Management & Policies, Development & Capture, Research & Aquaculture, Seafood Verification, and Licencing & Compliance. The latest annual report of the Fisheries Department (VFD, 2013) indicates that, as of 2012, there were 57 positions in the department.

Other government agencies in Vanuatu have some involvement in fisheries. Pascal *et al.* (2015) summarizes the fisheries-related involvement of those agencies:

Prime Minister's Office — The Office is responsible for the national development plan which sets the tone for and priority of natural resource management, including marine resource management. The office also gathers data on major sectors (i.e. agriculture) but not subsistence values.

Department of Environment Protection and Conservation — Environmental impact assessment is used in Vanuatu to put monetary values on damage to ecosystems, but not to put a value on healthy ecosystems. The department has studied wetland ecosystem services and made lists of the services they provide and has also done limited biodiversity assessments in protected areas.

Department of Forestry — The department's jurisdiction includes mangroves. The department has conducted some carbon accounting exercises, putting financial values on ecosystems (including mangroves), but on a very small scale.

Department of Tourism — Tourism in Vanuatu is an important source of revenue and is largely reliant on marine resources. The department conducts strategic planning for tourism development and, to inform this effort, produces quarterly reports and data on incoming and outbound tourists and the main purpose of visits, etc. The importance of the ecosystems on which much of the tourism value is based is not assessed.

Vanuatu National Statistics Office (VNSO) — Social statistics gathered by VNSO include data on education, health and the labour force. Fishing activities are also measured. For example, there is quarterly information on commercial catches and information on fishing tax and fishing licences, but no information on subsistence catches.

Public Works Department — The department is responsible for public works, which can often have impacts on the marine environment. Small collections of natural resources are quantified but not entire ecosystems.

Although Vanuatu is governed by a parliamentary democracy, village chiefs have an important role in decision-making at the village level, including decisions about the management of marine and coastal resources.

Other institutions in the country that are relevant to fisheries are the Vanuatu Maritime College, the Sports/Charter Boat Association, the Vanuatu Fishermen's Association, fishers' cooperative associations, and the Vanuatu Chamber of Commerce and Industry.

Important internet links related to national fisheries and aquaculture include:

- Vanuatu Fisheries Department: www.fisheries.gov.vu
- Vanuatu Maritime College: www.santovanuatu.com/place/vanuatu-maritime-college/
- Forum Fisheries Agency (FFA): www.ffa.int
- Pacific Community (SPC): www.spc.int
- Western & Central Pacific Fisheries Commission (WCPFC): www.wcpfc.int

15.7.1 Regional and international institutional framework

The major regional institutions involved with fisheries are the Forum Fisheries Agency (FFA), located in Honiara and the Pacific Community (SPC) in Noumea. Other players are the Parties to the Nauru Agreement (PNA) Office in Majuro, the Pacific Islands Forum Secretariat (PIFS) in Suva, the Secretariat of the Pacific Regional Environment Programme (SPREP) in Apia, and the University of the South Pacific (USP) in Suva. The various characteristics of those institutions are given in Table 15.9.

TABLE 15.9
Pacific Island regional organizations involved in fisheries

	FFA	SPC	Other regional organizations with fishery involvement
Main area of emphasis	Providing management advice on tuna fisheries and increasing benefits to Pacific Island countries from tuna fishing activities.	Most aspects of coastal fisheries and scientific research on tuna. Fisheries are only one aspect of SPC's work programme, which also covers such issues as health, demography and agriculture.	PNA – subregional grouping of countries where most purse seining occurs; SPREP – environmental aspects of fisheries; USP – School of Marine Studies (SMS) involved in a wide range of training; PIFS – major political initiatives, some natural resource economics; leads trade negotiations with EU, which have a major fisheries component
Inter-regional relationships	The FFA/SPC relationship has had ups/downs over the years. It was most difficult in the early 1990s, but tremendous improvement in mid/late 1990s. An annual colloquium has helped the relationship. Staff who have moved between the two organizations have made a noticeable improvement in understanding. Much of the success/benefits achieved by FFA/SPC cooperation depends on the personalities of FFA's Director/Deputy and SPC's Director of the Division of Fisheries, Aquaculture and Marine Ecosystems.		At least in theory, all regional organizations come under the umbrella of PIFS. Their activities are coordinated to some degree by the Council of Regional Organisations in the Pacific (CROP), which has a Marine Sector Working Group that meets at least once per year, but is limited by lack of resources for follow-up. FFA originally provided secretariat services to the PNA, but the PNA broke away from FFA in 2010. Currently, there are some sensitivities in the relationship, but it appears to be improving.
Main strengths	Direct contact with its governing body many times per year results in a high degree of accountability. Mandate of tight focus on tuna eliminates considerable dissipation of effort.	Noumea being a pleasant place to work, there is considerable staff continuity. The Oceanic Fisheries Programme often sets the standard for tuna research in the world. Documentation of work is very good.	Because PIFS is under the national leaders, it is considered the premier regional organization. PNA has achieved considerable success and credibility in such areas as raising access fees, 100 percent observer coverage, eco-certification, high seas closures, and controls on FADs. USP is centrally located in the region and SMS has substantial infrastructure. SPREP has close ties to NGOs active in the marine sector.
Membership	Australia and New Zealand, plus Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu	Includes the major metropolitan countries, all Pacific Island countries, and the French/UK/US territories; the most inclusive of any regional organization.	PNA: the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. USP: Cook Islands, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. SPREP: 21 Pacific Island countries and territories, plus Australia, France, New Zealand and United States of America. PIFS: same as FFA

Source: Adapted from Gillett (2014a).

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean entered into force in June 2004, and established the Western and Central Pacific Fisheries Commission (WCPFC). Vanuatu is a member of the commission, along with 26 other countries. WCPFC has its headquarters in Pohnpei, Federated States of Micronesia, and has held 13 annual meetings to date.

15.8 LEGAL FRAMEWORK

The Fisheries Act No. 10 of 2014 states that it is a law to repeal the Fisheries Act (CAP 315) and to make provision for the management, development and regulation of fisheries within Vanuatu waters, and for the control of fishing vessels entitled to fly the flag of Vanuatu outside of Vanuatu waters in a manner consistent with Vanuatu's international obligations, and for related matters.

The Act is a 135-page document containing 23 parts:

1. Preliminary matters
2. Purpose and principles
3. Administration
4. Fisheries management, development and conservation
5. Aquaculture management and development
6. Seafood verification agency
7. Vanuatu fishing vessels and local fishing vessels in Vanuatu waters
8. Registration of fishing vessels on the international shipping registry
9. Requirements for charter of fishing vessels
10. Foreign fishing vessels
11. Compliance with international obligations
12. Fishing by Vanuatu vessels beyond Vanuatu waters
13. General licensing provisions
14. Ban on driftnet fishing
15. Vanuatu marine mammals sanctuary
16. Other prohibited activities
17. Other approvals
18. Authorized officers, observers and port samplers
19. Monitoring, control and surveillance
20. Sale, release and forfeiture of seized property
21. Jurisdiction and evidence
22. Regulations and penalty notices
23. Miscellaneous

The notable provisions of the Act are as follows:

- The Fisheries Management Advisory Council is established. The function of the Council is to provide recommendations to the Director on policy matters relating to fisheries conservation and management.
- The Minister may determine that a fishery is a designated fishery if, having regard to scientific, economic, environmental and other relevant considerations, the Minister considers that the fishery is important to the national interest, and requires management and development measures for its effective conservation and optimum utilization. The Director of Fisheries is to prepare, and review where necessary, a plan for the management and development of each designated fishery.
- A person must not carry out aquaculture unless the person complies with the applicable laws, pays the prescribed licence fee, and is granted an aquaculture licence granted by the Director of Fisheries.
- The Vanuatu Seafood Verification Agency is established. The Agency has the following objectives: (a) to verify and certify the import and export of seafood;

and (b) to ensure the application of appropriate quality control measures and seafood production industry standards; and (c) to ensure the facilitation of exports from Vanuatu of all categories of seafood for human consumption.

- A person must not use a fishing vessel for commercial fishing or related activities in Vanuatu waters unless he or she has been issued with a local or foreign fishing licence.
- Requirements are given for registration of fishing vessels on the Vanuatu International Shipping Registry.

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This document *Fisheries of the Pacific Islands: Regional and national information* provides a recent update of the fisheries and aquaculture sector in the Pacific Region. The document consists of 2 main parts: a regional overview; and fisheries and aquaculture country profiles for the 14 independent Pacific Island countries. It consolidates a variety of sources of information into a single coherent review, to provide a general understanding of the status of fisheries and aquaculture in the Pacific Islands.

