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Fisheries of the Pacific Islands

Regional and national information

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FOREWORD

The Pacific Island region consists of fourteen independent countries and eight territories located in the western and central Pacific Ocean. These comprise about 200 high islands and some 2 500 low islands and atolls. 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, the opportunities for future development and food security are all highly dependent on coastal fisheries 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 undertaken by Pacific Islanders themselves, with very little access by foreign fishing vessels.

In contrast to the coastal fisheries, offshore fishing is dominated by large industrial-scale fishing vessels. Approximately 1 500 of these vessels operate in the EEZs of Pacific Island countries, mainly using purse seine, longline, and pole-and-line gear to catch tuna. There are about 327 vessels operated by national operations and approximately 1 200 foreign-based vessels operating in the waters of Pacific Island countries. It is important to note that the license fees paid to Pacific Island countries by these foreign-based vessels is substantial, and in some countries represents the major source of government revenue.

This publication presents information on coastal and offshore fisheries in the region. The information is broken down into resource categories, the major types of fishing, the important species, the status of those resources, and the fisheries management that occurs. The document also provides supplementary sectoral and governance related information on the fisheries in the 14 independent Pacific Island countries.

Statistics and information are of variable quality in the region. This publication attempts a significant effort to consolidate a variety of sources into a single coherent review. As such it is a timely contribution to our general understanding of the status of the fisheries in the Pacific Islands.

I would like to thank the staff of the national fisheries agencies, the Secretariat of the Pacific Community (SPC), FAO fisheries colleagues and the other fishery professionals who have contributed to this work, and through their activities are promoting and supporting fisheries information and statistical collection in the Pacific Islands region.

Hiroyuki Konuma
Assistant Director-General and
Regional Representative for Asia and the Pacific

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 1 500 of these vessels operate in the EEZs of Pacific Island countries, mainly using purse seine, longline, and pole-and-line gear to catch tuna.
- **Coastal fishing**. This can be divided into three categories: (1) Small-scale commercial fishing (also referred to as "artisanal") which can be further sub-divided 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) The industrial-scale shrimp fisheries, which in the region only occur 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, 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 life-styles, and restriction of individual movements to coastal areas. This paper discusses these resource categories. Information is provided on the major types of fishing, the important species, the status of those resources, and the fisheries management that occurs.

The report also provides information on the fisheries in the 14 independent Pacific Island countries in following categories:

- General geographic and economic data
- Fisheries data
- Fishery sector structure
- Post-harvest use
- Fishery sector performance
- Fishery sector development
- Fishery sector institutions
- General legal framework

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Preparation of this document

The regional information section was prepared under the direction of Jacek Majkowski of FAO's Fisheries Management and Conservation Service. The information on national fisheries was compiled as part of a global series of fishery country profiles under the direction of Marc Taconet of FAO's Fisheries and Aquaculture Information and Statistics Service. The author is Robert Gillett, a fisheries specialist based in Fiji.

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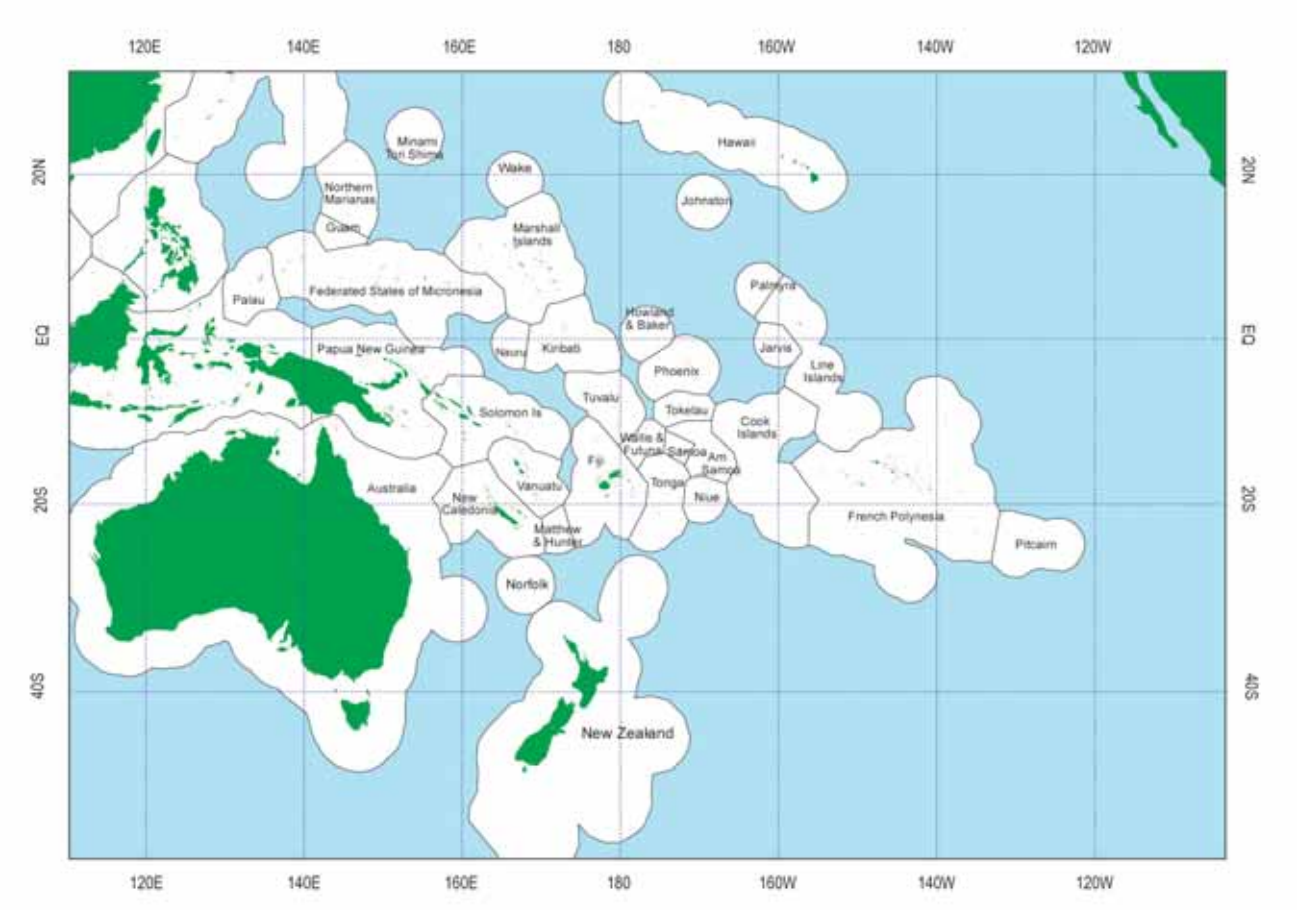
Abbreviations

ADB	Asian Development Bank
CCM	Conservation and management measure
DVA	Domestic value added
DWFN	Distant Water Fishing Nation
EAFM	Ecosystem Approach to Fisheries Management
EEZ	Exclusive Economic Zone
FAD	Fish Aggregation Device
FAO	Food and Agriculture Organization of the United Nations
FFA	Forum Fisheries Agency
FSM	Federated States of Micronesia
MPA	Marine Protected Areas
MSY	Maximum sustainable yield
MT	Metric tonne
MTCs	Minimum terms and conditions (of access)
NFA	National Fisheries Authority
NGO	Non-Government Organization
OFP	Oceanic Fisheries Programme of the Secretariat of the Pacific Community
PIMRIS	Pacific Islands Marine Resources Information System
PNG	Papua New Guinea
ProcFish-C	Pacific Regional Oceanic and Coastal Fisheries Project
SOPAC	South Pacific Applied Geoscience Commission
SPC	Secretariat of the Pacific Community (formerly South Pacific Commission)
SPREP	South Pacific Regional Environment Programme
TMP	Tuna Management Plan
UNCLOS	United Nations Conference on the Law of the Sea
US	United States
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	Western and Central Pacific Ocean

Regional information

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 shows these countries/territories, their 200-mile zones, and the international waters and Table 1 gives summary details of the countries and territories.



Source: Courtesy of SPC

Figure 1: The Pacific Islands region

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 western-most 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: The 22 Pacific Island countries and territories[1]

	Country/territory	Land area (sq km)	Area of 200-mile zone (sq km)	Estimated population[2] (July 2007)
Independent Pacific Island countries	Cook Islands	180	1 830 000	15 473
	Federated States of Micronesia	702	2 978 000	109 999
	Fiji	18 376	1 290 000	834 278
	Kiribati	726	3 550 000	93 707
	Marshall Islands	720	2 131 000	52 701
	Nauru	21	320 000	9 930
	Niue	258	390 000	1 587
	Palau	500	629 000	20 162
	Papua New Guinea	461 690	3 120 000	6 332 751
	Samoa	2 934	120 000	179 478
	Solomon Islands	29 785	1 340 000	503 918
	Tonga	696	700 000	102 264
	Tuvalu	26	900 000	9 701
	Vanuatu	12 189	680 000	227 146
Pacific Island territories	American Samoa	197	390 000	65 029
	French Polynesia	3 521	5 030 000	260 072
	Guam	549	218 000	173 995
	New Caledonia	19 103	1 740 000	242 561
	Northern Marianas	475	1 823 000	64 050
	Pitcairn Islands	5	800 000	54
	Tokelau	12	290 000	1 170
	Wallis & Futuna	124	300 000	15 369

Sources: Gillett and Preston (1997) and SPC (2008a)

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 freshwater 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 localised areas, and have 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.

The Pacific Island countries have two regional organizations with major involvement in fisheries. At least some knowledge of those organizations is a prerequisite to appreciating the management of fisheries of the area (Box 1).

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

[2] From SPC (2008).

Box 1: Fisheries and the regional organizations in the Pacific Islands

Compared with other fishing regions of the world, an important feature of the area is the strong regional organizations active in the fisheries sector. The two principal organizations are:

- **Secretariat of the Pacific Community (SPC).** SPC, based in Noumea, New Caledonia, helps its member countries and territories in matters relating to (a) coastal fisheries development and management, and (b) scientific research and catch data compilation on the tuna resources of the region.
- **The Forum Fisheries Agency (FFA).** FFA, based in Honiara, Solomon Islands, assists its member countries in matters dealing with the management of the region's tuna resources, including economics, surveillance, and legal aspects.

Other regional organizations also have responsibilities in fisheries. These are the South Pacific Regional Environment Programme (based in Apia, Samoa), the South Pacific Applied Geoscience Commission (Suva, Fiji), and the University of the South Pacific (Suva, Fiji).

Fishery statistics in the region

With respect to the quality and coverage of statistics, there are major differences between the region's coastal fisheries and the oceanic fisheries. The following, taken largely from two studies that review the fisheries statistics in the region (FAO 2001; Gillett and Van Santen 2008), summarizes the situation.

Offshore fishery statistics

The offshore statistical systems are in relatively good condition, both at a national and regional level. As a component to the SPC fisheries services to the region, the Oceanic Fisheries Programme (OFP) has a Statistics and Monitoring Section. The activities of that section currently include the compilation of estimates of annual catches of target tuna and billfish species, the estimation of annual catches of non-target species, the compilation of operational (logsheet) catch and effort data, data processing on behalf of member countries and territories, the provision of technical support for port sampling programmes and observer programmes in member countries and territories, training in fisheries statistics and database management, the development of data collection forms, the publication of the Tuna Bulletin and the Tuna Fishery Yearbook, statistical analyses, and the provision of statistical support to other regional and international organizations involved in the fisheries of the region.

Coastal fishery statistics

The situation of coastal fisheries statistics is considerably different. For coastal fisheries, the quality of fisheries statistics furnished to FAO by national governments is generally not very good. In fact, the estimation of the production from coastal fisheries by government fishery officers in about half of the Pacific Island countries is 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.

Although most of the countries in the region attach great important to their subsistence and small-scale commercial fisheries, it is these fisheries that present the greatest difficulties for the collection of

production information. Also to be considered is that many fisheries specialists have questioned the cost-effectiveness and practicalities of regular data collection from small-scale fisheries in the Pacific Island countries.

Attention is now being focussed on the collection of fisheries production information using surveys outside the fisheries sector. Many fisheries specialists in the region support the concept that well-conducted household income and expenditure surveys and censuses can provide basic information on the composition, quantity and estimated value of coastal fisheries.

Main categories of fisheries in the region

Fishing activity in the Pacific Islands can be classified both by area in which the fishing is undertaken and by scale. Although the terminology used is not standardized across the region,[3] one system of classification is as follows:

Offshore fishing is undertaken mainly by large industrial-scale fishing vessels.[4] Approximately 1 500 of these vessels operate in the EEZs of Pacific Island countries, mainly using purse seine, longline, and pole-and-line gear to catch tuna. 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 sub-divided into two categories:

- *Locally-based offshore fishing:* A survey carried out in 2008 (Gillett 2008) showed that 269 longline vessels, 56 purse seine vessels and 2 pole-and-line vessels were based in the region. About 1 169 people from the Pacific Islands are employed on these tuna vessels.
- *Foreign-based offshore fishing:* Approximately 1 200 foreign-based vessels operate in the waters of Pacific Island countries. Although about 65 percent of the vessels are longliners, about three-quarters of the tuna catch is taken by purse seiners. Most foreign fishing vessels are based in Asia, while some US-flagged purse seine vessels are based in American Samoa. The license fees paid to Pacific Island countries by these foreign-based vessels is substantial and in some cases, the major source of government revenue for some countries.

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, the opportunities for future development, and food security are all highly dependent on coastal fisheries 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 fishing,* (also referred to as "artisanal") which can be further broadly sub-divided 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.
- *The industrial-scale shrimp fisheries,* which in the region only occur in Papua New Guinea.

[3] A lengthy discussion of classifying fisheries in the region is present in Gillett (2005c).

[4] 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 short paper, an industrial fishing vessel is defined as a fishing craft that is generally greater than 15 metres in length.

In 2008 the Asian Development Bank 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 2).

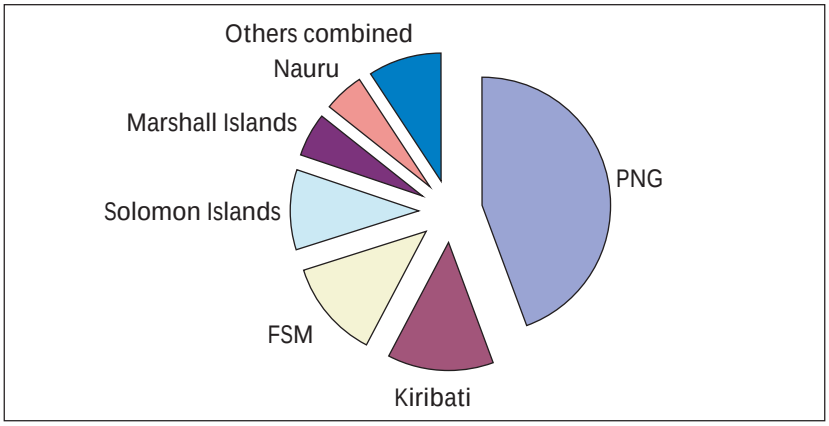
Table 2: Marine fishery production in 2007 in Pacific Island countries
(metric tonnes)

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based	Total
PNG	5 700	30 000	256 397	327 471	619 568
Kiribati	7 000	13 700	0	163 215	183 915
FSM	2 800	9 800	16 222	143 315	172 137
Solomon Islands	3 250	15 000	23 619	98 023	139 892
Marshall Islands	950	2 800	63 569	12 727	80 046
Nauru	200	450	0	69 236	69 886
Fiji	9 500	17 400	13 744	492	41 136
Tuvalu	226	989	0	35 541	36 756
Vanuatu	538	2 830	0	12 858	16 226
Samoa	4 129	4 495	3 755	25	12 404
Tonga	3 700	2 800	1 119	0	7 619
Palau	865	1 250	3 030	1 464	6 609
Cook Islands	133	267	3 939	0	4 339
Niue	10	140	640	0	790

Source: ADB (2009)

These results are shown graphically in Figure 2. The six countries that have the most production have large tuna fisheries and, with the exception of PNG, most of the tuna catch in those countries is taken by foreign-based vessels. Other notable features of the information in Table 2 are:

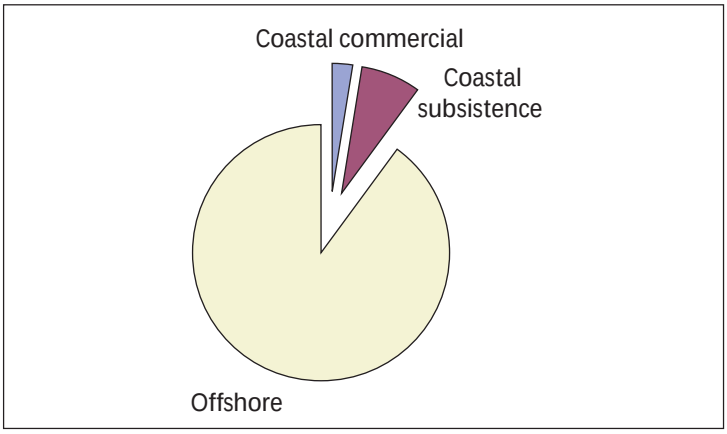
- There is a general pattern of decreasing total national catches going from west to east across the region, and from equatorial to higher latitudes.
- The relatively large contribution of offshore locally-based production in the Marshall Islands and (to a lesser extent) Fiji.
- The relatively large contribution of non-tuna production in Fiji.



Source: Table 2 above

Figure 2: Marine fishery production by volume in 2007 by major producing countries

Figure 3 below shows that the production from the offshore fisheries[5] is about nine times greater than the coastal fisheries (commercial and subsistence). It is easy to conclude that offshore fishing and the tuna resources upon which they are based, are very important to the region.



Source: Modified from Table 2 above

Figure 3: Marine fishery production in 2007 by volume by fishery category

With respect to catch value, the ADB study determined that the unit price across the region equates to:

- Coastal commercial: US$3.70 per kg
- Coastal subsistence: US$1.82 per kg
- Offshore locally-based: US$1.49 per kg
- Offshore foreign-based: US$1.26 per kg

The very high unit value of coastal commercial production is due to high prices paid for invertebrate species (e.g. bêche-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 sashimi production and less for cannery-grade tuna.

Fishery resources

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

- **Oceanic 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.
- **Coastal resources** include a wide range of finfish and invertebrates. They are characterized by their shallow water habitats or demersal life-styles, 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.

[5] The categories of locally-based offshore fishing and foreign based offshore fishing have been combined and adjusted in the figure. This is for reasons of double-counting – the catch of a Pacific Island fleet in the zone of another Pacific Island country is counted on the table both as "offshore locally-based" in the home country of the fleet and as "offshore foreign-based" in the country where the catch is made.

Coastal fishery resources

Sources of information on coastal fishery resources

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

- The book *Nearshore Marine Resources of the South Pacific. Information for Fisheries Development and Management* (Wright and Hill 1993) 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.
- In the early 1990s the FFA produced fishery resource profiles for most of the Pacific Island countries. Each national profile has a section on the important fishery resource containing a summary of the resource, the fishery, stock status, management, and references. As an example, the "Fiji Fisheries Resources Profiles" (Richards 1994) cover 37 groups of fishery resources (e.g. emperors, small pelagics, giant clams) in 235 pages.
- The *FAO Species Identification Guide for Fishery Purposes: the Living Marine Resources of Western Central Pacific* (Carpenter and Niem, 1998) consists of 6 volumes and 4 218 pages. The series covers virtual all 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.
- SPC produces a series of fishery information bulletins, including several focussed on coastal resources of special interest. These include bulletins on bêche-de-mer (28 bulletins issued since January 1990), trochus (14 since July 1992) and pearl oyster (18 since February 1990).
- Various development partners have undertaken regional studies of specific fishery resources. These include the Asian Development Bank for the fish of the live reef food fish trade, the World Bank for trochus, FAO for bêche-de-mer, and the WorldFish Center for 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 PNG, 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.

Pacific Islands Marine Resources Information System (PIMRIS) is a formal cooperative network of libraries and information centres within the Pacific Islands 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. This is from projects they have carried out (e.g. bêche-de-mer, lobster, deepwater bottomfish, aquarium fish), documentation accumulated over the previous 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 classifying, i.e. whether for economic or biological reasons. For the purpose of the present report, resources are given in the categories of finfish, invertebrates, and others.

Table 3: Composition of reef and lagoon fishery landings from 15 locations in the Pacific Islands region

Scientific name	Common name	Percent
Lethrinidae	Emperors	13.32
Acanthuridae	Surgeonfish	10.91
Lutjanidae	Snappers	9.19
Carangidae	Jacks/scads	7.19
Serranidae	Groupers	6.96
Mugilidae	Mullets	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	Barraccudas	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

Source: Dalzell and Schug (2002)

Finfish: Dalzell and Schug (2002) review finfish that are important in Pacific Island coastal fisheries. They state that a typical small-scale commercial reef fishery in the western and central areas of the region may harvest between 200 and 300 finfish species, although it is likely that only a few species will dominate landings. Table 3 is a composite "average" of landings from 15 Pacific Island countries. Approximately one-third of the coastal catch total is comprised of emperors (Lethrinidae), surgeonfish (Acanthuridae) and snappers (Lutjanidae).

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 (about 40 percent of total), and bêche-de-mer (about 5 percent), followed by much smaller amounts of crabs, lobsters, strombus, turbo, arc shell, other bivalves/gastropods, trochus, urchin, octopus, shoreline gastropods, beach bivalves, and land crabs.

– Export invertebrates have historically been bêche-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 exported from a few countries (e.g. Tonga). In the *Fiji Fisheries Resources Profiles* (Richards 1994), 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. (Lovell 2000).

Important types of coastal fishing

Table 2 above gives estimates of fisheries production for each Pacific Island country for 2007. Figure 4 takes the coastal fishing data from the table and shows graphically the annual production by country.

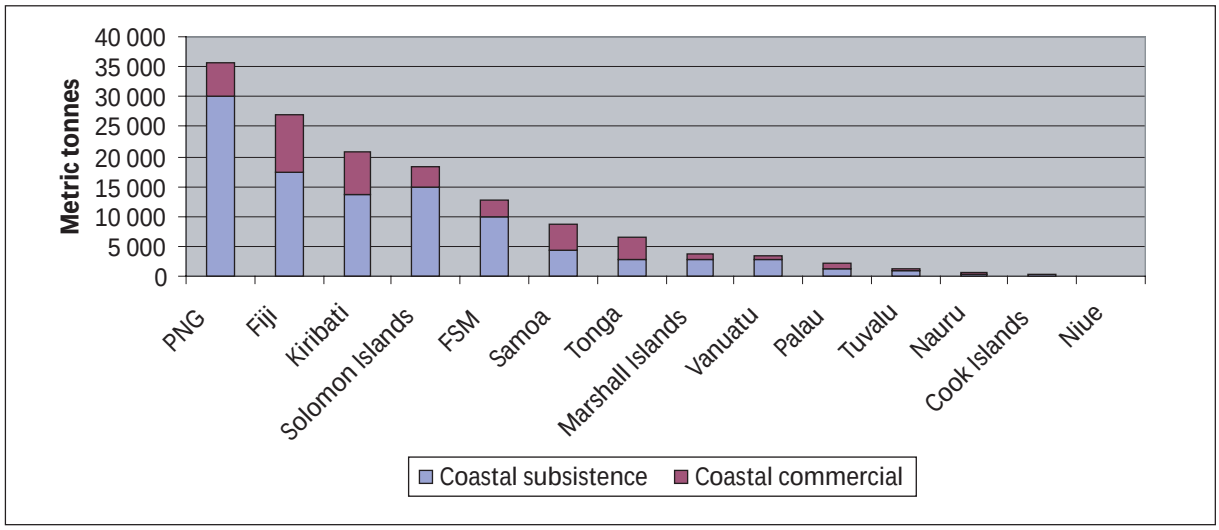


Figure 4: Coastal fishing production, 2007

The figure shows that in most countries of the region, the volume of production from coastal subsistence fisheries is many times greater than that of coastal commercial fishing, with Tonga and Samoa being notable exceptions.

Subsistence fishing

As can be seen on Table 2, about 70 percent of the overall fisheries production from coastal areas of the Pacific Islands is produced by subsistence fishing. In several countries over 80 percent of the coastal catch is from the subsistence sector: Tuvalu, Solomon Islands, Vanuatu, PNG, and Niue.

In a recent review of benefits from Pacific Island fisheries, ADB (2009) estimated that the contribution of subsistence fishing to gross domestic product was actually quite large in a number of Pacific Island countries. Overall, about 30 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) reports that in Western Samoa the subsistence fisheries make use of 500 species. In a study of coastal resources management in the Pacific Islands (World Bank 2000), residents in coastal villages in five countries identified what they considered were their major coastal resources (Table 4).

Table 4: Resources that support subsistence fishing

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

Source: World Bank (2000)

Subsistence fishing tends to be most important in rural areas, but as rural economies become increasingly monetised, 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 either does not involve a vessel (i.e. gleaning from shore, or swimming) or uses a non-powered canoe. Typical characteristics of subsistence fisheries in the Pacific Island 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 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 Pacific Island subsistence fisheries situation estimate that fishing activity by women actually results in a greater amount of family food than produced by men.

Although there has been several development projects attempting to commercialize aspects of fishing in subsistence communities, they have usually met with limited success. On the basis of studying the fish marketing situation in many Pacific Island countries, an FAO study (Carleton, 1983) 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." This is still true today.

Coastal commercial fishing

Compared to the subsistence fisheries of the region, the coastal commercial fisheries are smaller and 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 (trochus, green snail and pearl shell, 9 percent), crustaceans (8 percent), bêche-de-mer (7 percent), and estuarine fish (6 percent).

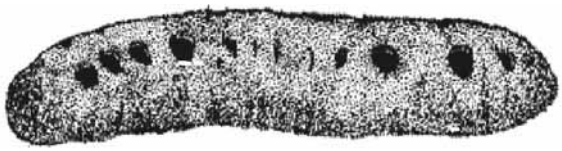
It may not be appropriate to place the various types of coastal commercial fishing into discrete "fisheries", especially for the smaller-scale fishing. A single fishing trip often involves the use of several types of gear to make a range of catches. For example, Gillett and Moy (2006) state that during a multi-day fishing trip, spearfishers in Fiji characteristically collect bêche-de-mer, trochus and lobster, and do some handlining, in addition to the main effort of spearing finfish. Therefore, it is more suitable 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. The main gears are handlines, spears, and gillnets. Dalzell and Schug (2002) give the yields for the common types of gear used in the region for shallow water reef fish (Table 5). Commercial export of shallow water reef fish is not a major activity; the vast majority of the catch is for the domestic urban market.

Table 5: 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
Spear fishing	kg/man-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

Bêche-de-mer: About 20 species are currently exploited in the region, primarily for export to Asia. Recent annual production from Pacific Island countries is about 1 500 tonnes (dried, equivalent to 15 000 tonnes live weight). Villagers can process bêche-de-mer into a non-perishable product which can be stored for extended periods awaiting opportunistic transport to markets. "Pulse fishing" is often used to describe the fishery – 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, and then a dormant period in which the resource is able to recover. Information on bêche-de-mer fishing in PNG is given in Box 2.



***Holothuria atra,* a common species of bêche-de-mer**

Box 2: Bêche-de-mer fishing in PNG

Papua New Guinea (PNG) is now the third largest producer of bêche-de-mer in the world, supplying around 10 percent of the global market. Bêche-de-mer is not a common "traditional" food in PNG, hence almost all are exported. They are mainly harvested by hand by free divers, or with spears and lead "bombs" in deeper water. Night fishing with torches and underwater breathing devices are used now despite their prohibition. Management of the fishery in PNG was recognized as necessary after catches declined from the fishery's inception in the nineteenth century. The government has gazetted the *National Bêche-de-mer Management Plan* in 2001, which aims to maximize the long-term economic benefits from the fishery while ensuring resource and environmental sustainability. Factors that contribute to management problems include the remoteness of fishers and the limited human and financial resources of provincial fisheries offices. Moreover, export volumes continue to rise as fishers are collecting large quantities of low-value species.

Source: Kinch *et al.* (2008)

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 (2009), the Pacific Islands region annually exports a million ornamental fish and coral pieces and 700 tonnes of live rock, worth US$59 million. Collection operations have been established in most Pacific Island countries in the past 40 years (Table 6). ADB (2009) shows that aquarium products are one of the major fishery export items in several countries: Cook Islands, Fiji, Kiribati, Marshall Islands, Palau, Solomon Islands, Tonga, and Vanuatu.

Table 6: Pacific Island aquarium export companies and participation, 2008

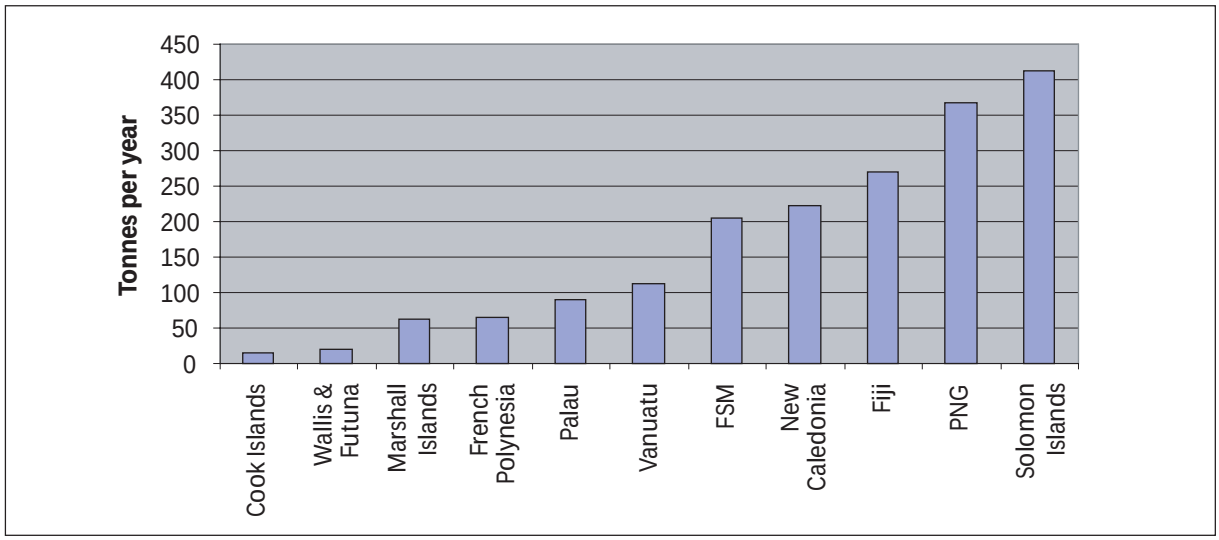
	Number of companies	Estimated No. of households involved
Cook Islands	1	10
FSM	1	20
Fiji	5	600
Kiribati	12	100
RMI	5	50
Palau	1	30
PNG	1	50
Solomon Islands	2	250
Tonga	3	100
Vanuatu	3	100

Source: Kinch and Tietlebaum (2009)

Trochus: *Trochus niloticus* 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 the 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 metric tonnes, with five Pacific Island countries providing most of the harvest (Figure 5). The combined Pacific Islands area is a significant producer of trochus – 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 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.

Trochus niloticus



Source: Gillett (2008b)

Figure 5: Annual trochus harvests in the Pacific Islands region

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. A variety of techniques/gears are used in live reef food fish fishing. The major exporter in the region is PNG, with sporadic fishing operations in Palau, Solomon Islands, Fiji, and Kiribati. Box 3 gives the main methods used in PNG.

Box 3: Live reef food fishing in PNG

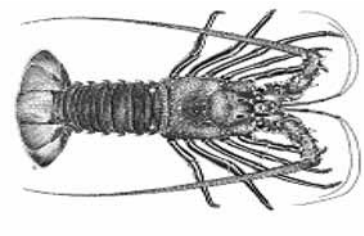
Two methods are used legally to catch live reef food fish in Papua New Guinea: hand lines and traps. For the latter, the choice of bait and fishing time depends on the species targeted. The traps are mainly rectangular or arrowhead in design with a frame of steel or mangrove, covered with chicken wire. 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 sea water 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 and 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)

It is difficult to determine the quantities of live reef food fish harvested and exported from the Pacific Islands region. Gillett (2008b) estimated 1 500 mt, based on the region having five percent of the Asia-Pacific trade of 30 000 mt cited in Sadovy *et al.* (2003). Although there is considerable interest in several countries developing this lucrative fishery, there have been numerous problems in the past with the use of cyanide and the unsustainable targeting of fish spawning aggregations.

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 PNG 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 PNG, unpublished data).



Panulirus penicillatus

Smaller lobster fisheries, based mainly on the double-spined lobster (*Panulirus penicillatus*), take place in many Pacific Island countries. The most common fishing method is by 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). In fact, the history of Pacific Island fisheries is littered with a very large number of failed lobster export operations.

Nearshore pelagics: Trolling for tuna and other large pelagics just outside the reef is practiced in most Pacific Island countries. Table 3 above shows that about five percent of the coastal catch in the region consists of tunas and mackerels. Alternatively, Gillett (2005b) estimated about 19 000 tonnes of tuna are caught annually in the region by "very small-scale tuna fishing". PNG, Kiribati, and Fiji are likely to have the largest production from coastal trolling. The use of fish aggregation devices (FADs) increases catches and reduces operating costs.

Sport gamefishing: This is a specialized form of small-scale commercial fishing which is growing in importance in the region. Table 7 estimates the number of sport gamefishing vessels in the region. The target species range from large coastal pelagics to bonefish. Sport fishermen, especially tourists, spend money on vessel charter, accommodation, provisions and shore-side recreation. Another aspect of this fishing is the international tournaments held annually in most countries of the region.

Table 7: Gamefishing charter boats in Pacific Island countries

	Gamefishing charter boats: numbers and locations
Cook Islands	9 boats working from Rarotonga and 5 from Aitutaki.
FSM	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.
PNG	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 operation out of Vava'u.
Tuvalu	Nil at present.
Vanuatu	Around 9 charter boats, 7 at Port Vila and 2 at Santo.

Source: Chapman (2004)

Deepwater bottomfish: The target of deepwater bottomfishing in the Pacific Islands is actually a number of fish species which inhabit reef slopes and shallow seamounts between 100 and 400 metres. In simple terms, fishing for deepwater 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 the various Pacific Island countries range from small open skiffs to vessels of 15 metres capable of making multi-day trips to offshore banks and seamounts. The most active export-oriented deepwater bottomfish fisheries in the Pacific Islands are presently in Fiji and Tonga. Other countries in the region have considerable potential but do not enjoy the convenient air freight connections to the lucrative markets. Information on the export quantities of deepwater bottomfish from Fiji is elusive. Industry sources suggest that Fiji has exported about 150 tonnes annually in recent years. Tonga's exports are slightly more. In the mid-1990s the Solomon Islands exported nearly 50 tonnes deepwater bottomfish annually. Table 8 indicates the most important species in Fiji. SPC has been involved in the promotion of deepwater bottomfish fishing for many decades. Their experience in developing, assessing, and managing these fisheries is well documented and available on their website (www.spc.int).

Table 8: Important deepwater bottomfish of Fiji

Scientific name	Common name	Export status
Etelis carbunculus	Ehu	Dominant
Etelis coruscans	Onaga	Dominant
Etelis radiosus	Smalltooth snapper	Probably included in Ehu exports
Pristipomoides multidens	Purplecheek opakapaka	This is the most common Fiji species and is well received on the export market
Pristipomoides flavipinnis	Yellow-finned opakapaka	An export species used in the whole deep fried market because of its smaller size.
Pristipomoides filamentosis	Opakapaka	The most desirable *Pristipomoides species.*
Pristipomoides zonatus	Gindai	A specialty Hawaii export species
Pristipomoides typus	Red tailed opakapaka	This species is not very common.
Aphareus rutilans	Lehi	Dominant
Wattsia mossambica	Large eye bream	Local Market
Paracaesio kusakarii	Bedford	Local market
Paracaesio stonei	Stone's snapper	Local Market
Lutjanus malabaricus	Rosi ni bogi	Occasional export to Hawaii
Epinephelus magniscuttis	Hapu	Exported
Epinephelus miliaris	Hapu	Exported
Epinephelus morrhua	Hapu	Exported
Epinephelus septemfasciatus	Hapu	Exported
Seriola rivoliana	Kahala	Not exported to Hawaii due to Ciguatera

Source: Stone (2003)

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 produce significant exports are the four trawl fisheries located in PNG. Characteristics of the PNG fishery are given in Gillett (2008c). 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 merguiensis*) and to a lesser extent, the giant tiger prawn (*Penaeus monodon*). Production from the PNG shrimp trawl industry has been variable over the past two decades. The maximum catch recorded from the fishery was 1 870 tonnes in 1979, but annual 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. Fisheries 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 (live fish trade to Asia). In some cases the benefits of export fisheries are concentrated into a few individuals, while the adverse side-effects may be experienced by many (e.g. the export of live coral). Information on the quantity of exported fishery products is often insufficient to gauge the benefits of the fishery or assess the sustainability.

Table 9 is an attempt to estimate the volume of exports from Pacific Island coastal fisheries.

Table 9: Exports from Pacific Island coastal fisheries

Commodity	Quantities	Country origin of exports	Source of information
Bêche-de-mer	1 500 tonnes (dried, equivalent to 15 000 tonnes live weight)	The major exporters are PNG, Solomons, Fiji, and New Caledonia.	SPC data
Trochus	2 300 tonnes of shell annually during the last decade	The major exporters are PNG, Solomons, FSM, Fiji, and New Caledonia.	Data from Gillett (2008c)
Deepwater bottomfish	350 tonnes annually in recent years	The major exporters are in Fiji and Tonga.	G. Southwick, D. Lucas, and B. Holden (per.com.); Wilson (2007)
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; Solomons is the major shell exporter.	SPC data; CITES data also available
Live reef food fish	1 500 tonnes	The major exporter is PNG, with sporadic operations in Palau, Solomons, Fiji, and Kiribati.	Estimate based on 5 percent of the Asia-Pacific trade of 30 000 mt cited in Sadovy *et al.* (2003)
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 PNG and Australia	National Fisheries Authority of PNG (unpublished data) and K. Friedman (per. com.)
Prawns	600 tonnes	All from PNG	Gillett (2008c) – using various primary sources.
Other	Considerably less 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.	

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 the rapidly-growing Asian economies. The coastal fisheries are also negatively affected by habitat degradation, which occurs from 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 (2008c) 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 to identifying specific indicators that can be used for long-term monitoring of the status of reef fisheries. 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 number of active fishers per unit reef area".

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 it should be noted there have been a multitude of other changes in management conditions, including:

- 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 effectiveness of the former systems of coastal resource management, especially near urban areas.

Although there is considerable variation between 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 starting using various forms of fisheries management measures, most typically through restrictions (gears, 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 began using marine protected areas (MPAs) as management tools. A decade later the concept of community-based MPAs gained momentum. Research by R. Johannes led to the book "Words of the Lagoon" (Johannes 1981) and 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 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

The management of coastal fishery resources in many Pacific Island countries is a mixture of several systems:

- Traditional management. This is most prevalent in rural areas and characteristically involves village leaders restricting the fishing by those outside the community and by various controls on fishing by community members.
- Central government management. All Pacific Island countries have a fisheries law giving wide powers to the government fisheries agency in controlling fishing activity. For various reasons, the system is mostly ineffective, with the situation in Tonga (Box 4) being an example. There is some degree of success, however, in central governments applying point of export restrictions on those coastal resources which are exported.
- The use of marine protected areas (MPAs) and similar arrangements whereby communities, with varying degrees of outside assistance, establish an area which is closed to fishing or is subjected to reduced fishing pressure.

Box 4: Difficulties with coastal fisheries management in Tonga

Coastal fisheries management in Tonga is attempted on a centralized basis. Fisheries legislation is enacted in the capital. Similarly, the management section in the Ministry of fisheries and all of the section's staff is located in the capital. For budgetary and other reasons, these staff are rarely able to travel to other island groups in Tonga. In reality, fisheries laws made in the capital have little effect on the situation in the outer islands and remote villages where there is frequently no authorized enforcement officer or even knowledge of the fisheries laws. In urban areas there are also problems with the nature of fisheries laws. Although the legislation is reasonably comprehensive, enforcement and prosecution can be impractical in the context of Tongan society where lack of social friction is important. For example, in the past three years, despite no shortage of illegal activity, there has been only one successful prosecution for a fisheries offense, and that involved two non-Tongans.

Source: Petelo *et al.* (1995)

It is ironic that, although the fisheries that produce export products should be relatively easy to manage, this is not often the case. The SPC sees an opportunity to improve the situation (Box 5).

Current coastal fishery management measures (both centrally-administered and community-driven) tend to be non-quantitative and are intended to protect stocks in a generalized way (Preston 2008). These 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.

Box 5: SPC's approach to improving invertebrate export fisheries

Bêche-de-mer and mother-of-pearl fisheries are not new. These products have been commercially exported from the Pacific Islands for over a century. The products from these fisheries are simple to process, non-perishable and the trade pumps significant amounts of cash directly into rural coastal communities, which have few alternative sources of income. Pacific Island countries and territories are significant market suppliers of these high-value products, e.g. Papua New Guinea alone supplies 10 percent of the world's bêche-de-mer market (annual value US$11.5 million), and Fiji, Solomon Islands and PNG between them have produced more than 50 000 tonnes of trochus shell since World War II (total value over US$200 million). However, these resources are chronically overfished, and would yield much greater income if they were more actively managed. The costs of conventional management (such as the management applied to tuna fisheries) would be unrealistic, but there are unique aspects to these fisheries that a more regional approach can take advantage of. One of the most favourable factors is that these are not food security fisheries, and thus harvesting can occur in "pulses" that can take advantage of optimum markets. And because these are export fisheries there are highly-controllable bottlenecks in the supply chain, yet at the same time the harvesting side is amenable to community rights-based management. With a little cooperation and active attention it should be possible to, relatively quickly, turn around the least productive fisheries in the region into models of sustainability.

Source: SPC (2008c)

Some management measures are ongoing, such as a minimum size for trochus or bêche-de-mer, while others require a "trigger". Examples of the latter are total catches of bêche-de-mer falling to a low level, initiating a complete ban on bêche-de-mer fishing. Other triggers for management action are low abundance of the target species as noted by fishery-independent field survey (giant clams in several countries), the discovery of illegal activity (the use of cyanide by live fish operations), complaints by villagers (scuba spearfishing at night), and falling catch per unit effort (Tonga deepwater bottomfishery).

Many current management measures are in support of biological objectives. This is 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.

Recent developments

The Pacific Islands have experienced a remarkable proliferation of marine protected areas 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. In fact, a survey of 15 independent countries and territories in the south of the Pacific Islands region showed that over 500 communities have established these protected areas, which cover over 12 000 sq km (Govan 2009).

The Pacific Islands Forum is a meeting of the heads of state and government of the Pacific Island countries plus Australia and New Zealand. The 37th Forum meeting took place in Tonga in mid-October 2007. The report of that meeting gave special and unprecedented prominence to fisheries and adopted the Vava'u Declaration on Pacific Fisheries Resources. The Declaration asserts the importance of fisheries to the economies of Pacific Island countries and calls for *inter alia* additional attention to be focused on the management of coastal/inshore fisheries to support food security, sustainable livelihoods and economic growth for current and future generations of Pacific people.

To meet the expectation of Pacific Islands leaders under the Vava'u Declaration, the Pacific Islands Regional Coastal Fisheries Management Policy, known as the Apia Policy, was developed by 18 Pacific Island countries and territories during the special session of the SPC Heads of Fisheries held in Apia in February 2008. The implementation of the strategic actions under the regional policy is guided by six principles, considered to be essential for successful management of coastal fisheries and its environment. These principles are:

1. Improving our understanding of important fisheries species and of the ecosystems on which they depend.
2. Sustainably managing coastal fisheries, reducing their adverse impacts on coastal ecosystems and optimising production to meet local nutritional needs and contribute to economic development.
3. Creating community partnerships to support the customary and traditional management of nearby ecosystems and fish stocks.
4. Creating stakeholder collaborations to manage ecosystems and reduce the negative environmental impacts of non-fisheries activities, including those causing high loads of silt and nutrients in coastal waters.
5. Promoting the participation of women and youth in all fisheries-related activities.
6. Enhancing the regional exchange and sharing of information regarding common interests relating to the management of ecosystems and fisheries.

There has been considerable amount of recent activity associated with applying the ecosystem approach to fisheries management (EAFM) to coastal fisheries in the region:

- The Vava'u Declaration commits leaders to *"the development and management of coastal/ inshore fisheries and aquaculture to support food security, sustainable livelihoods and economic growth* and *to maximize sustainable returns from fisheries by developing an ecosystem based management planning framework…."*
- The goal of the SPC's Coastal Fisheries Programme, as stated in its Strategic Plan 2007-2009, is *"to assist SPC members in their commitment to implement the Ecosystem Approach to Coastal Fisheries and Aquaculture by 2010."*

Preston (2008) reviews the current EAFM situation 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 states that few, if any, Pacific Island countries have enacted legislation or declared policies that commit them to implementation of the EAFM. Despite this, however, many countries have implemented fisheries management measures that are compliant with the EAFM, and which 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 marine protected areas 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 are already encouraging adoption of the EAFM, and are able to provide support and assistance in its implementation.

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 that 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 6 summarizes the results.

Box 6: Livelihood diversification as a marine resource management tool

Four main types of activities have been promoted in the region to reduce fishing pressure as alternatives to inshore fishing: 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 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.* (2009)

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 a rapidly expanding population coupled with a coastal fisheries production that is not increasing. Table 10 lists historical estimates of coastal fisheries production and population for the independent countries and the territories combined. The data for the various periods is not strictly comparable (i.e. different methodologies and rigor associated with the estimates) and there are complicating factors (large inland population in PNG, freshwater fisheries production), but the basic concept is valid: a stagnant or decreasing amount of food and employment from coastal fishing is being spread among a growing number of people. Because the Pacific Islands region is so highly dependent on coastal fisheries for food and employment, this is a major concern.

Table 10: Annual production from coastal fisheries

Source	Period	Coastal fisheries production (t)	Population of region	Per capita fish supply from coastal fisheries (kg)
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 and Adams (1994)	Early 1990s	108 242	6 068 000	17.8
ADB (2009)	2007	154 722	9 315 395	16.6

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 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 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 being guardians of marine resources.

Another important issue in the management of coastal fishery resources is pointed out by Birkeland (1997). 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 fishermen 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 dollar value of reef resources overrides management policies, traditional practice, and Law.

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 7). Significant changes can be expected in the availability and relative abundance of the fish and invertebrates that currently support coastal fisheries in the Pacific (Bell 2009).

Box 7: 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 300 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 has occurred in Fiji in 2006 and in 2009.

Source: Lovell (2009)

The number of non-government organizations (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 Worldwide 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 is 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 (i.e. displacing of functions). 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 catalyse more comprehensive action on the part of government fisheries agencies. In any case, there is a real need for coordinating the activities of NGOs and government fisheries agencies.

SPC (2008b) points out an issue that is growing in importance in many Pacific Island countries: "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".

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 8).

Box 8: The OFP

SPC's Oceanic Fisheries Programme, 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. The ongoing expenses of the Programme are currently funded by extra-budgetary contributions from Australia, France, and New Zealand, and a contribution from the SPC core budget. Specific projects during the past five years have been funded by numerous donors. The OFP mission is "to provide member countries with the scientific information and advice necessary to rationally manage fisheries exploiting the region's resources of tuna, billfish and related species". The OFP has three sections, each headed by a principal-level officer: Statistics and Monitoring, Tuna Ecology and Biology, Stock Assessment and Modelling, with common functions (reporting and liaison, information technology/computer support) supported by a small administrative section.

Source: SPC website (www.spc.int)

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

- *An SPC policy brief titled Tuna Fisheries and Their Impacts in the Western and Central Pacific Ocean.* This short document gives a good overview of tuna resources in the region and their management.
- *Western and Central Pacific Tuna Bulletin.* The Bulletin presents tables of monthly catch rates for selected longline, pole-and-line and purse-seine fleets operating in the WCPFC statistical area. Maps of catches, plots of catch rates and histograms of annual catches are also presented. The Tuna Bulletin is prepared by the OFP under contract to the Western and Central Pacific Fisheries Commission (WCPFC).
- *WCPFC Tuna Fishery Yearbook:* The Yearbook presents annual catch estimates in the WCPFC Statistical Area from 1950 onwards. The tables of catch statistics cover the four main commercial species caught in the region. The Yearbook is prepared by the OFP under contract to the WCPFC.
- *A 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 modeling, exploitation/movement of tuna, and the pelagic ecosystem in the region.

– *Papers prepared by OFP for the WCPFC Scientific Committee:* Examples from the 2008 meeting are: Stock Assessment of Bigeye Tuna in the Western and Central Pacific Ocean (Langley *et al.* 2008); and Overview of Tuna Fisheries in the Western and Central Pacific Ocean (Williams and Terawasi 2008).

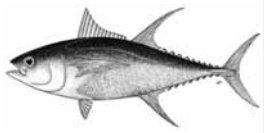
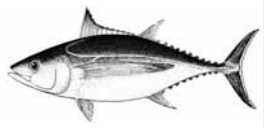
A very large amount of documentation on the tuna resources of the region is presented by various agencies to meetings of the WCPFC, especially the Scientific Committee. For the August 2008 meeting, over one hundred technical documents on national and regional aspects of tuna resources and their management were given.

Other agencies that have provided a substantial amount of useful information on offshore resources of the region are the Pelagic Fisheries Research Programme 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, and Japan's National Research Institute of Far Seas Fisheries.

Important offshore resources

Although several species of scombrids are found in the Pacific Islands area, four species of tuna are of major commercial importance: skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), bigeye tuna (*T. obesus*), albacore tuna (*T. alalunga*). Table 11 gives information on these fish in the western and central Pacific Ocean (WCPO).

Table 11: The 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.

Another important target of offshore fishing is swordfish (*Xiphias gladius*). This is caught by relatively shallow longline gear mainly in the sub-tropical parts of the WCPO.

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 platypterus*), 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.*).

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 is 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 Palau 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 the highest level of 33 000 metric tonnes in 1937. All commercial tuna fishing in the area came to a halt during World War II.

Box 9: The 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 unfavourable 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 during the early 1980s. The US purse seine fleet 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 the mid-2000s nearly 200 tuna purse seiners from 18 countries operated in the Pacific Islands region.

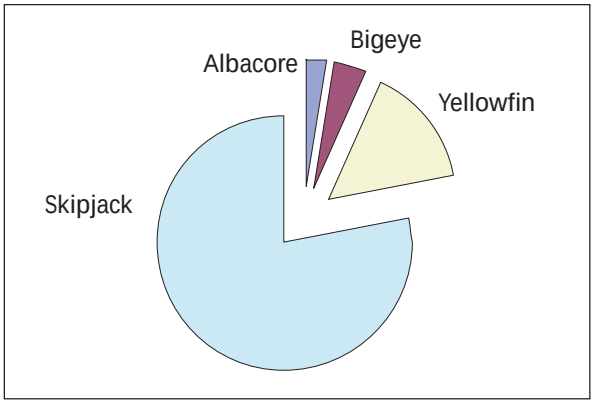
Source: Gillett (2007)

Tuna fishing activity in post WW II Micronesia was remarkably different. 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 Islands area. Between the early 1950s and the early 1960s, tuna longline bases were established in Pago Pago (American Samoa), 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 Islands 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 9 gives an account of that process.

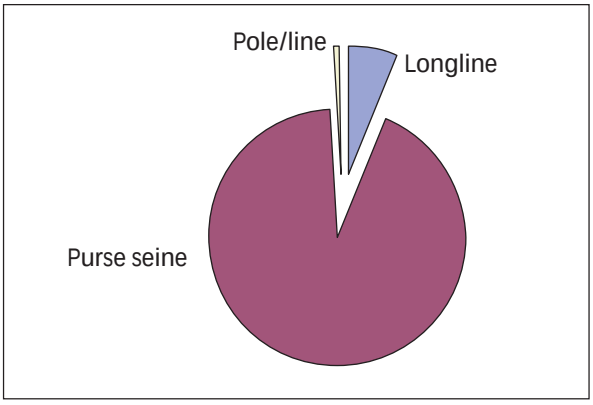
Current situation in the Pacific Islands area

In 2007 about 1 080 000 tonnes of tuna was caught in the exclusive economic zones (EEZs) of Pacific Island countries. Figure 6 gives the breakdown by species, and Figure 7 by capture method. Figure 8 gives the main types of industrial tuna fishing currently used in the region.



Source: FFA/SPC unpublished data

Figure 6: Composition of the tuna catch in the EEZs of Pacific Island countries



Source: FFA/SPC unpublished data

Figure 7: Capture method of tuna catch in the EEZs of Pacific Island countries

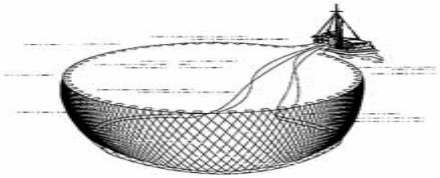
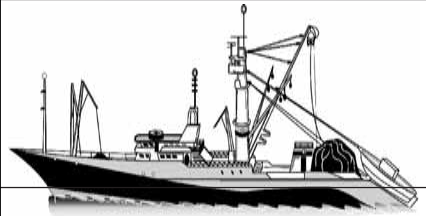
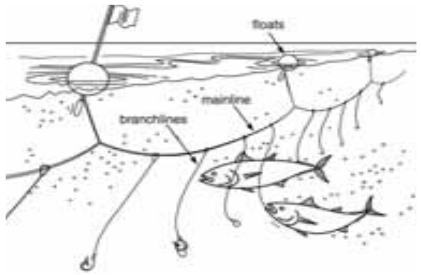
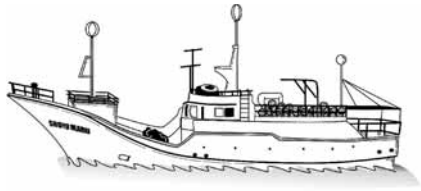
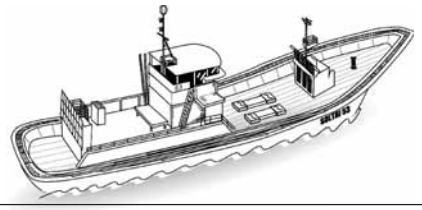
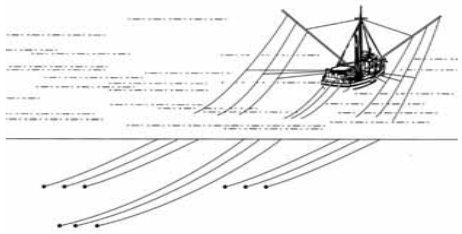
The above catches are made by both tuna vessels based in Pacific Island countries and those based outside the region. Table 12 partitions the offshore catch by country and by basing category. This is shown graphically in Figure 9. It can be seen that almost 70 percent of the offshore catch in the EEZs of Pacific Island countries is made by vessels based outside the region. Vessels in PNG are responsible for about two-thirds of the catch made by locally-based vessels.

Table 12: Volume of fisheries production, 2007 (mt)

	Offshore locally-based	Offshore foreign-based	Total
PNG	256 397	327 471	583 868
Kiribati	0	163 215	163 215
FSM	16 222	143 315	159 537
Solomon Is.	23 619	98 023	121 642
Marshall Is.	63 569	12 727	76 296
Nauru	0	69 236	69 236
Tuvalu	0	35 541	35 541
Fiji	13 744	492	14 236
Vanuatu	0	12 858	12 858
Palau	3 030	1 464	4 494
Cook Is.	3 939	0	3 939
Samoa	3 755	25	3 780
Tonga	1 119	0	1 119
Niue	640	0	640

Source: Table 2

Figure 8: Industrial tuna fishing in the region

Gear type	Catch	Typical vessel	Notes
Purse seine			
	Mainly skipjack and small yellowfin are caught by purse seine gear. Most catch is for canning.		About 72 percent of the tuna catch in the WCPO region is by purse seine gear. Most of the purse seine catch is taken within 5º of the equator.
Longline			
	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.		About 10 percent of the tuna catch in the WCPO 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.
Pole-and-line			
	Mainly skipjack and small yellowfin are caught by pole-and-line gear. Most catch is for canning or producing a dried product.		About 10 percent of the tuna catch in the WCPO 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. Most of the catch by this gear is made in Asian waters.
Trolling			
	Large-scale trolling targets albacore for canning.		Gear types other than the three listed above are responsible for about 10 percent of tuna catch in the WCPO. Large-scale trolling is an important part of this. It is carried out in the cool water to the south and north of the Pacific Islands region.

Source: Gillett and Bromhead (2008)

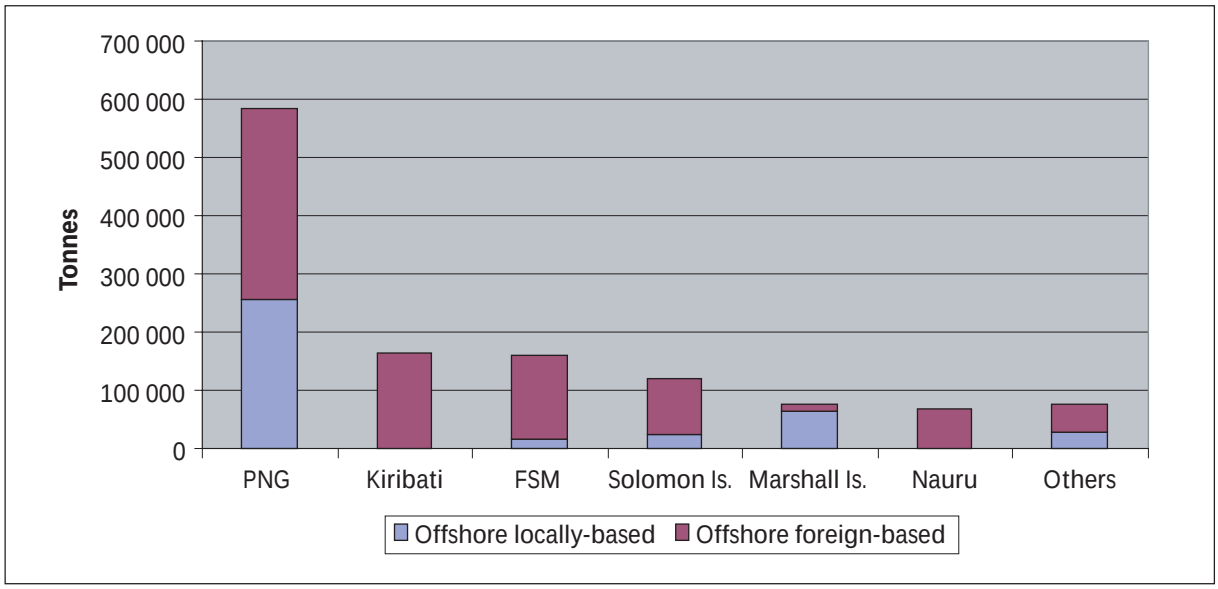


Figure 9: Volume of fisheries production

The WCPFC area catches

The above catch information is for the independent Pacific Island countries and their EEZs (Figure 1), which is a subset of the area covered by the Western and Central Pacific Fisheries Commission (Figure 10). 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 than that 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 level higher than that of an individual country) are now compiled/presented for the entire WCPFC area.

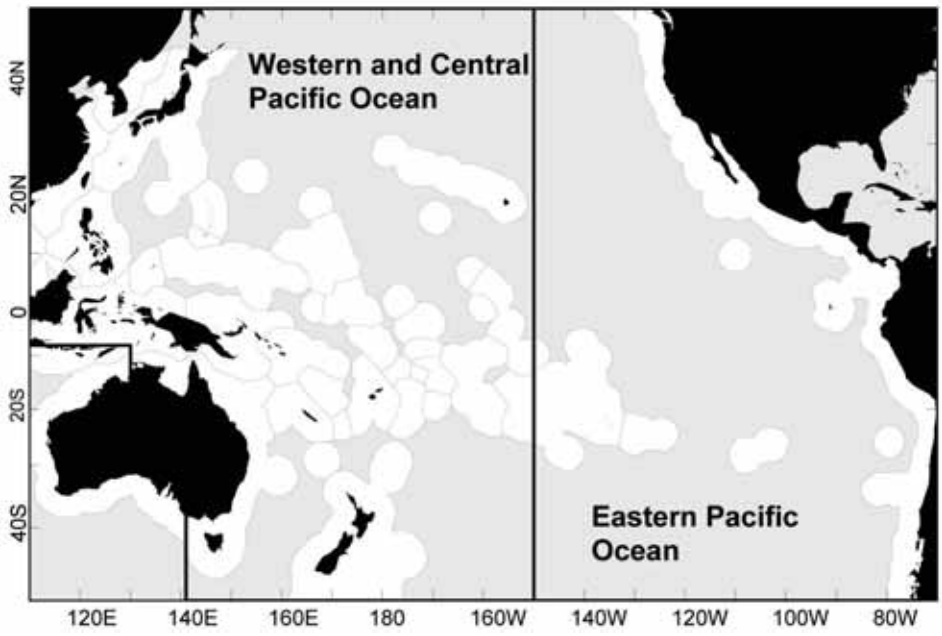
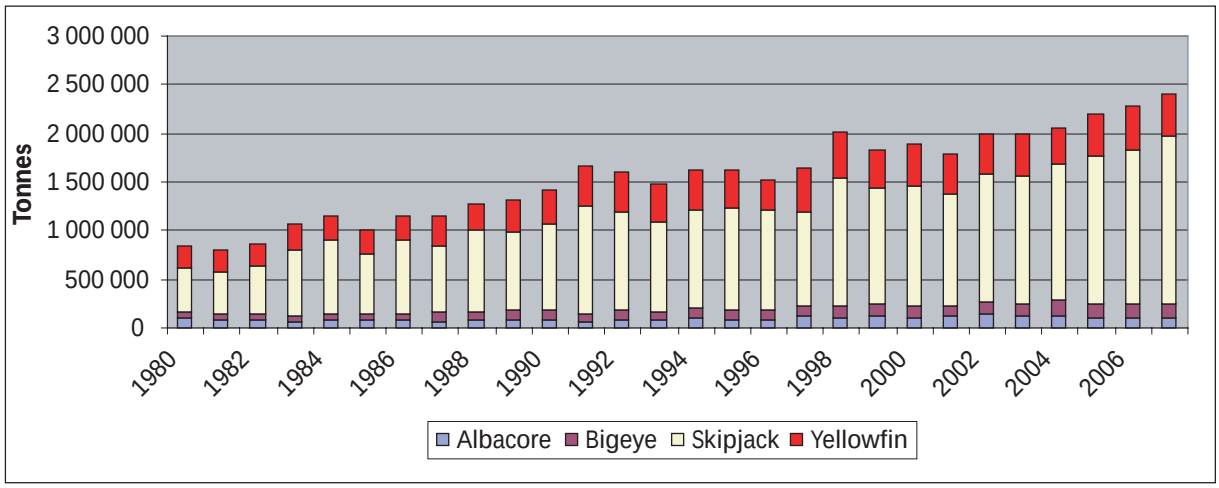


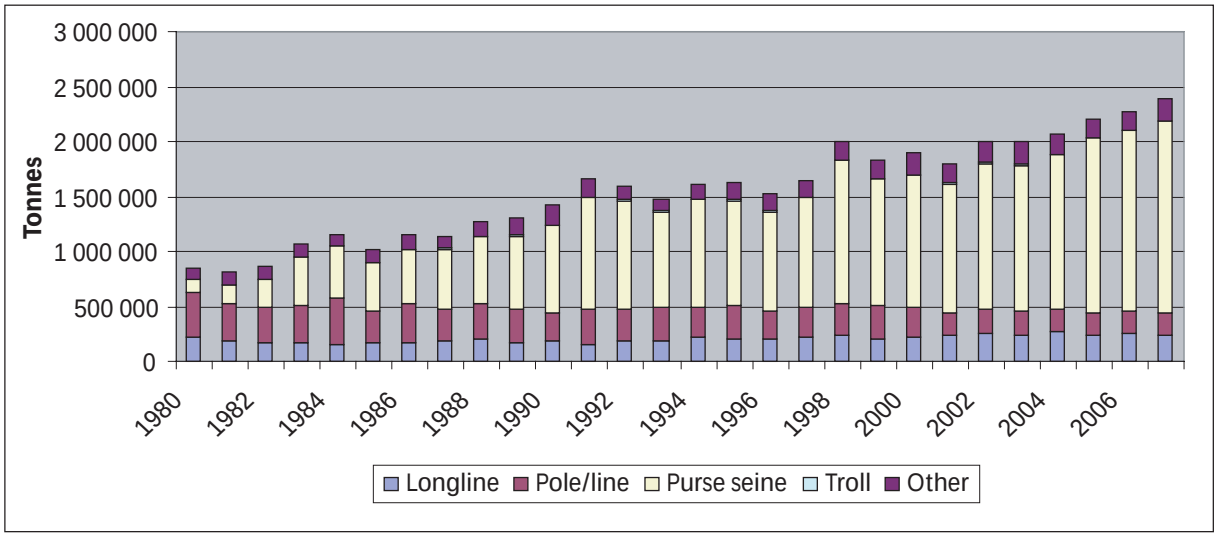
Figure 10: The WCPFC area

Information in OFP (2008) can be graphed to show trends over the past three decades in catch by species (Figure 11) and by gear type (Figure 12).



Source: OFP (2008)

Figure 11: WCPFC tuna catches by species



Source: OFP (2008)

Figure 12: WCPFC tuna catches by gear

From the above figures it can be seen that much of the tuna catch expansion 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 that skipjack catches, they are a source of more concern due to the relatively small size of the bigeye resource in the region.

Williams and Terawasi (2008) comment on the 2007 tuna catches in the WCPFC area:

- The provisional total WCPFC area tuna catch for 2007 was estimated at 2 396 815 mt, clearly the highest annual catch recorded, and more than 120 000 mt higher the previous record in 2006 (2 273 322 mt).
- During 2007, the purse seine fishery accounted for an estimated 1 739 859 mt (73 percent of the total catch, and a record for this fishery), with pole-and-line taking an estimated

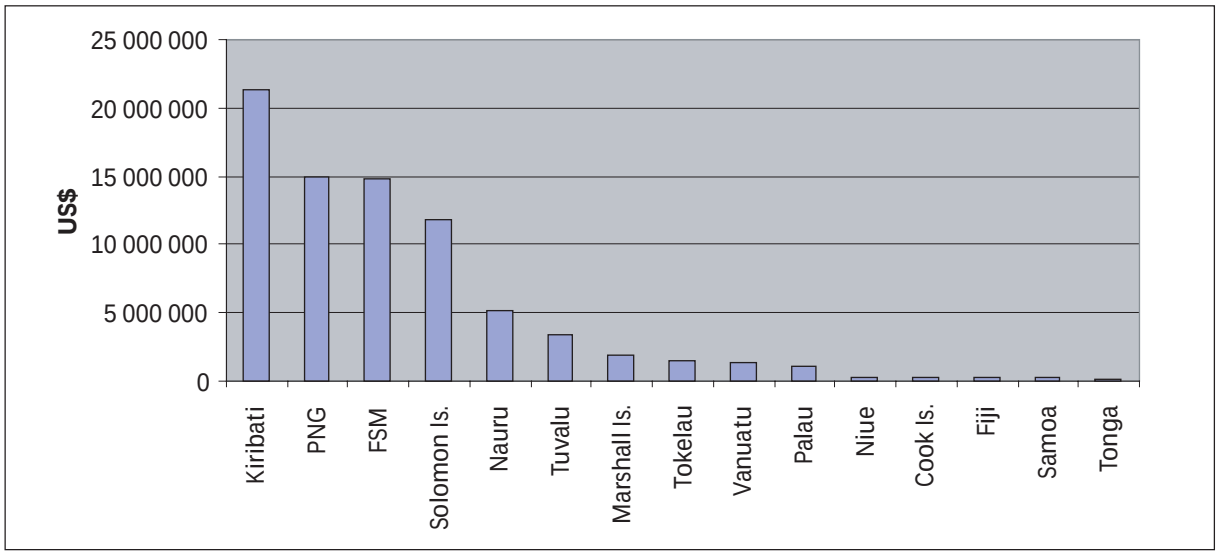
214 935 mt (9 percent), the longline fishery an estimated 232 388 mt (10 percent), and the remainder (8 percent) taken by troll gear and a variety of artisanal gears, mostly in eastern Indonesia and the Philippines.

– The WCPFC tuna catch (2 396 815 mt) for 2007 represented 84 percent of the total Pacific Ocean catch of 2 800 740 mt, and 55 percent of the global tuna catch.

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. ADB (2009) estimated that the total access fee payments for the countries of the region for 2007 were about US$77 million. Fees received by country are shown in Figure 13. In some countries the access fees form a very large portion of government revenue: Kiribati (42 percent of all government revenue in 2007), Nauru (17 percent), and Tuvalu (11 percent). It also is large relative to the population size: Nauru (US$518 per resident), Tuvalu ($355), and Kiribati ($288).



Source: ADB (2009)

Figure 13: Access fees paid by foreign tuna vessels, 2007

A small change in the level of access fees can make a large difference in payments. According to ADB (2009), the value of the 2007 tuna catch in the region by foreign based vessels was US$1.1 billion. A one percent increase in access fees as a proportion of the value of the offshore catch therefore represents an additional $11 million in access fees.

The locally-based offshore fishing vessels employ substantial numbers of Pacific Islanders. A study by the Forum Fisheries Agency (Gillett 2008a) estimated that in 2008 about 800 citizens of Pacific Island countries were employed on the 269 longliners and 56 purse seiners, and 2 pole/line vessels based in the region.

Status of the exploited offshore resources

The Oceanic Fisheries Programme of SPC 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. Formal resource assessments were carried out in 2008 on albacore, bigeye, and skipjack, while the last yellowfin assessment was in 2007.

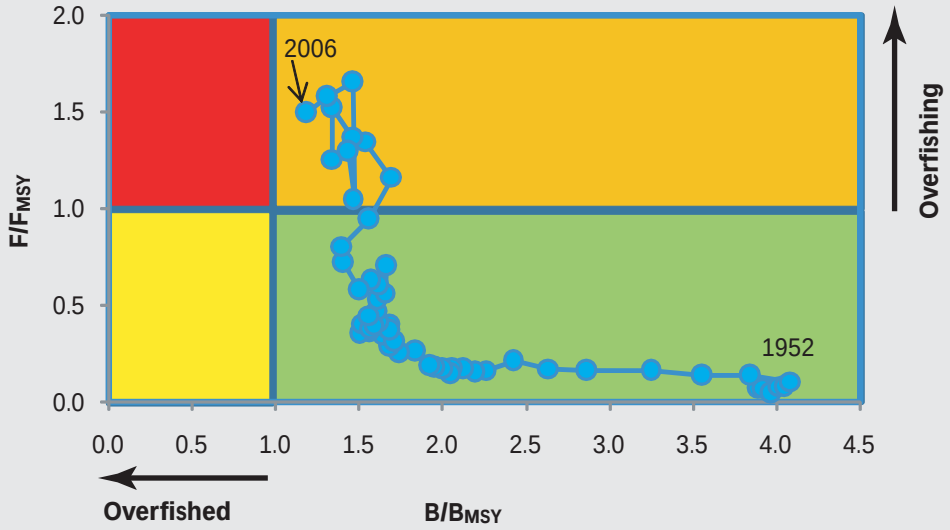
The results of the SPC stock assessments are presented in various documents and discussed/debated at the annual Scientific Committee of the WCPFC where conclusions are reached. WCPFC (2008) summarizes the conclusions on the assessments *and gives the advice of the Scientific Committee:*

> **Bigeye:** There is a very high probability that overfishing of bigeye tuna is occurring in the WCPO. While the stock is not yet in an overfished state with respect to total biomass, the situation is less optimistic with respect to adult biomass. Projections indicate that the stock will be overfished after 2013 with regards to both total biomass and spawning biomass. Recent catches are high relative to the estimated maximum sustainable yield (MSY), both because of high recent fishing mortality and because the stock has benefited from above-average recruitment over the past 15 years. *The Scientific Committee recommended a minimum 30 percent reduction in fishing mortality from the average levels for 2003-2006, with the goal of returning the fishing mortality rate to the rate at MSY. The reduction should occur throughout the WCPO from all major fishing types with priority in the western equatorial region.*
>
> **Yellowfin:** There is a small probability (6.2 percent) that the yellowfin stock is in an overfished state. The composite longline fishery is responsible for biomass depletion of about 10 percent in the WCPO during recent years and generally catches larger, older size classes, while purse-seine fisheries are responsible for a larger percentage of the impacts and generally the catch is smaller and younger fish. *In order to reduce the likelihood of overfishing, and if the WCPFC wishes to maintain average biomass at levels greater than 5 percent above the biomass at MSY, there should be reductions in the fishing mortality rate.*
>
> **Skipjack:** The major conclusions of the skipjack assessment are essentially unchanged from the last three assessments (2002, 2003 and 2005): overfishing is not occurring and the stock is not in an overfished state. There is an increasing trend in estimated recruitment throughout the entire time series of the fishery. This trend may reflect skipjack tunas' high productivity relative to other tuna species, as well as its position in the ecosystem. High recent catches are considered to be sustainable unless recruitment falls persistently below the long-term average. *Any increases in purse-seine catches of skipjack should be carefully monitored as they may result in a corresponding increase in fishing mortality for bigeye and yellowfin tunas.*
>
> **South Pacific albacore:** The recent assessment indicates lower levels of stock size and maximum sustainable yield than previous assessments. There is uncertainty regarding the sustainability of the South Pacific albacore stock. *Catches of South Pacific albacore should remain at current levels, considering the current rates of fishing mortality on adult albacore.*
>
> **Swordfish:** For swordfish in the ***southwest*** Pacific, overfishing is not occurring and the stock is not in an overfished state. The stock assessment attempted for swordfish in the ***south-central*** Pacific was unable to determine the current stock status – the available data do not indicate evidence of significant fishery impacts in the south-central Pacific, but catches have increased in recent years to levels exceeding those in the southwest Pacific. *There should be no further increase in catch or effort in order to keep the stock above its associated reference points.*

From the above it is obvious that the offshore fishery resource of the region that is the currently most threatened by fishing pressure is bigeye. Box 10 gives additional information on bigeye status from the latest SPC assessment.

Box 10: 2008 bigeye stock assessment by SPC

A detailed stock assessment for bigeye tuna was undertaken for the WCPFC in 2008. The assessment concluded that current exploitation levels were well above maximum safe levels, with almost certainty that overfishing is occurring. Significant reductions in fishing mortality are required to reduce the risk that the stock will be reduced to below the level that will support the maximum sustainable yield.



Temporal trend in annual stock status of bigeye tuna, relative to biomass (x-axis) and fishing mortality (y-axis) reference points, for the assessment model period (1952-2006). Current fishing mortality is well above the overfishing reference level, and biomass is approaching overfished conditions.

Source: SPC (2009b)

Management of offshore fishery resources

The management of the offshore fishery resources in the Pacific Islands area is complex and involves political, resource, and historical considerations. Current management occurs on the 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. In 1998 the Canada-South Pacific Oceans Development Programme cooperated with the Forum Fisheries Agency to produce a detailed tuna management plan (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 tuna management plans for FSM and Samoa respectively. FFA has continued with this process using its own staff, and has prepared tuna management plans for Tonga, the Marshall Islands, Niue, and Tokelau. Recently New Zealand has provided fisheries assistance that includes support for TMPs in the Cook Islands and in the Solomon Islands. Currently, all Pacific Island countries have prepared national tuna management plans, and most have been formally adopted.

Characteristically, the 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 the 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 11 gives the major elements of the "Plan for the Management of Tuna in the Federated States of Micronesia".

Box 11: The FSM tuna management plan

The Plan for the Management of Tuna in the FSM is a 53-page document with 13 sections, mostly based on management objectives but also including a section on implementation, monitoring and amendment. The plan gives three overall management objectives: ensure that the nation's tuna resources are used in a sustainable way; obtain maximum sustainable economic benefits from the nation's tuna resources; and promote economic security for the nation through the use of tuna resources. The plan gives six specific objectives:

- Ensure that the tuna catch does not exceed sustainable levels;
- Obtain national revenue from foreign fishing access agreements;
- Support development of FSM-owned and/or foreign FSM-based fishing enterprises;
- Encourage investment in enterprises related to tuna fisheries;
- Promote employment opportunities;
- Enhance international relationships beneficial to FSM.

The plan specifies mechanisms to be used to attain each objective.

Source: www.norma.fm

Experience gained in studying the formulation and implementation of tuna management plans in the region indicates that TMPs have had their successes and disappointments. On a different level, these plans have had a major positive effect on many of the countries of the region. Although the process has not always been smooth, there have been substantial benefits. The first experience of some countries at 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 the inshore fisheries.

Most Pacific Island countries are presently contemplating the modification of TMPs or formulation of entirely new plans.

Regional level management

There are a number of regional tuna fishery management arrangements in the Pacific Islands. All are promoted and coordinated by the Forum Fisheries Agency. The first measures, introduced in the 1980s and early 1990s were:

- In licensing foreign fishing vessels, countries agreed to insist on the Harmonised Minimum Terms and Conditions for Foreign Fishing Vessel Access (MTCs, Box 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.
- Reciprocal fisheries law enforcement as per the Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region
- Incentives to local-basing for industrial tuna vessels as per the Federated States of Micronesia Arrangement for Regional Fisheries Access

Box 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 EEZs of the 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 license 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 PIC 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.

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 licenses that can be issued by the seven Pacific Island countries 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) is used as the basis for management. In May 2004 a sub-set of FFA member countries decided to adopt such a scheme and it has subsequently been progressively implemented.

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.

International level management

In the mid-1990s, there was a growing awareness of the need for a tuna management agency that would cover an area larger than that encompassed by Pacific Island countries and which would include countries that have vessels fishing in the area, such as Japan and the US. 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 13 provides some details of the commission established by the convention.

The Commission, which has its secretariat headquarters in Pohnpei, has been operational for over five years and five annual meetings of the Commission have been held. There are subsidiary bodies of the WCPFC, including the Scientific Committee and the Technical and Compliance Committee which also have annual meetings.

Box 13: 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 sauries. 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 early 2009, participation in the Commission consisted of:

- Members: Australia, China, Canada, Cook Islands, European Community, Federated States of Micronesia, Fiji, France, Japan, Kiribati, Korea, Republic of Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Philippines, Samoa, Solomon Islands, Chinese Taipei, 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.
- Cooperating non-members: Belize, Indonesia, Senegal, Mexico, El Salvador.

Source: WCPFC Website

The Commission adopts "resolutions" which are non-binding statements and "conservation and management measures" (CCMs) which are binding. As of mid-2009 a total of 26 CCMs have come into force.[6]

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 to agree to management initiatives. Langley *et al.* (2009) chronicle the increasing concern over the last two decades about the condition of bigeye and yellowfin resources and the concurrent increase in fishing effort on these species. There is the view that the effectiveness of the Commission is being undermined by some DWFNs.

In the December 2008 Commission meeting a crucial CCM was adopted – which may increase the effectiveness of the WCPFC in its tuna management efforts. The objectives of that measure (CCM 2008-2006) are:

- The implementation of a package of measures which, over a three-year period commencing in 2009, results in a minimum of 30 percent reduction in bigeye tuna fishing mortality from the annual average during the period 2001-2004 or 2004;
- Ensuring that there is no increase in fishing mortality for yellowfin tuna beyond the annual average during the period 2001-2004 average or 2004; and
- Adoption of a package of measures that shall be reviewed annually and adjusted as necessary by the Commission, taking account of the scientific advice available at the time as well as the implementation of the measures.

Other resource management measures of the WCPFC deal with seabirds, swordfish, striped marlin, and sharks.

[6] Eight of the older CCMs have been replaced by more recent CCMs.

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 has an important role.

Some important issues relating to offshore fishery resources and their management

With respect to offshore fishery resources, without doubt the most important issue is over-exploitation of bigeye, and to a somewhat lesser degree, for yellowfin. The gravity of the situation is emphasized by the topic being taken up at the highest political level in the region. A recent meeting of the Pacific Islands Forum (heads of state/government) took the unprecedented step of making a declaration on the issue:

> "…Seized the scientific advice that overfishing of two key regional tuna species – bigeye and yellowfin tuna – now places stock levels in jeopardy,… We commit ourselves and our governments to the conservation and sustainable management of highly migratory tuna resources by:
>
> – Fully implementing without delay the conservation and management measures developed and endorsed by the Western and Central Pacific Fisheries Commission.
>
> – Seeking the urgent adoption of additional measures by the WCPFC to address overfishing of bigeye and yellowfin, including a reduction in longline catches and addressing purse seine fishing, and specific steps to reduce the catch of juvenile bigeye and yellowfin."

The reduction of fishing effort on bigeye/yellowfin raises some interesting management issues:

– Many distant water fishing nations are very reluctant to embrace more restrictive controls on effort and catch – which leads to the contention that effectiveness of the WCPFC is being undermined by some DWFNs.

– Reductions in bigeye/yellowfin mortality are possible through controls on purse seine fishing efforts and controls on longline fishing effort. These two types of measures are causing some degree of polarization between Pacific Island countries that receive substantial benefits from purse seining and countries (mainly those in the non-equatorial region) that are not involved with purse seining but rather have locally-based longliners.

– Although the skipjack resource holds the most potential for tuna catch expansion, Pacific Island countries have difficulty taking advantage of this because the only viable industrial harvesting technique is purse seining – which also catches yellowfin and (when fishing around FADs) bigeye.

Another important offshore resource issue concerns bycatch. The amounts and type of non-target species from tuna fishing in the Pacific Islands vary between the various fishing gear. SPC studies show that in the purse seine fishery, from 0.35 to 0.77 percent of the total catch from fishing on tuna schools not associated with floating objects is bycatch. For sets on tuna aggregating around floating objects, the level is higher at an estimated 3.0-7.3 percent. The most common bycatch species observed in floating object sets are amberjack (*Seriola rivoliana*), mackerel scad (*Decapterus macarellus*), rainbow runner (*Elagatis bipinnulata*), drummer (*Kyphosus cinerascens*), mahimahi (*Coryphaena hippurus*), and ocean triggerfish (*Canthidermis maculatus*). In the longline fishery, over 50 nontarget fish species have been observed in the catch in the tropical and subtropical waters of the WCPO. The SPC study had insufficient data to estimate relative quantities. The nontarget fish species can be categorized into shark (21 species), non-target tuna (7 species), billfish (6 species), and other fish (21 species). The blue shark (*Prionace glauca*) was observed as the most common shark species taken throughout the WCPO.

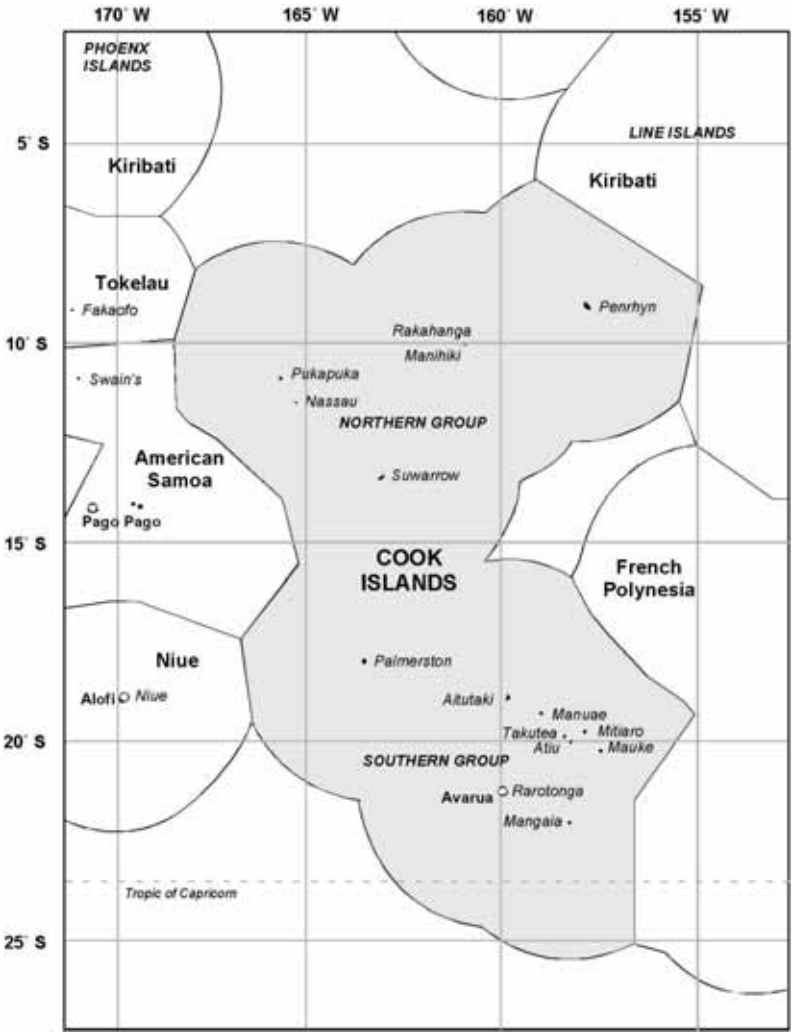
Many of the interesting issues associated with tuna bycatch are related to measures to reduce bycatch. These include gear/area restrictions, strategies for live release, and special measures for swordfish fishing. There is also the possibility of trade restrictions relating to bycatch by the major importing nations.

Other important offshore resource issues 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. Initial modelling indicates that the concentrations of skipjack and bigeye tuna are likely to be located further to the east than in the past. The simulations have yet to be done for yellowfin and albacore (Bell 2009).
- Recent stock assessment work shows that tuna fishing in Indonesia and the Philippines are having a large impact on the stocks in the WCPO region. SPC studies show that the Indonesian fishery is a large contributor to the depletion of WCPO yellowfin stock. Much of the tuna captured in Indonesia and the Philippines is taken with very small-scale gear, and consequently it is difficult to place controls on that type of fishing. Even if Pacific Island countries put considerable effort into establishing national and region tuna management, those regimes may be undermined by the unmanaged tuna fisheries in Indonesia and the Philippines.

National information on fisheries

COOK ISLANDS



1. GENERAL GEOGRAPHIC AND ECONOMIC DATA

Area	237 km^2	Population (2007)*	20 000
Water area	1 830 000 km^2	GDP at purchaser's value (2008)	225 676 000 USD[7]
Shelf area	[no continental shelf]	GDP per head (2008)	10 645 USD
Length of continental coastline	419 km (length of the coast of islands)	Agricultural GDP (2008)	17 172 000 USD[8]
		Fisheries GDP (2007)	3 318 000 USD[9]

*** source:** UN Population Division

[7] 2007 average exchange rate: US$1 – New Zealand $1.36; GDP source: A summary of the national accounts of the Cook Islands is given in Statistics Office (2008). Economic Statistics. Available at www.stats.gov.ck/Statistics/Economic. Staff of the Statistics Office kindly provided a disaggregation of the "agriculture and fishing" component, from which the fishing contribution to GDP can be determined.

[8] This is the official contribution of agriculture to GDP and does not include fishing.

[9] This is the official fishing contribution to GDP. A recalculation shows the total fishing contribution to be USD$2.9 million: Gillett (2009). The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories. Pacific Studies Series, Asian Development Bank, Manila.

2. FISHERIES DATA

2007	Production	Imports	Exports	Total supply	Per caput supply
	tonnes liveweight				kg/year
Fish for direct human consumption[10]	2 056	351	1 259	1 148	57.4
Fish for animal feed and other purposes	1 144	–	0	–	

Estimated employment (2001)	
(i) Primary sector (including aquaculture)	427[11]
(ii) Secondary sector	Unavailable
Gross value of fisheries output (2007)	10.3 million USD[12]
Trade (2007)	
Value of fisheries imports(*)	1.1 million USD
Value of fisheries exports(*)	2.2 million USD

(*) This amount does not include pearl, pearl shells and ornamental fish.

Cook Islands are an archipelagic state comprising 15 widely scattered islands with a total land area of 237 sq km, distributed in an EEZ of over 1.8 million sq km. 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, although with one or two atolls or semi-atolls.

3. FISHERY SECTOR STRUCTURE

3.1 Overall fishery sector

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

With respect to the current situation fisheries in the waters of the Cook Islands can be placed into six categories. These categories and the associated production in 2007 are:

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based[13]	Fresh-water	Aquaculture	
						Fishes (tonnes)	Pearls & giant clams pieces[14]
Volume of production (metric tonnes or pieces)	133	267	3 939	0	5	2	190 000
Value of production (USD)	1 029 412	1 250 000	5 772 059	0	36 765	2 235 294	

Source: Gillett (2009)

[10] Data from FAO food balance sheet of fish and fishery products.

[11] The Cook Islands 2001 Census of Population and Dwellings has a limited amount of information specifically on fisheries employment: Of the employed population recorded in the census (5 928 people), 427 (7.2 percent) indicated they were employed in "agriculture and fishing".

[12] From Gillett (2009); includes the six fishery production categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally-based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing, and (6) aquaculture.

[13] This is the catch in the Cook Islands zone by vessels based outside the country.

[14] Pearls and giant clams are commonly measured in pieces, rather than kg.

The main trends and important issues in the fisheries sector

The main trends in the sector include:

- Increasing exploitation of the coastal resources, especially those close to urban markets
- The total longline catch in the Cook Islands zone remaining steady in most of the 2000s, until 2008 when foreign license issuance was suspended and the catch dropped
- The Rarotonga-based longline fleet declining in numbers in recent years, with companies selling off boats and processing facilities
- Increasing pearl production in the mid-2000s
- The industrial troll fleet declining over the years, with only one vessel remaining
- Increasing attention by the government and NGOs to the quality of the inshore marine environment of Rarotonga
- Increasing use of traditional protected areas (ra'ui) as a fisheries management tool

Some of the major issues in the fisheries sector are:

- Labour for industrial-scale tuna fishing is scarce and considering population trends in the country, the labour pool is not likely to grow in the foreseeable future.
- Operating longliners out of Rarotonga is very expensive, relative to other locations in the Pacific Islands region.
- The country has had a dynamic pearl culture industry but is now facing a situation of expanded supply in the international markets and increasing competition with other countries.
- The rising fuel prices are having an increasing impact on motorized small-scale fishing activities.

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 longline vessels, and to a limited degree by purse seine vessels registered in the USA.
- Coastal fishing is primarily carried out for subsistence purposes and for sales for local markets. In addition, there are some coastal fisheries that are export oriented: aquarium fish and trochus.

The longline fisheries that operate the vicinity of the Cook Islands EEZ are characterized by two sub-fleets (Anon 2009):[15]

- Vessels in the southern Cook Islands fishery, based out of Rarotonga are small-scale vessels, carrying out fresh fish operations to cater for domestic and international markets (NZ, Japan, USA). These vessels target tuna and swordfish. Bycatch species are sold at local markets.
- Vessels operating in the northern fishery are based out of Pago Pago, American Samoa and concentrate fishing activities in the northern zone of the Cook Islands EEZ, targeting albacore for canning.

The oceanographic features of the Cook Islands have important implications for tuna fishing. Bigelow (1997)[16] reviewed the oceanography of the Cook Islands EEZ, with the major points given in the box:

Coastal fishing is carried out for mainly subsistence purposes – except in those places where there are markets (i.e. Rarotonga and to a lesser extent, Aitutaki) or relatively easy access to those markets (e.g. Palmerston). Fishing is mostly conducted from small outboard-powered craft and canoes in the lagoons and along the outer reef edge. There are also important small-scale fisheries that occur further offshore: fishing for tuna around fish aggregation devices (FADs) and fishing for flyingfish at night using lights and dip-nets.

[15] Anon (2009). Cook Islands – National Fisheries Report. WCPFC-SC5-AR/CCM-04, Fifth Scientific Committee Meeting, Western and Central Pacific Fisheries Commission, Port Vila.

[16] Bigelow, K. (1997). Cook Islands National Fisheries Assessment. Oceanic Fisheries Programme, Secretariat of the Pacific Community, New Caledonia.

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-1 or 0.5 knots);
- The Cook Islands extend over a considerable north/south distance and the subsurface thermal structure indicates that longline catchability may vary across the area. In the northern area (5º-15ºS) the 15ºC isotherm is within 220m of the surface and the thermocline gradient is strong. In the southern area (15º-25ºS), the 15ºC 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 subsurface 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 are relatively low compared to high islands within the south Pacific.

3.2.1 Marine catch profile

The catches made by Cook Island offshore vessels are (*):

	2004	2005	2006	2007	2008	2009
Longline catch (tonnes)	3 163	3 318	2 868	3 324	2 890	2 098
Troll catch (tonnes)	293	37	120	47	–	–
Total catch (tonnes)	3 456	3 355	2 988	3 371	2 890	2 098

(*) **Source:** WCPFC Yearbook 2009

Using price information from a variety of sources, Gillett (2009) estimated the value of the 2007 tuna catch to be USD$5.8 million.

Unpublished US/NMFS public domain data shows the catches made by USA purse seine vessels in the waters of the Cook Islands averaged about 13 tonnes per year in the mid-2000s. The Cook Islands fall outside the normal fishing grounds of these seiners, but there are two features that tend to result in at least some US purse seine fishing in the Cook Islands: (1) During El Niño periods the purse seine fishery moves eastward from its focus in PNG and FSM, to Kiribati. Although Cook Islands is usually outside of even the area of El Niño fishing, some activity does occasionally occur within the Cook Islands EEZ; and (2) In the late 1990s the US began to make use of drifting fish aggregation devices (FADs). Many of the FADs were set in areas close to the US fleet base in Pago, even in non-El Niño periods. This tended to increase the effort and catch in the Cook Islands EEZ.

The two most significant recent sources of information on coastal fishery production in the country are:

- A study on the situation and outlook for Cook Islands Marine Resources 2007 (MMR 2008)[17]
- The Cook Islands household expenditure survey that was carried out in 2005-2006 (Statistics Office 2007)[18]

Estimates of coastal fisheries production derived from these two sources are similar – about 133 mt for coastal commercial fishing and 267 mt for coastal subsistence fishing. Most of this commercial

[17] MMR (2008). Situation and Outlook for Cook Islands Marine Resources 2007. Ministry of Marine Resource, Government of the Cook Islands, Rarotonga.

[18] Statistics Office (2007). Cook Islands Household Expenditure Survey (HES) 2005-2006.

production is from the Southern Group, while the subsistence production comes mainly from islands other than Rarotonga and Aitutaki.

MMR (2008) contains some information on specific coastal fisheries in 2007:

- *Fish Aggregating Device Fishery:* In Rarotonga, the annual average catch around FADs is between 8 and 12 metric tonnes, which include catch from both subsistence and recreational fishing. For the Northern outer islands, an average of 3 to 7 metric tonnes is caught annually year around the FADs as compared to the Southern outer islands that catch an average of 13 to 30 metric tonnes. It is estimated that the total catch for the Cook Islands FAD fishery averages around 20 to 50 metric tonnes of fish caught annually by subsistence and semi-commercial fishers.
- *Trochus Fishery:* In 2007, there was no commercial harvest of trochus in the Cook Islands. Aitutaki, Rarotonga and Penrhyn are currently the only fisheries with a large trochus population available for a commercial harvest. A recent survey of the trochus on Aitutaki estimated that around 30 percent of the current population (about 18 metric tonnes) in Aitutaki have reached the legal size for exploitation while around 6-8 metric tonnes is available for harvest in Rarotonga.
- *Parrotfish Fishery:* For parrotfish, about 24 metric tonnes (whole fish weight) was caught in 2006, which is the equivalent of around 16 metric tonnes of fish fillets. Total catch (whole fish) in 2007 fell to 18 metric tonnes, with supply restricted by the breakdown of the blast freezer and irregular shipping service to Palmerston Island.
- *Aquarium Fish Fishery:* Although data on aquarium fish in 2007 and over the last four years are not available, it is estimated that a minimum of 1 500 to 1 600 fish are caught annually.

3.2.2 Marine landing sites

In the Cook Islands the only developed port is a small harbour on Rarotonga. Penrhyn Island in the north has a rudimentary port with few facilities. Chapman (2001)[19] indicates that the existing port facility on Rarotonga, Avatiu Harbour, is very limited and becomes easily congested with shipping, visiting yachts and local fishing vessels.

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 small amount of tuna that are purse seined are also offloaded at Pago Pago.

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

3.2.3 Marine fishing production means

All domestic offshore tuna fishing in the Cook Islands involves longline gear:

- Longline vessels in the southern Cook Islands fishery, based out of Rarotonga are generally below 20 metres in length and use ice.
- Vessels fishing in the northern Cook Islands fishery are generally larger and have mechanical refrigeration for storing the catch.

The small amount of tuna purse seining that occurs in the Cook Islands zone is carried out by vessels from the USA. Those vessels are mainly 55 to 75 metres in length.

[19] Chapman, L. (2001). Tuna Fishery Development Strategy for the Cook Islands. Secretariat of the Pacific Community, Noumea.

Coastal fishing is often carried out by modern methods such as trolling off the reef, and closer inshore, gillnetting, cast netting, and underwater spear fishing. Reef gleaning is very important. MMR (2000)[20] contains some interesting 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; 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 fisherman has a small baited hook attached to a short length of line (15 to 30 centimetres) on a rod of about one metre. Fishermen 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 fisherman 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 method uses a two to five metre rod and is done either from boats or from the shore. Fishermen 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, titiara (trevally) or at night to catch ku (squirrelfish).

- *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. Fishermen 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 from shifting about with the swell and currents. The fisherman either waits or leaves the baited hook over night 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 flying fish. Ground-up bait and a weight (usually a rock) is 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 and 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 to 15 metres 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 closed to reef as possible to catch squirrelfish.

Much of the small-scale tuna fishing around Rarotonga, and to a lesser extent the other islands, is in conjunction with fish aggregation devices (FADs). Chapman (2001) stated that FADs form a large part of the small-scale tuna fishery in Rarotonga, especially in the tuna season. Fishermen rely on the FADs to hold tuna schools in set locations, allowing them to troll around the FADs to maximise their catch. In

[20] MMR (2000). Basic Information on the Marine Resources of the Cook Islands. Ministry of Marine Resources, Rarotonga, Cook Islands.

addition, mid-water fishing techniques are being used to further increase the catch of larger tunas from around the FADs. These mid-water fishing techniques allow fishermen to minimize their running costs while increasing their potential catch. The Cook Islands fishermen have become very reliant on the FADs as part of their regular fishing practice.

Flyingfish fishing is important in the Cook Islands – and the technique used is quite interesting. Gillett and Ianelli (1993)[21] contains an account of the fishery (box).

> 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 dip nets 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.

3.2.4 Main resources

WCPFC Yearbook 2009 indicates that in the 2009 longline fishery in the waters of the Cook Islands, the catch composition consisted of:

- Albacore 74.6 percent
- Bigeye 10.4 percent
- Yellowfin 8.6 percent
- Others 6.3 percent

Anon (2009) states that wahoo makes up almost 46 percent of reported non-target species catches, while mahi-mahi contributes to 11.5 percent of this catch. The shark group contributes to 30.7 percent and moonfish contributes 5.4 percent of total non-target species catches.

With respect to the coastal resources, many species of finfish and invertebrates are found in the inshore marine areas of the Cook Islands. According to Passfield (1999),[22] there are an estimated 200 species of algae, 600 species of fish, 390 species of molluscs, 200 species of crustacean, 70 species of echinoderms, and 120 corals. The most commonly exploited fish species in Rarotonga are surgeonfish, parrotfish, goatfish, squirrel fish, bulls-eyes, and small groupers.

[21] Gillett, R. and J. Ianelli (1993). Flyingfish. Chapter 7 In: A. Wright and L. Hill (ed.) Nearshore Marine Resources of the South Pacific: Information for Fisheries Development and Management. Forum Fisheries Agency, Institute of Pacific Studies, and International Centre for Ocean Development, pages 177-201.

[22] Passfield, K. (1999). Review of Living Marine Resources and Related Issues in the Cook Islands. Worldwide Fund for Nature.

FFA (1993)[23] gives the names of important "Lagoon and Reef" fin-fish as listed on the poster, "Seafoods of the Cook Islands". The English, scientific, and Cook Islands names are:

Milkfish	Chanos chanos	Ava
Bonefish	Albula neoguinaica	Kiokio
Queenfish	Scomberoides lysan	Rai
Garfish	Hyporhamphus dussumieri	I'e, tikoroto
Bigeye scad	Selar crumenophthalmus	Ature
Warty-lipped mullet	Crenimugil crenilabis	Kanae
Mackerel scad	Decapterus macarellus	Koperu
Yellowfinned goatfish	Mulloidichthys vanicolensis	Vete
Silver rabbitfish	Siganus argenteus	Morava
Unicornfish	Naso unicornis	Ume
Yellowfin surgeonfish	Acanthurus xanthopterus	Parangi
Black surgeonfish	Ctenochaetes striatus	Maito
Five-banded parrotfish	Scarus ghobban	U'u, pakati, pa'o
Napoleon wrasse	Cheilinus undulatus	Maratea
Topsail drummer	Kyphosus cinerascens	Pipi, nanue
Bigeye bream	Monotaxis grandoculis	Mu
Orange-emperor	Lethrinus kallopterus	Tamure
Red snapper	Lutjanus bohar	Anga-mea
Black-tipped cod	Epinephelus fasciatus	Atea
Marbled cod	E. microdon	Apuku
Brown cod	E. tauvina	Patuki
Peacock cod	Cephalopholis argus	Roi, patuki roi
Lunar-tailed cod	Variola louti	Oka
Squirrel fish	Myripristes berndti	Ku
Brown moray	Gymnothorax javanicus	A'a pata
Bullseye	Priacanthus sp.	Ku pa
Green triggerfish	Pseudobalistes flavimarginatus	Kokiri

FFA (1993) indicates that about 20 species of fish are important in the aquarium fish fishery. The flame angel (Centropyge loriculus) and red hawk (Neocirrhites armatus), are especially important due to their high value.

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

3.2.5 Management applied to main marine fisheries

General

According to the website of the Ministry of Marine Resources (MMR), living marine resources are regarded as common property in the Cook Islands. No individual has exclusive rights over them, and anyone in the community has a right to harvest these resources.

Management of the marine environment has been practised in the Cook Islands since the ancestors of the present Polynesian populations 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

[23] FFA (1993). Cook Islands Fisheries Resources Profiles. FFA Report No. 93/25, Forum Fisheries Agency, Honiara.

resources. Income from fisheries is becoming increasingly important, as people have come to rely on cash for purchasing imported foods and goods. More efficient fishing gear (such as gill nets) means that more fish can be caught in less time; and with storing facilities such as freezers, a surplus of fish can be had.

Offshore fisheries management

The offshore longline fishery of the Cook Islands is managed according to "The Longline Fishery Plan 2008". It only has 12 pages of text in 6 parts: preliminary information, consultative process, licensing committee, ecosystem considerations, conservation and management measures, and miscellaneous. Some of the important features of the Plan are:

- The stated objectives of the plan are: (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 large pelagic longline fishery, (c) to mitigate the impact of fishing on non-target species; (d) to develop and maintain the economic viability of the large pelagic longline 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 Cook Islands meets its international environmental and fisheries obligations, and position Cook Islands for equitable participation in the regional tuna fisheries; (f) to protect traditional and small-scale commercial inshore fishers; (g) to protect the integrity of government revenue, and (h) to fulfill the purposes and principles in the Act.
- Eight ways are given to achieve the objectives, including the licensing arrangements that encourage the landing, value adding and processing of fish in Cook Islands. The plan states that the measures involve a shift away from the dependence on demise charter[24] vessels that have characterised the tuna longline fishery since its rejuvenation in 2001. The plan proposes a "Domestic Tuna Fishery Development Facility" – from which grants or loans can be made available.
- The plan includes requirements for consultations with key stakeholders in the pelagic longline fishery at least once in each calendar year, the establishment of a Licensing Committee (after the number of applications reaches 40) to provide transparent advice on the granting of licences, and a review of the conservation and management measures each two years.
- The section on ecosystem considerations covers limits on effort, conservation of target species, protection of non-target species, and marine pollution.
- The conservation and management measures include vessel licensing requirements, licensing criteria, terms of licensing, and conditions of fishing.
- The plan was approved by cabinet in mid-2008. The "Marine Resources (Longline Fishery) Regulations 2008" was signed by the Queen's Representative on 27 August 2008.

In addition to national management of offshore fishery resources, the Cook Islands is involved with management across the Pacific Island region through membership in the Forum Fisheries Agency. Recently, a Polynesian fisheries subgroup within the FFA, Te Vaka Moana Arrangement, has been formed to strengthen fisheries cooperation in the eastern sub-region.

The Cook Islands is a member of the Western and Central Pacific Fisheries Commission that 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.

In February 2010 the Cook Islands signed the Convention on the Conservation and Management of High Seas Fishery Resources in the South Pacific Ocean. The treaty covers the Pacific Ocean south of the equator from West Australia to the West, and to the edge of the Exclusive Economic Zone (EEZ) of Chile and Peru to the East. Its objective is to protect non-tuna species from overfishing.

[24] Ship leasing arrangement in which the use of the entire vessel and all associated expenses pass on from the ship owner to the lessee (charterer).

Coastal fisheries management

In accordance with the Marine Resource Act 2005, a fishery can be declared a designated fishery if it is important to the national interest and requires management measures for ensuring sustainable use of the fishery resource. Formal management plans have been prepared for such important coastal fisheries, including those for parrotfish on Palmerston and for 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 Pacific Islands. In fact, a detailed case study to document the success of that fishery was undertaken by the Secretariat of the Pacific Community in the 1990s. Friedman and Pakoa (2007)[25] provide some details of that 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 millimetres. 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.

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 a 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. Tiraa (2006)[26] discusses a revival of the ra'ui system (Box).

The last marine ra'ui decreed by a traditional chief on Rarotonga was in the 1950s. The state of Rarotonga's marine environment — in particular the depletion of seafood resources found in the lagoon and on the reef slope — became a matter of considerable concern to the Koutu Nui (formalized group of traditional leaders) in the late 1980s and early 1990s. After a number of public meetings in 1997 relating to the development of a Tourism Master Plan, at which the public expressed concern about Rarotonga's marine resources, the Koutu Nui decided to attempt to reestablish the ra'ui system in some areas of the lagoon and reef slope.

A total of five areas were initially selected in which to implement the ra'ui. A series of consultations with stakeholders in these areas showed that there appeared to be sufficient support to give at least some chance of success and the ra'ui were declared in 1998.

There is no legal basis for the ra'ui. Rather they rely on respect for traditional authority. Any poaching is assumed to be dealt with by rebuke and community pressure. The main purpose of the ra'ui is to help protect the marine environment, and to contribute towards an increase in marine life for present and future generations.

The ra'ui appeared to meet with obvious success within a comparatively short time of 12 months. Surveys conducted at the beginning of the ra'ui and later by the Ministry of Marine Resources indicated an increase in abundance of marine life. Education and awareness activities were used to promote the ra'ui extensively during its early stages and support for it grew. This resulted in the number of ra'ui increasing to a maximum of 12.

[25] Kim Friedman and Kalo Pakoa (2007). Aitutaki and Palmerston Atoll, Cook Islands. Secretariat of the Pacific Community, Noumea.
[26] Tiraa, A. (2006). *Ra'ui* in the Cook Islands – today's context in Rarotonga. Traditional Marine Resource Management and Knowledge Information Bulletin #19, Secretariat of the Pacific Community, Noumea.

Management measures and institutional arrangements

In the Cook Islands the main institution involved with fishery management is the Ministry of Marine Resources. The role of this agency is covered in more detail in a section below.

3.2.6 Fishermen communities

The concept of "fishermen 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".

3.3 Inland sub-sector

The lack of large freshwater bodies in the Cook Islands results in the 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

The annual freshwater fishery production in the mid-2000s was estimated to be 5 tonnes, worth USD$36 765.

3.4 Recreational sub-sector

Chapman (2004)[27] gives information on commercial sport fishing vessels in the Cook Islands. Charter sport fishing commenced in Rarotonga in the early 1980s with one operator, expanding to three by the mid-1980s. The number of charter operators remained constant at three on Rarotonga until 1998-1999, when another 6 operators entered the charter fishing sector. On Aitutaki, there have been a constant number of charter operators from the early 1980s to the present, with these operators upgrading their boats from time to time.

3.5 Aquaculture sub-sector

The culture of black pearls is by far the most important aquaculture activity in the Cook Islands. Starting in the 1980s blacklip pearl oysters (Pinctada margaritifera) were cultured and seeded on Manihiki Islands to produce black pearls. By 1988 more than 40 pearl farms had been established there, and were successfully producing both half and whole pearls. In 2000 there were about 100 pearl farms on Manihiki (about 1.5 million adult oysters being cultured) and on Penrhyn about 100 farms (200 000 oysters cultured). There were 32 active farms in the Cook Islands in October 2008.

MMR (2008) summarizes recent pearl harvests. In 2005 just above 100 000 pearls were harvested and in 2006 the harvest was about 190 000 pearls. An estimated total of 186 725 pearl pieces were harvested in 2007, weighing around 280 kilograms, with 89 percent of the harvest from Manihiki and 11 percent from Rakahanga. The gross value of pearl harvest at the farm gate in 2007 was estimated to be USD$2.2 million.

Apart from pearl culture, aquaculture production in the Cook Islands is relatively small and limited to subsistence and semi-commercial production of tilapia, milkfish and clams. MMR (2008) provides a summary of the production in 2007:

- In 2007 a total of 36 000 tilapia fry were imported by the Ministry of Marine Resources for a trial with a fish farmer in Rarotonga. After eight months of grow-out period, the first harvest yielded an estimated total of around 8 400 tilapia with an average weight of about 160-250 grams per fish.

[27] Chapman, L. (2004). Nearshore Domestic Fisheries Development in Pacific Island Countries and Territories. Secretariat of the Pacific Community, Noumea.

– A total of 3 058 live giant clams were produced by the hatchery in 2007. Around 1 858 live juvenile clams were supplied for export to the aquarium trade, up from 320 juvenile clams in 2006. An additional 1 200 clams were also transferred to Rarotonga for the construction of coral gardens for tourists.
– A small amount of milkfish was harvested in 2007 from a research growth trial on Rarotonga.

The 2007 aquaculture production of the Cook Islands can be summarised as:

Product	Production	Value (USD$)
Pearl and pearl shell	186 725 pearls plus shell	2 200 000
Tilapia	1 680 kg	12 265
Giant clam	3 058 clams	7 645
Milkfish	not available	not available

4. POST-HARVEST USE

4.1 Fish utilization

The marketing and processing of the production of the small-scale fisheries in the Cook Islands is not well-developed. Although some of the production from small-scale fishers on Rarotonga, especially the 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. Very little fish and other seafoods taken in small-scale fisheries are exported.

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 both by government and by private entrepreneurs, but have met with only 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 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 the edible fishery products. Pearl oyster culture and trochus collecting is associated with elaborate marketing arrangements. The black pearls are sold both in Rarotonga and overseas. Trochus shells are sold 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 US market. As there is no market for bycatch in Pago Pago, most is discarded at sea. Any tuna caught by seiners (mostly skipjack) in Cook Islands waters is delivered to the canneries in Pago Pago.

The distribution channels for the tuna fishery in the south are more complex. The fresh tuna and other fish to be exported pass through processing facilities on Rarotonga. It is graded, packaged, chilled, and stored for export. The market destinations of longline fish are:[28]

[28] Source: Marurai, J. (2004). Cook Islands Tuna Fishery Report. 17th Meeting of the Standing Committee on Tuna and Billfish, Majuro Marshall Islands.

Country	Percentage of retained catch
USA	60
Japan	30
Australia	2
New Zealand	1
Local Rarotonga market	7

The catch bound for the USA is mainly the second-grade tuna, swordfish, and dolphinfish. The fish for Japan is the top-grade tuna and swordfish. Species and quality grades not suitable for export market are sold in Rarotonga. Most of them are consumed by the booming tourism industry.

4.2 Fish markets

On Rarotonga where the cash economy is well-developed there are both roadside sales of fish and sections of supermarkets and trade stores where local fish is sold. Some of the longliners sell tuna and bycatch directly to restaurants and hotels.

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

5. FISHERY SECTOR PERFORMANCE

5.1 Economic role of fisheries in the national economy

A recent study by the Asian Development Bank attempted to quantify the fishery-related benefits received by the Cook Islands. The study gave the available information on the contribution of fishing/ fisheries to GDP, exports, government revenue, and employment. The results can be summarized as:

- Official estimates show that fishing in 2007 was responsible for 6.3 percent of the GDP of the Cook Islands. A recalculation using a different methodology shows it was less that one-quarter of that amount.
- Exports of fishery products are about 79.4 percent of all export in 2007.
- Access fees paid by foreign fishing vessels represent 0.4 percent of all government revenue.
- The Cook Islands 2001 Census of Population and Dwellings indicated that 7.2 percent of the employed population indicated were employed in "agriculture and fishing".

From the above it can bee seen that fisheries make a relatively important contribution to GDP and exports.

5.2 Demand

The per capita consumption of fish in the Cook Islands, based on the 2007 FAO Food Balance Sheet, is 57.4 kg. Various other studies have made estimates ranging between 47.0 and 71.0 kg. Considering the Cook Islands population, 60 kg of fish consumption per capita translates into a 2010 demand for 940 tonnes of fish.

Factors influencing the future demand for fish are emigration, remittances from overseas, increase price of fish (over-exploitation of inshore areas, fuel cost increases), relative cost of fish substitutes, changes in dietary preferences, and outbreaks of ciguatera fish poisoning.

5.3 Supply

The government has several strategies to increase the national fish supply. These involve supporting the marketing of fishery products in Rarotonga from other parts of the country, deploying offshore fish aggregation devices, and promoting aquaculture.

Major factors affecting the local supply of fish are overfishing, transport links to the outer islands, cost of fuel, and the offloading of fish by the offshore fleet.

5.4 Trade

The fishery exports of the Cook Islands in 2006 and 2007 in thousands of USD$ were:

	2006	2007
Live fish	92	46
Fish fresh, chilled or frozen	692	2 301
Pearls	1 327	1 565
Pearl shells	2	204
Total fishery products	2 113	4 116
Total exports of Cook Islands	3 519	5 185
Percentage fishery product exports of total exports	60.0%	79.4%

Source: Statistics Office (2008); Units USD$ thousands

5.5 Food security

Fish is an important element of food security in the Cook Islands. The FAO Food Balance Sheets show that in 2007 fish contributed an average of 21.6 percent of all protein to the diet and 29.3 percent of animal protein. In rural areas of the country the contributions are much higher.

The outer islands are highly dependent of fish. As an example, Passfield (1997)[29] calculated the annual per capita consumption of fish in Tongareva Island as being 219.0 kg.

Animal protein substitutes for fish consist mainly of various types of imported meat, much of which are extremely fatty and have negative health implications.

5.6 Employment

Good data on employment related to fisheries are not ready available. The Cook Islands 2001 Census of Population and Dwellings has a limited amount of information specifically on fisheries employment. Of the employed population recorded in the census (5 928 people), 427 (7.2 percent) indicated they were employed in "agriculture and fishing". Of those people, 183 were on Rarotonga (Statistics Office 2003).

A study by the Forum Fisheries Agency[30] tracked the number of Cook Island citizens employed in tuna fishing and processing in the country over a seven-year period:

[29] Passfield, K. (1997). Valuing Coastal Marine Resources in the Pacific Islands: Case Studies of Verata, Fiji and Tongareva, Cook Islands. Thesis. University of the South Pacific, Suva

[30] Gillett, R. (2008). A Study of Tuna Industry Development Aspirations of FFA Member Countries. Forum Fisheries Agency, Honiara, 70 pages.

	2002	2006	2008
Local jobs on vessels	50	15	12
Local jobs inshore facilities	15	15	10
Total	**65**	**30**	**22**

From a broad perspective, the number of Cook Islanders working on the longliners is quite small, but a significant number of locals are now employed onshore. As the population of Cook Islanders is now in a decline and individuals can freely and cheaply move to what is perceived by many as greater opportunities in New Zealand, labour (especially skilled workers) is likely to more scarce in the future, resulting in a higher proportion of foreign workers in the fishing industry.

5.7 Rural development

According to the recent annual reports of the Ministry, 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 for 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; and,
- Developing new commercial fisheries, such as that for deepwater snappers.

In additional to staff based in relatively developed Rarotonga and Aitutaki, the Ministry of Marine Resources has people on Pukapuka, Manihiki, Aitutaki, Rakahanga, Penrhyn and Mitiaro.

6. FISHERY SECTOR DEVELOPMENT

6.1 Constraints and opportunities

Some of the major constraints of the fisheries sector are:

- 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 without the use of FADs – which are quite expensive.
- There are considerable difficulties associated with marketing fishery products from the remote areas where abundance is greatest to Rarotonga where the marketing opportunities are greatest.
- The high-cost of Cook Islands labour makes it difficult to compete internationally.
- The port facilities are extremely limited.

The opportunities in the fisheries sector include:

- Expansion of the longline fleet to take advantage of the diversity of fishing conditions provided by the large north/south expanse of the Cook Islands EEZ;
- The availability of swordfish in commercial quantities in the south of the national EEZ;
- Making use of the under-utilized fresh fish processing capacity; and
- A very efficient government fisheries agency with highly qualified/motivated staff.

A report by the Forum Fisheries Agency[31] summarized the opinions of the public and private sectors on opportunities in the Cook Island domestic tuna industry development as follows:

- The government fisheries agency aspires to raise the tuna longline catch from the present 2 000 to 3 000 tonnes to 6 000 tonnes within 10 years. In addition aspirations included a fully domesticated longline fleet owned by Cook Islands nationals, capability in on-board processing, a high degree of offloading in Rarotonga for subsequent overseas shipment, and access to EU markets.
- A major operator of longline vessels aspires to have a cautious expansion of the longline fleet in the future. He does not envision an expansion of processing capability.

6.2 Government and private sector policies and development strategies

The clearest indications of government strategies (and by inference, policies) in the fisheries sector are in the annual reports of the Ministry of Marine Resources. The 2007/2008 report indicates the following development strategies:

- Offshore Fisheries – Annual reviews of the tuna management plan, formulation of industry development strategies (e.g. establishment of new markets), economic feasibility studies, monitoring/surveillance systems, and development research on swordfish.
- Pearl Industry Support – Assistance to implement the Pearl Industry Development & Recovery Plan, implementation of revised grading standards, lagoon management plans monitored in terms of both farmer compliance and health of oysters, establishment of long term research programmes to improve pearl quality, encouraging new farms on Pukapuka/Palmerston, and a training programme to develop local seeding technicians.
- Aquaculture – Promotion of giant clam farming for commercial aquarium trade, milkfish farming for food or bait, coral gardens for tourism, and private sector initiatives.
- Inshore Fisheries – Implementation of a parrotfish management plan on Palmerston Island, conducting marine resource surveys for commercial species and for resource conservation, implementing monitoring and evaluation systems to assess the nutrient and disease status of the lagoons, producing reports on occurrences of ciguatera poisoning, maintaining a national network of FADs to relieve inshore fishing pressure, and enhancing food security and income.

6.3 Research

The Ministry of Marine Resources undertakes fisheries and aquaculture research in the Cook Islands. According to the Ministry's website, this research has recently involved:

- Lagoon monitoring: This includes environmental monitoring of the pearl culture industry, including water quality, pearl oyster health and growth, pearl farm mapping and census. It also involves baseline surveys and monitoring of the fish, corals and invertebrates of various Islands.
- Ciguatera programme: The Ministry of Marine Resources monitors the lagoon around Rarotonga for outbreaks of ciguatera several times a year and informs the public about areas that should not be fished. There is also research into ciguatera monitoring methodology and progress reports on occurrences of ciguatera poisoning.
- Marine reserves: The Research Section monitors the results of the Rarotonga marine reserves that have been put in place by the community elders.

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

- The collection of data by MMR, mainly through the requirement that all licensed vessels maintain and submit logbooks

[31] Gillett, R. (2008). A Study of Tuna Industry Development Aspirations of FFA Member Countries. Forum Fisheries Agency, Honiara, 70 pages.

- Relatively simple compiling, processing, analyzing, interpreting, and presenting of Cook Islands tuna data by MMR
- More complex sophisticated data analysis by the Oceanic Fisheries Programme (OFP) at SPC. This category is further divided into two sub-components: (a) Analysis of the Cook Islands data for presentation to MMR for national use, and (b) Combining the Cook Islands data with those of other Pacific Island countries to enable regional assessments by the Oceanic Fisheries Programme of the Secretariat of the Pacific Community. An example of the end product of this process is the overview and status of stocks of tuna in the Pacific Islands region produced annually by OFP staff.

The Ministry of Marine Resources encourages students who are interested in conducting research in the Cook Islands. The Ministry's website gives some details (Box).

> If you look at the outline of the Ministry of Marine Resources, you can get an idea of what we are involved in. We have several masters and PhD students working in the Cook Islands. One PhD student is conducting research into sea cucumbers, a masters student is looking into coral recruitment, several students have been to Aitutaki to work on clams, both physiological and ecological aspects.
>
> Researchers are welcome and will be provided with technical advice (although limited involvement), and in many situations accommodation and research equipment. The Ministry of Marine Resources are unable to provide funding, it is up to the individual to organize this independently.

6.4 Education

Education related to fisheries in the Cook 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, and to a lesser extent at universities in New Zealand, Australia, and the United Kingdom.
- Training courses, workshops and attachments are frequently organized by the regional organizations: the Secretariat of the Pacific Community in New Caledonia and by the Forum Fisheries Agency 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 by bilateral donors.

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 to development of the fisheries sector has flowed from a range of sources, including FAO, UNDP, UNCDF, EU, USAID, JICA, NZODA, AUSAID, ACIAR, FFA, SPC, ICOD and CIDA. Projects have variously been concerned with the provision of shore-based plant and equipment (buildings, ice plant, aquaculture and mariculture research and training centres, fisheries stations), fishing vessel construction, research, fisheries harbours, marketing, training, and fish aggregation devices (FADs). In recent years much fisheries aid has been directed towards supporting the development of the pearl culture industry.

The largest donor project relating to fisheries is the Cook Islands Marine Resources Institutional Strengthening Project (CIMRIS). This New Zealand-funded activity aims to build capacity to achieve sustainable management of marine resources.

7. FISHERY SECTOR INSTITUTIONS

Successive Cook Islands Governments have long considered the marine resources of the Cook Islands a priority for development. This was demonstrated by the formation of a Ministry of Marine Resources (MMR) in 1984. It was the first government ministry in the Pacific Islands region dedicated to the fisheries sector, with most other countries' fisheries coming under the control of the Ministry responsible for agriculture. The formation of MMR was in part a response to the Law of the Sea Convention 1982, from which the Cook Islands anticipated substantial development opportunities (Passfield 1999).[32]

The MMR is organized into five sections:

- Offshore Fisheries
- Pearl Industry Support
- Aquaculture and Inshore Fisheries
- Policy and Legal Services
- Corporate Services

These sections also correspond to the work programme and Ministry's budget. In the financial year 2007/2008 the Ministry's budget was USD$1 147 036.

The Minister currently responsible for the MMR is the Deputy Prime Minister. The newly-appointed Secretary of Marine Resources (April 2010) served for several years as the aquaculture adviser for the Secretariat of the Pacific Community in Noumea.

MMR has a total of 35 staff, about half of whom are based in at MMR headquarters in Avarua, Rarotonga. Other staff are based on Pukapuka, Manihiki, Aitutaki, Rakahanga, Penrhyn and Mitiaro.

Ministry staff have acquired in the last decade considerable knowledge of tuna development and management, and they have long had considerable expertise in many inshore fisheries, with trochus and pearl oysters being prime examples. The Ministry has provided pearl oyster expertise to other Pacific Island countries and many fisheries specialist feel that Aitutaki trochus fishery is the best-managed fishery in the region.

The Asian Development Bank reviewed the developments in all sectors of the Cook Island economy in the mid-2000s, including that of fisheries.[33] They indicated the main accomplishments of the Ministry of Fisheries in the past decade were its promotion of:

- The expansion of pearl farming on Manihiki and its establishment on Penrhyn and (in a small way) on Rakahanga;
- Reduction in the licensing of distant water fishing vessels, with only 4 Korean longliners licensed in 1999 and none in 2000;
- Ongoing development of a new Marine Resources Act;
- Moves towards rights based fisheries management and localization of the longline fishery; and
- Increasing use of ra'ui – traditional fishing bans over areas of lagoon and reef, as a measure to improve habitat and conserve fish.

Some of the important internet links related to fisheries in the Cook Islands are:

www.spc.int/coastfish/countries/cookislands/MMR/mmr.htm The site contains a basic outline of the Ministry of Marine Resources and information on the marine resources of the Cook Islands:

- The marine environment and fisheries resources
- Common fishing methods

[32] Passfield, K. (1999). Review of Living Marine Resources and Related Issues in the Cook Islands. Worldwide Fund for Nature.

[33] ADB (2003). Cook Islands Economic report. Office of Pacific Operations, Asian Development Bank, Manila.

- Marine ecosystem and fisheries management
- Marine based careers
- A brief overview of the marine environment for each of individual island
- The future of Cook Islands marine resources
- Subjects and marine species of particular interest
- Research and business opportunities

www.spc.int/coastfish/countries/cookislands/cooks.htm The site contains information on Cook Islands fisheries, links to other sites concerning Cook Islands, and some SPC reports on fisheries in the Cook Islands:

nla.gov.au/nla.cat-vn193778 The site contains the Cook Island Fisheries Bibliography

8. GENERAL LEGAL FRAMEWORK

The main fisheries law of the Cook Islands is the Marine Resources Act 2005. This is a 56-page document containing ten 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
Part 6: jurisdiction and evidence
Part 7: sale, release and forfeiture of retained property
Part 8: miscellaneous
Part 9: regulations
Part 10: general

Some of the important and distinguishing features of the Act include the following provisions:

Authority: The Ministry of Marine Resources has the principal function of, and authority for the conservation, management, 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 such 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. (3) 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 authorising participation in aquaculture activity in the area; and
- 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:

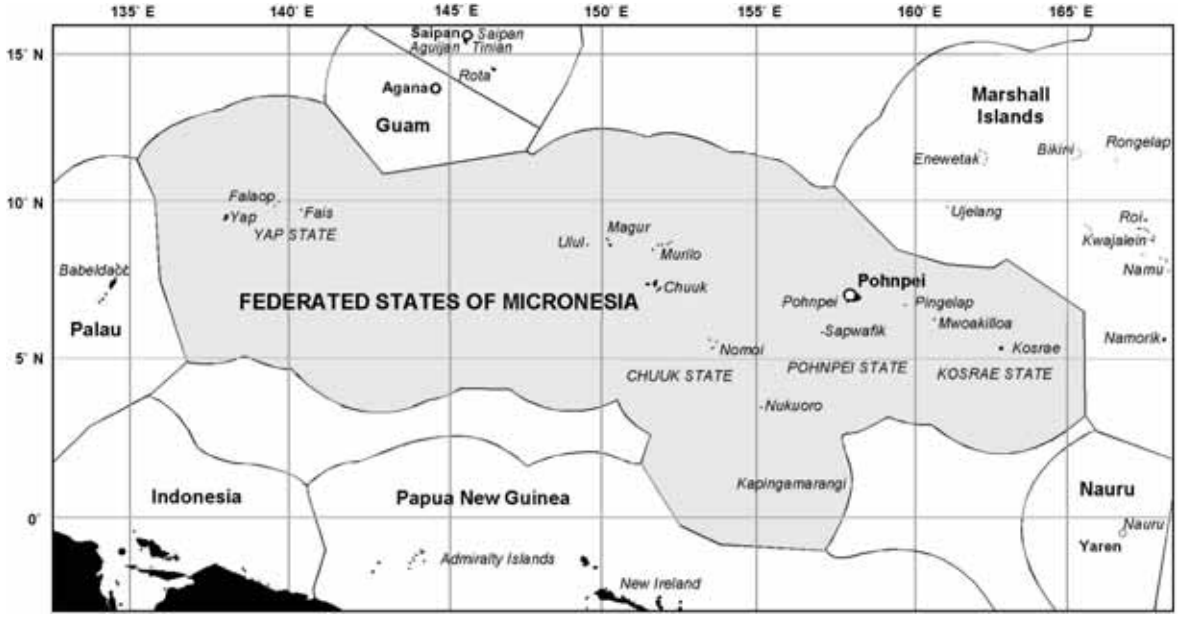
- A right to take a particular quantity of fish, or to take a particular quantity of fish of a particular species or type, or a proportion of fishing capacity, from, or from a particular area in, a designated fishery;
- A right to engage in fishing in a designated fishery at a particular time or times, 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.

One of the first regulations made under the Act were the "Marine Resources (Longline Fishery) Regulations 2008". This was signed by the Queen's Representative on 27 August 2008. It contained the "Longline Fishery Plan 2008" made up of 12 pages of text in 6 parts: preliminary information, consultative process, licensing committee, ecosystem considerations, conservation and management measures, and miscellaneous.

Other legislation relevant to fisheries includes:

- Continental Shelf Act (NZ) 1964
- Continental Shelf (Amendment) Act 1977
- Territorial Sea and Exclusive Economic Zone Act 1977
- Marine Farming Act 1971
- Fisheries Protection Act 1976
- Ministry of Agriculture and Fisheries Act 1978
- Ministry of Marine Resources Act 1984
- Outer Islands Local Government Act 1987
- EEZ (Foreign Fishing Craft) Regulations 1979
- Aitutaki Fisheries Protection By-Laws 1990
- Manihiki Pearl and Pearl Shell By-Laws 1991
- Rarotonga Fisheries Protection Regulations 1992

FEDERATED STATES OF MICRONESIA



1. GENERAL GEOGRAPHIC AND ECONOMIC DATA

Area	701 km^2
Water area	2 980 000 km^2
Shelf area	[no continental shelf]
Length of continental coastline	6 112 km (coastline of islands)
Population (2007)	110 000(1)
GDP at purchaser's value (2006)	USD236.9 million[34]
GDP per head (2006)	USD2 162
Agricultural GDP (2006)	[unavailable][35]
Fisheries GDP	2006: USD23.77 million 2007: USD28.5 million[36]

2. FISHERIES DATA

2007	Production	Imports	Exports	Total supply	Per caput supply
	tonnes liveweight				kg/year
Fish for direct human consumption[37]	7 990	2 370	5 510	4 850[38]	44.1
Fish not for local consumption	9 000	–	–	–	

[34] Statistics Division (2008b). FY 2007 Economic Statistical Tables. Statistics Division, Office of Statistics, Budget & Economic Management, Overseas Development Assistant & Compact Management, FSM National Government, Pohnpei.

[35] GDP contribution by industrial sector is unavailable.

[36] From Gillett (2009). The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories. Pacific Studies Series, Asian Development Bank, Manila.

[37] Data from FAO food balance sheet of fish and fishery products (in live weight).

[38] Corrected to reflect actual supply.

Estimated employment (2007)	
(i) Primary sector (including aquaculture)	[unavailable][39]
(ii) Secondary sector	[unavailable]
Gross value of fisheries output (2007)	USD224.5 million[40]
Trade (2007)	
Value of fisheries imports (estimate)	USD1.9 million
Value of fisheries exports	USD12.3 million[41]

3. FISHERY SECTOR STRUCTURE

3.1 Overall fishery sector

The Federated States of Micronesia (FSM) contains 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 FSM state are all located on high islands where land and freshwater resources are more abundant. These features have major implications for FSM's fisheries.

The fisheries sector is an important component in the economy of the FSM. Subsistence fishing is important to most households in the country, and is a critically important component of the food supply in the outer islands. The money received from licensing foreign fishing vessels represents about 10 percent of all government revenue and grants.

The country's fisheries can be placed into six categories. These categories and the associated production in 2007 are estimated as:

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based[42]	Fresh-water	Aquaculture	
						Tonnes	Pieces
Volume of production (metric tonnes or pieces[43])	2 800	9 800	16 222	143 315	1	0	16 000
Value of production (USD)	7 560 000	15 732 000	23 908 377	177 195 590	8 000	80 000	

Source: Gillett (2009)

The above estimates included the production by vessels under foreign flags operating within the EEZ of the Federated States of Micronesia (in the category "Offshore – Foreign Based"). Total production of fish, crustaceans, molluscs, etc., by FSM reported to FAO was 21 699 tonnes from capture fishery in 2008.

Main trends and important issues in the fisheries sector

The main trends in the sector include:

- The total number of fishing vessels licensed to fish in the EEZ of the FSM decreased from a high of 408 in 2004 to 303 in 2007. During the same period, vessels operating under the FSM flag increased from 28 to 33.

[39] Statistics Division (2008a) cites 132 people employed in fishing, but this is likely to be a gross under-estimate.

[40] From Gillett (2009); includes the six fishery production categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally-based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing, and (6) aquaculture.

[41] Statistics Division (2008b). International Trade Publication, Federated States of Micronesia 2007. Office of Statistics, Budget & Economic Management, Overseas Development Assistant & Compact Management, FSM National Government.

[42] This is the catch in the EEZ zone of the Federated States of Micronesia by vessels based outside the country.

[43] The production of black pearls is measured in pieces (individual pearls) rather than in weight.

- The total number of longliners licensed to fish in the EEZ of the FSM decreased from a high of 217 in 2004 to 133 in 2007, while those operating under the FSM flag increased from 22 to 29 during the same period. Thus there has been a slow but steady expansion of the domestic-based (but foreign owned/operated) long-lining fleet operating mainly from Pohnpei.
- The total number of pole-and-line vessels licensed to fish in the EEZ of the FSM decreased from 30 in 2004 to 8 in 2007, while the number of purse seiners increased and totalled 162 in 2007. In the same period those operating under the FSM flag decreased from 6 to 4.
- After some spectacular losses in the late 1980s and early 1990, the profitability of domestic-based purse seining has steadily improved in the last decade – as evidenced by operations in Yap and Pohnpei.
- Lack of clear trends for tuna catches – purse seine fishing conditions in the FSM zone vary considerably from year to year making licensing revenue unpredictable.

Some of the major issues in the fisheries sector are:

- A large amount of money is generated from licensing foreign fishing vessels. A major issue is whether licensing could and should be used to leverage domestic tuna industry development; i.e. a requirement for shore based activities or transshipment as condition of licence.
- The large number of government agencies involved in aspects of coastal fishing tend to stifle management and development initiatives.
- The government has a large desire for a major tuna canning or loining facility in FSM, but there is a lack of interest by potential investors in such facilities.
- At the FSM state level there is a belief that there is considerable potential to derive additional benefits from coastal fishery resources, whereas the reality is that most of the resources that are economically viable to exploit, are fully- or over-exploited.
- When the time comes to limit offshore tuna fishing effort it may be very difficult to balance tuna conservation concerns with the income needs of a country strapped for cash.
- Despite considerable funding over decades, the development record of aquaculture in the country has been poor.

3.2 Marine sub-sector

The marine fisheries of FSM have two very distinct components, offshore and coastal:

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

3.2.1 Marine catch profile

Offshore fishing in the FSM is conducted by several fleets:

- Locally-based offshore vessels consist of FSM-flagged purse seiners and FSM and Chinese-flagged longline vessels. In recent years the catch from these vessels has ranged from about 12 000 to 24 000 tonnes, with about two-thirds of the catch from the purse seiners.
- Foreign-based offshore vessels consist mainly of purse seiners and longliners from mainly Asian countries. Japanese pole-and-line vessels occasionally fish in the FSM zone. The catch in FSM waters by foreign-based offshore vessels in 2007 was about 143 000 tonnes, of which about 95 percent was from purse seine vessels.

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 FSM, 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 FSM, during El Niño periods the purse seine fishery moves eastward and tuna catches in FSM decline sharply.

Volume of tuna caught by the FSM-flagged offshore fleets (tonnes)

	2004	2005	2006	2007
Longliners	842	334	482	1 943
Seiners	27 744	28 021	10 332	13 497
Total (tonnes)	28 586	28 355	10 814	15 440

Sources: WCPFC

The production in recent years from coastal marine fisheries has been about 12 500 tonnes, of which about one-quarter is sold. The general situation is that on the main islands of each FSM state, small-scale fishers sell catch in excess of their own requirements through various outlets.

3.2.2 Marine landing sites

Of the offshore fleets mentioned in section 3.2.1 above, only the locally-based longliners land fish in the FSM.

Purse seine tuna catches are not landed in FSM. Depending on the nationality of the vessel the tuna is either transshipped for transport to a cannery (seiners from Taiwan and Korea), delivered directly to Pago Pago (US 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 FSM zone do not land fish in FSM. 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, having about half of the FSM population, receives about half of the landings.

3.2.3. Marine fishing production means

The offshore fleets that operate in the FSM zone characteristically operate in the zones of many other Pacific Island countries. To gain an understanding of the vessels and gear involved in FSM fishing it is therefore necessary to understand the fleet dynamics in the larger Western and Central Pacific Ocean (WCPO):

The offshore fleets operating in the FSM EEZ use only three gear types: purse seines, longlines, and pole-and-line:

- Purse seine vessels tend to fish mostly in the equatorial part of the FSM zone, especially the area near Kapingamarangi and Nukuoro islands. In terms of the number of days spent fishing in the FSM zone by seiners, there is little seasonality between months. There is, however, much inter-annual variation. Purse seining in FSM is strongly affected by El Niño conditions.

Purse Seine Fleet: About 230 purse seiners are presently in the Pacific Islands region. The main fleets are from Japan; Republic of Korea; Philippines; Taiwan Province of China, China; United States; and Vanuatu. Vessels from 13 other countries are also active. The combined fishing power of all purse seine vessels fishing in the Pacific Islands has increased remarkably in the last two decades.

Longline Fishery: The total number of longline vessels in the WCPO has fluctuated between 4 000 and 5 000 since the mid-1970s, and has remained close to 5 000 since 1992. In recent years, the number of Pacific Islands domestic vessels—such as those from American Samoa, Cook Islands, Samoa, Fiji Islands, French Polynesia, New Caledonia, and Solomon Islands—has gradually increased. These fleets (about 500 longliners in all) mainly operate in their respective exclusive economic zones (EEZs) with albacore being the main species taken.

Pole-and-Line Fishery: Economic factors and technological advances in the purse seine fishery have resulted in gradual decline in the number of pole-and-line vessels in this fishery. Most of the Pacific Islands domestic fleets (Palau, Papua New Guinea, and Kiribati) are no longer active, and the one vessel operating seasonally in the Fiji Islands is now non-operational. Fewer than ten pole-and-line vessels continue to operate in the Solomon Islands. About 150 Japanese distant-water pole-and-line vessels presently operate in WCPO.

Source: Gillett and Bromhead (2008)[44]

- 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 FSM zone, while those longliners based in Pohnpei (both domestic and foreign) tend to fish closer to Pohnpei in the centre of the FSM 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 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 FSM EEZ and fishing in that zone, if any, tends to be the north and east of the zone.

Subsistence and coastal commercial fishing employ a wide range of fishing gears and techniques in FSM. Such fishing is actually a continuum from purely subsistence fishing 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, hand-lining, gillnetting and cast-netting.

3.2.4 Main resources

The marine resources of FSM can be broadly split into two main categories:

- *Offshore resources,* which include tunas, billfish and allied species. They are characterized by an open-water pelagic habitat, potentially extensive movements of individuals, and wide larval dispersal. FSM's 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.
- *Coastal resources*, which include many groups of fish and invertebrates, such as finfish (scarids, lethrinids, lutjanids, and carangids), beche de mer, trochus, giant clam, lobster, and turbo.

[44] Source: Gillett, R. and D. Bromhead (2008). Tuna for Tomorrow? – Some of the Science Behind an Important Fishery in the Pacific Islands. Asian Development Bank and Secretariat of the Pacific Community, Manila, ISBN 978-971-561-651-5, 50 pages.

A survey[45] in the 1990s found that in Chuuk, Kosrae, Pohnpei, and Yap, the number of reef fish species was 205, 351, 445, and 370, respectively. Most inshore fishery resources are characterized by their shallow water habitats or demersal life-styles. Because of their relative accessibility, these resources form the basis of most of the small-scale fisheries in FSM.

3.2.5 Management applied to main fisheries

The Federated States of Micronesia is a member of the Western and Central Pacific Fisheries Commission that 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.

Management objectives

The objectives of fisheries management in FSM vary considerably depending on the level of government. In FSM there are three levels 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 exclusive economic zone.
- *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 practical terms, the national government manages the industrial tuna fisheries, in which most of the participating vessels are from distant-water fishing nations. The objectives of national-level fisheries management are set out in two locations:

- Title 24 of the FSM 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 Plan for Management of Tuna in FSM (adopted December 2001) gives specific objectives for the management of the tuna resources, the only fishery resource managed on a national basis. These objectives are to (a) Ensure that the tuna catch does not exceed sustainable levels; (b) Obtain national revenue from foreign fishing access agreements; (c) Support development of FSM-owned and/or foreign-owned but FSM-based fishing enterprises; (d) Encourage investment in enterprises related to tuna fisheries; (e) Promote employment opportunities; and (f) Enhance international relationships beneficial to FSM.

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 prevention of destructive fishing, deterring of over-harvesting, and protection of endangered species. The objectives of management at the village level mainly revolve around assuring the sustainability of local marine foods.

Measures and institutional arrangements

There is a very large difference in fishery management arrangements at the national level (outside 12 nautical miles) and the state level (inside 12 nautical miles). There are also great differences between the states:

[45] Smith, A. (1992). Federated States of Micronesia Marine Resources Profiles. Report 92/17, Forum Fisheries Agency, Honiara.

At the **national level** the National Oceanic Resources Management Authority (NORMA) has the authority under the fisheries law to adopt regulations for the management, development and sustainable use of fisheries resources in the exclusive economic zone. Regulations adopted by the Authority have the full force and effect of law, and are considered an integral part of the fisheries law. Management measures have historically revolved around strict vessel licensing requirements and effective enforcement to achieve the objective of obtaining national revenue from foreign fishing access agreements. In recent years the objective of ensuring resource sustainability has received considerable attention, with restriction of purse seine effort being the main supporting measure.

At the **state level** the most common type of fishery management measure used are various types of bans (e.g. destructive fishing techniques) and closed seasons. Example of common ban is the prohibition of fishing for trochus except during short open seasons. The use of marine protected areas is increasing.

At the state level the fisheries management conditions and arrangements are:[46]

Although **Chuuk State** has by far the largest state fishery agency in FSM, it is also the state with the most serious fishery management problems. 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 building materials are largely uncontrolled. The State's numerous municipalities nominally have some authority to control access to their fishing areas but these seem to be upheld only in the outer islands and more remote parts of Chuuk proper, and are largely ignored close to the population centres.

Kosrae State is the state with the least complex fishery management environment. A single small island with a small population (who are historically not such ardent fishermen as those of other FSM states), limited resources, and far 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, but most threats to coastal resources come from land-based developments, which cause increased runoff, 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.

Pohnpei State is something of an intermediate case in terms of resources, degree of exploitation, and the extent of fishery management problems. The general perception in Pohnpei seems to be that resources are not yet in crisis but that the time is quickly 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 tenure systems on Pohnpei proper may impede the development of community-based management arrangements.

Yap State is unique in the degree to which traditional marine tenure arrangement 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 absolute authority over access to and use of coastal areas. Relative to other states, Yap has a large resource base and small population, and in this sense

[46] Source: GPA (2001). National-Level Arrangements for Coastal Fisheries Management in FSM. Gillett Preston and Associates, Fisheries Management and Development Project TA No. 2832-FSM, Asian Development Bank, Manila.

management issues related to over-exploitation are not pronounced. Nevertheless some resources, especially of sessile types such as clams and beche-de-mer, have been seriously over-exploited in the past, demonstrating that the traditional system of tenure does not guarantee responsible stewardship.

3.2.6 Fishing communities

The concept of "fishermen communities" is not very relevant to FSM. 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 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 in FSM are "fishing communities".

3.3 Inland sub-sector

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

3.4 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 in FSM offer fishing activities (many trolling outside the reef) to their overseas guests.

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

3.5 Aquaculture sub-sector

Aquaculture has been the focus of technical and development attention in FSM for over 30 years. Numerous documents, reports and reviews exist, most of which emphasize the potential of specific forms of aquaculture for development as well as for other purposes, such as reef re-seeding.

The National Aquaculture Centre 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.

Other aquaculture initiatives have been and continue to be supported both by the Government and by several local and international organizations working in FSM, including the College of Micronesia, Japan Overseas Cooperation Volunteers, the Pohnpei Agricultural Training School, and FAO. Sponge culture trials were begun in Pohnpei about 10 years ago and several pilot farms started in Pohnpei with donor funding support, but none of these has grown to become a commercial operation. The culture of *Eucheuma* seaweed was attempted in Pohnpei during the mid-1980s, but relatively low returns to farmers and other problems prohibited it from developing despite success in growing the seaweed. Black pearl culture trials began on Nukuoro atoll in Pohnpei state in 1995.

Presently, the only significant aquaculture operations in FSM are the culture of giant clams from the government aquaculture facility on Kosrae and black pearls on Nukuoro Atoll.

With respect to giant clam aquaculture:

- Unpublished data on the Kosrae facility from the FSM Government's Department of Resources and Development shows: 2005 clam sales = USD8 000; 2006 clam sales = USD17 000; 2007 clam sales = USD27 000. An official of the Department indicates that these were all sales for export. (M. Henry, personal comm., October 2008).

– CITES (2008) reports exports of giant clams from FSM to have been: 2005 – 10 118 live clams; 2006 – 13 374 live clams; 2007 – 20 195 live clams.

With respect to black pearl aquaculture:

– 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. The farm relies on the collection of wild spat to supply the farm (Lindsay 2002).

– Recent pearl harvests on Nukuoro have been: 2005 – 3 000 pieces; 2006 – none; 2007 – 2 000 pieces; 2008 – none. All of the pearls are retailed in Pohnpei, prices ranging from USD20 to USD480 per pearl.

4. POST-HARVEST USE

Post-harvest aspects for **coastal fisheries** are quite different from that for the offshore fisheries:

– 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 which 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 allowed numerous small fish markets to spring up around the island. A fisheries study[47] in Pohnpei in 1998-2008 found that 475 tonnes of reef fish is caught and sold in Pohnpei each year.

– A number of attempts have been made to provide improved 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. A small amount of finfish and invertebrates is exported to Guam and Saipan by air freight, but no regular supply lines exist and most goes to expatriate Micronesians living in those areas.

– Although FSM 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. This is thought to be due to irregularity in supply of raw material and relatively high labour costs.

By contrast, post-harvest aspects of the **offshore fisheries** mainly involve external trade:

The catch from the various purse seine fleets operating in the FSM is almost all for canning, but the mechanisms for getting the catch to the canneries shows considerable variation:

– Japanese purse seiners return to Japanese ports to offload the catch and do not transship in FSM or other Pacific Island countries.

– US purse seiners offload their catch at the canneries in Pago Pago, American Samoa, and usually do not transship in FSM.

[47] GPA (2001). National-Level Arrangements for Coastal Fisheries Management in FSM. Gillett Preston and Associates, Fisheries Management and Development Project TA No. 2832-FSM, Asian Development Bank, Manila.

– Taiwanese and Korean seiners (and those vessels of other national fleets owned by Taiwanese/ Korean interests) usually transship their catch in an FSM port or in a port in a neighbouring country (mostly Papua New Guinea or Marshall Islands).

As can be seen from above, the issue of purse seine tuna transshipment[48] is very important to the FSM 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 FSM ports. This results in benefits to FSM 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 estimated at USD4 000 per transshipment port call.[49]

The majority of fish landed in FSM by locally-based longline vessels (most vessels are based in Pohnpei) is air-exported to Japan, via Guam. The amount of fresh tuna exported depends on the number of such longline vessels fishing from 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 FSM mainly unload in Guam or in their home ports in Asian countries.

Fish from locally-based longliners which are 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.

5. FISHERY SECTOR PERFORMANCE

5.1 Economic role of fisheries in the national economy

A recent study by the Asian Development Bank attempted to quantify the fishery-related benefits received by FSM in various categories. The study gave the available information (focused on 2007) on the contribution of fishing/fisheries to GDP, exports, government revenue, and employment. The results can be summarized as:

– The total GDP contribution from fishing in 2007 (USD28 537 932) is 14.4 percent of the projected 2007 CPI deflated real GDP of FSM of USD197.5 million.
– In the five year period 2003-2007, marine products represented from 70 percent to 94 percent of all exports of the country.
– Access fees paid by foreign fishing vessels represent about 10 percent of total revenue and grants of the FSM Government.
– Very few individuals have formal employment in fisheries. Most of those who earn an income from fisheries are self-employed.

From the above it can be seen that fisheries make a relatively important contribution to GDP, exports and government revenue.

5.2 Demand

The per capita supply of fish in FSM, based on the 2007 FAO food balance sheet, is 44.1 kg. Various studies have made estimates of per capita fish consumption ranging between 69.3 and 142 kg. Considering UN projections for the population of the FSM, an hypothetical annual average consumption of 70 kg of fish per capita would translate into a demand for about 7 800 tonnes of fish in 2010.

[48] 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.

[49] Gillett, R., M. McCoy, L.Rodwell, and J.Tamate (2001). Tuna: A Key Economic Resource in the Pacific Islands – A Report Prepared for the Asian Development Bank and the Forum Fisheries Agency. Pacific Studies Series, 95 pages.

Factors influencing the future demand for fish are emigration to the USA, cash remittances by overseas relatives, local cash employment, increases in the price of fish (over-exploitation of inshore areas, fuel cost increases), and relative cost of fish substitutes.

5.3 Supply

The government has several strategies to increase the national fish supply. This involves facilitating private sector growth, promotion of aquaculture, stabilizing the production from inshore areas by improved management, encouraging the harvesting of tuna resources by small-scale fishers, encouraging the landing of bycatch from longlining, and supporting the local marketing of fishery products.

Major factors affecting the local supply of fish are overfishing, siltation, destructive fishing, the availability of FADs, and the landing of non-export grades of fish by the offshore fleet.

5.4 Trade

The FSM Statistics Division publishes statistics on exports from the country[50] (table below). In the five year period 2003-2007, marine products represented from 70 percent to 94 percent of all exports of the country.

Marine and non-marine exports of FSM (USD and kg)

		2003	2004	2005	2006	2007
Marine products						
Offshore fish						
Purse seiner (domestic)	Kg	470 009	10 821 634	12 332 619	5 848 499	7 535 195
	Value	2 368 895	7 206 011	9 670 269	5 465 828	11 155 265
Purse seiner (domestic based foreign)	Kg	211 259	0	0	0	0
	Value	1 064 767	0	0	0	0
Longliner (domestic)	Kg	8 528 891	1 832 053	364 300	0	0
	Value	7 957 251	2 070 220	1 417 127	0	0
Longliner (domestic based foreign)	Kg	3 236 000	823 468	152 000	0	0
	Value	1 947 816	930 519	591 280	0	0
Reef fish	Kg	214 335	16 273	152 159	5 630	244 241
	Value	733 022	55 650	520 382	241 421	841 376
Crab/lobsters	Kg	6 142	3 651	6 311	2 193	6 887
	Value	41 442	25 369	45 362	19 831	39 163
Trochus shell	Kg	0	0	0	135 100	23 714
	Value	0	0	0	430 970	78 255
Live clams	Kg				2 474	4 281
	Value				17 349	29 780
Other marine products	Kg	0	52	58	14 553	22 723
	Value	0	90	225	38 506	157 480
Total marine products	Kg	12 666 636	13 497 131	13 007 447	6 008 449	7 837 039
	Value	14 113 193	10 287 859	12 244 645	6 213 906	12 301 318
Non-marine products						
Total agriculture products	Kg	461 352	963 401	344 547	445 365	319 576
	Value	919 099	788 890	611 865	2 273 678	2 791 431
Total all others	Kg	3 158	9 758	17 800	39 531	4 124 752
	Value	3 174 077	2 925 854	127 925	434 756	1 096 892
Total	**Kg**	**13 131 146**	**14 470 290**	**13 369 794**	**6 493 345**	**12 281 368**
	Value	**18 206 369**	**14 002 603**	**12 984 435**	**8 922 341**	**16 189 640**

[50] Statistics Division (2008). Key Statistics – Gross Domestic Product by Major Sector of Economic Activity and State. Statistics Division, Office of Statistics, Budget & Economic Management, Overseas Development Assistant & Compact Management, FSM National Government, Pohnpei.

5.5 Food security

Fish, both local and imported, is an important element of food security in the FSM. Various studies have made estimates of per capita fish consumption in the country ranging between 44 and 142 kg – which is extremely high compared to the global average. In addition to fresh fish, the consumption of imported fish (mainly canned mackerel, tuna, and sardine) is substantial.

Another aspect of food security is the role of fish in post-disaster periods. FSM is prone to natural disasters, especially typhoons, which can devastate food crops. The effects on fishery resources are much less and the food production from fisheries in recovery periods is quite important.

5.6 Employment

There is no good data on employment in FSM related to fisheries. Official statistics show that the number of "employed persons in fishing" was 1.3 percent of all employed people in FSM in 2007, but it should be noted that the survey was oriented to formal employment with the larger fishing companies. Little information is available on participation in small-scale fisheries.

An important component of fisheries employment in the FSM are those jobs related to offshore fishing. A study by the Forum Fisheries Agency tracked the number of FSM citizens employed in FSM's offshore fishing industry (both onboard and in processing plants) over a seven-year period:

Employment in the tuna fisheries of FSM[51]

	2002	2006	2008
Local jobs on vessels	89	36	25
Local jobs inshore facilities	131	24	140
Total	**220**	**60**	**165**

Although 165 jobs is not a huge number, it does represent a significant portion of non-government formal employment in the country. The three productive sectors of the FSM economy (agriculture, tourism, and fisheries) account for about 1 000 formal jobs.

5.7 Rural development

An important characteristic of the social situation in FSM is the large difference in prosperity between the urban residents (largely supported by government spending) and the subsistence-oriented communities in the outer islands. Income distribution in FSM is more unequal than in other countries of the region.[52] 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 associated with transport of perishable fisheries products to urban areas equates to few commercial fisheries development opportunities in the outer islands. Unrestricted emigration to the USA has had a large impact on entrepreneurial skills.

Aquaculture has been highlighted by the national and state governments as having the potential to provide significant benefits to FSM, including local job creation, but the results to date have been modest at best.[53] Any impact of aquaculture on rural development is likely to come from the production of non-perishable products, such as pearls.

[51] Source: Gillett (2009).

[52] Abbott, D. (2004). The Federated States of Micronesia Hardship and Poverty Status Discussion Paper. Asian Development Bank, Manila.

[53] Lindsay, S. (2002). Federated States of Micronesia Aquaculture Profile. SPC Aquaculture Technical Papers, Secretariat of the Pacific Community, Noumea, New Caledonia.

6. FISHERY SECTOR DEVELOPMENT

There is a large difference between the fisheries development opportunities in the coastal fisheries and those in the offshore fisheries. In general:

- In the coastal fisheries, most of the readily accessible fisheries resources are fully exploited. Any expansion of benefits generated in these fisheries is likely to arise from improved resource management and from improved post-harvest practices.
- In the offshore fisheries, there is considerable development potential. Although there have been numerous expensive failures in the past, the government and the private sector have learned from the experiences and are proceeding cautiously.

6.1 Constraints and opportunities

Some of the major constraints of the fisheries sector are:

- Fully-exploited nature of many of the inshore resources, especially those close to the urban markets.
- Difficulties for small-scale fishers in accessing the offshore fishery resources.
- Difficulties associated with marketing products from the remote areas where abundance is greatest to the urban areas where the marketing opportunities are greatest.
- Difficult business conditions in the country.
- Lack of local capital for investment in the offshore fisheries; poor track record of previous investments.
- Relatively expensive labour and a reluctance on the part of FSM citizen to accept work in offshore fishing.
- Given the high cost of FSM services and the necessity for importing many of the goods used by the tuna industry, FSM is a high cost location and the industry is not necessarily compensated by proximity to the tuna resources.

The opportunities in the fisheries sector include:

- The presently under-utilized assets of the failed government fisheries companies could represent a significant foundation for a private sector firm. Despite past failed attempts at privatization, if the buildings, cold storage, 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 attractiveness of FSM ports to foreign fishing vessels is likely to result in a large expansion of onshore expenditures by foreign fleets.
- Greater use of management partnerships (community, government, NGO) in the management of coastal fisheries could result in greater sustainability of the coastal fisheries.

6.2 Government and private sector policies and development strategies

The net result of over a decade of work on an FSM fisheries policy has not been very fruitful. A national consensus on the form and function of a fisheries policy has yet to be achieved and the various policy documents do not appear to have had impact on fisheries-related decisions of the national Congress. There could be several reasons for the lack of success of fisheries policy work in FSM. One may be found in the national Constitution, which gives the four FSM states virtually all control over fishery resources inside the 12-mile limit. This is not conducive to a national consensus on fisheries issues.

In another sense, a *de facto* national fisheries policy does exist in the FSM: The *Plan for the Management of Tuna in the Federated States of Micronesia.* The Plan gives six specific goals and for each of those goals, there are associated guiding principles – which could be considered government policies in specific areas. The six specific goals are: (1) Ensure that the tuna catch does not exceed sustainable levels; (2) Obtain national revenue from foreign fishing access agreements; (3) Support development of FSM-owned and/or foreign FSM-based fishing enterprises; (4) Encourage investment in enterprises related to tuna fisheries; (5) Promote employment opportunities; (6) Enhance international relationships beneficial to FSM.

There are several guiding principles associated to each goal. An example of these are those that should guide the goal of "Support development of FSM-owned and/or foreign FSM-based fishing enterprises". These principles are:

- The transition from direct government involvement in the development of the domestic fishing industry to primarily private sector leadership should be supported.
- Active and ongoing consultation with domestic industry will enhance decision-making.
- Optimum utilization of FSM's fisheries infrastructure and facilities is of national economic and social benefit.
- Any negative impacts of foreign fleets on domestic fishing must be minimized.
- The adverse environmental and social impacts of activities relating to tuna fishing must be minimized.
- The interests of artisanal and subsistence fishers must be taken into account.
- The national fisheries management agency has a role in ensuring that FSM domestic vessels comply with all FSM laws, international laws, and the laws of nations in which they are fishing.

With respect to the private sector, there are no formal policies. In the 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. For offshore fishing, the domestic private sector suffered huge losses in the previous decade and is reluctant to make further investments. It prefers to offer services to locally-based foreign vessels and vessels that transship.

6.3 Research

There is a long heritage of tuna research in FSM – over 75 tuna research and exploratory projects have been carried out in the Micronesian area since the 1920s. These have been undertaken mainly by the Japanese and US governments, as well as by Pacific Island regional organizations. Three major tuna tagging programmes were carried out in FSM and surrounding countries by the Secretariat of the Pacific Community (SPC) in the late 1970s, the late 1980s, and in the late 2000s. Log sheet catch and effort data covering the major Japanese fleets prior to 1979 are available from the Fisheries Agency of Japan. Since the inception of the SPC regional tuna fishery database in 1979 FSM has been carrying out a relatively comprehensive observer programme, and one of the objectives has been to verify the accuracy of logbook data. Over-all assessments of the tuna resources of FSM are done periodically by the SPC.

Although the FSM scientific research policy on the tuna fisheries has not been formalized into a document, aspects of a research policy can be inferred from past and present activities. Major elements of the FSM tuna research policy can be construed to be:

- 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 outside scientific expertise; and
- Recognition that for tuna conservation efforts to be effective, FSM should promote and be actively involved in regional and international efforts.

The fisheries research policy is very different at the state level. There appears to be a 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 FSM situation. Much of the earlier research is summarised in the FSM Fishery Resource profiles.[54] In general, at the political level there is an over-optimistic view of the degree to which coastal resources of the states can support commercial development and a lack of appreciation of the need for, and benefits of, fisheries research.

6.4 Education

Education related to fisheries and marine resources in FSM is undertaken in 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 has the Fisheries and Maritime Institute which gives four modules of fisheries education: (1) Basic Fishing knowledge, (2) Practical Longline fishing, (3) Fishing gear design, instruments & machinery, and (4) Marine resources management/ Financial management.
- Academic training in biological, economic and other aspects of fisheries is given to FSM students at the University of the South Pacific in Suva – although FSM is currently not a member of USP.
- Training courses are frequently organized by the major regional organizations involved in fisheries: the Secretariat of the Pacific Community in New Caledonia and the Forum Fisheries Agency 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 USA, and Australia.

6.5 Foreign aid

Several donors and agencies have provided assistance to FSM in the fisheries sector in recent years. These include Asian Development Bank, United Nations Development Programme, Secretariat of the Pacific Community, Forum Fisheries Agency, Food and Agriculture Organization of the United Nations, World Bank, Japan International Cooperation Agency, South 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 US National Oceanic and Atmospheric Administration.

The areas receiving donor support in recent years include aquaculture, fisheries wharves, community-based management, fishing vessels, and marine biodiversity conservation.

7. FISHERY SECTOR INSTITUTIONS

FSM's National Oceanic Resources Management Authority (NORMA) is the government's regulatory and management arm within FSM's 200-mile EEZ. NORMA[55] began operation on January 1, 1979, at the same time as legislation entered into force establishing the FSM's 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

[54] Smith, A. (1992). Federated States of Micronesia: Marine Resources Profiles. Report 92/17, Forum Fisheries Agency, Honiara.
[55] It was then known as the Micronesian Maritime Authority (MMA).

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 appointed at-large.

The Executive Director of NORMA has the full responsibility for the operation of the office and is assisted by the Deputy Director in meeting his obligations. The Executive Director is appointed by the Authority and serves under conditions set by them. Together with the Deputy Director, they form the Executive Management of MMA. This Executive Management has the 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 decisions of the Authority and reporting to the President and Congress on the affairs of MMA, and (c) formulating, reviewing and promoting fisheries management measures within the EEZ.

Other NORMA sections are:

- The Research Section is responsible to the Executive Management for the conduct of its programme to ensure effective fisheries management and conservation by collecting, monitoring and analyzing catch and biological information by all means at its disposal.
- The Licensing, Statistics and Computer Section is responsible for licensing of all fishing vessels operating in the EEZ, including the undertaking of all prerequisite checking prior to licensing and providing analysis of aggregated catch and vessel information in support of access negotiations.
- The Office Administration Section is maintained by the Administrative Officer and Executive Secretary who are responsible for both clerical and administrative functions.

Other national government agencies with fishery responsibilities are:

- The National Fisheries Corporation (NFC) is a public corporation established by the FSM Government in 1984. The aim of the corporation is to develop and promote a profitable and long-term commercial fishery within the FSM. In addition to the National Fisheries Corporation'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 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, established in 1991 as a focal point for aquaculture demonstration, training and advisory services.

Various government departments and semi-government agencies are involved in marine resource use and management at the state level, including:

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

As FSM is a collection of a large number of 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. There are also a large number of stakeholders in the tuna fisheries of FSM. The Plan for the Management of Tuna in FSM defines a stakeholder as a person, group, company, or other entity with a specific interest in tuna.

The main national government stakeholders in tuna fisheries, in addition to NORMA and NFC (described above), are:

- Congress – for approval of access agreement involving ten or more vessels
- The Justice Department – for coordination of surveillance and enforcement activities
- Foreign Affairs Department – for fisheries aspects of bi-lateral and multilateral treaties and for attendance at regional fisheries management meetings
- The Office of the President – for Cabinet meetings (Norma Executive Director is a Cabinet member), approval of travel, and for appointment of NORMA board members
- Finance Department – budget matters and all disbursements except for fishery observer activities
- The Department of Economic Affairs – for coordinating the activities of the DEA Fisheries Section in matters concerning tuna

The major private sector association involved with tuna fisheries is the National Offshore Fisheries Association. The Association was established in 2002 and members consist of 26 companies, including those involved with longlining, purse seining, vessel servicing, and operating shore facilities.

Some of the important internet links related to fisheries in FSM are:

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

8. GENERAL LEGAL FRAMEWORK

The FSM is a confederation of four States. Distribution of powers between the central and the 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 those applying to fisheries in the EEZ. Laws and regulations governing fishing activities in the territorial sea and internal waters are to be found in the code of each State.

With respect to national legislation, the FSM enacted the Marine Resources Act of 2002 (Public Law 12-34). The major features of that law include:

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; and
    - any other matter relating to fisheries management.

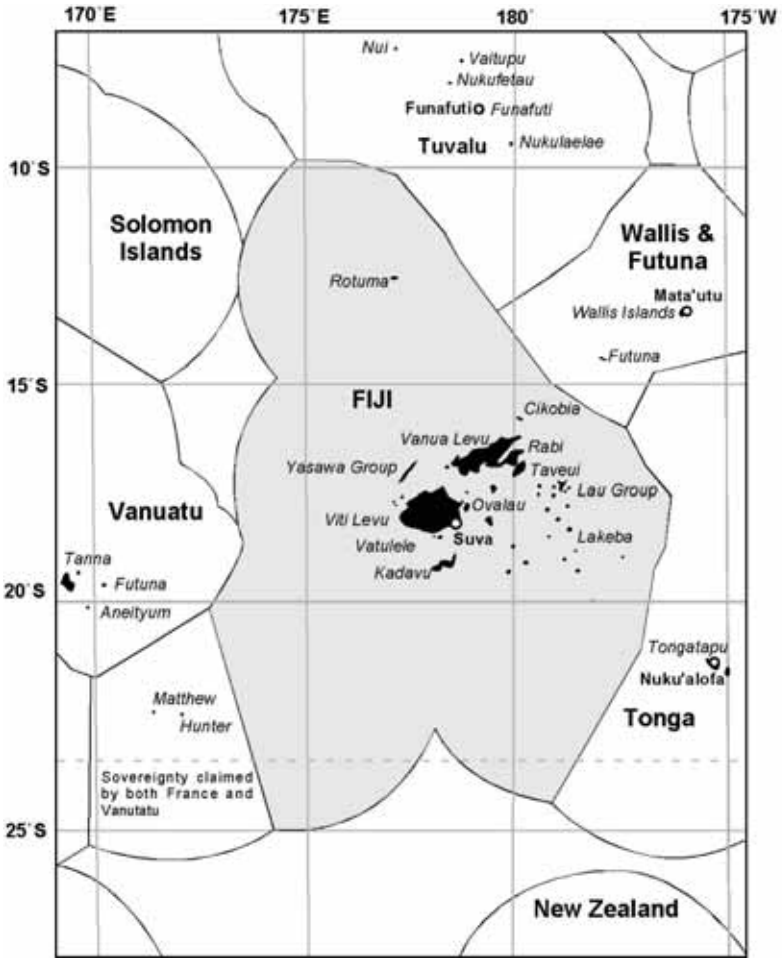
Since no subsidiary legislation has yet been adopted under the Marine Resources Act of 2002, subsidiary legislation implementing the previous Title 24 of the FSM Code, particularly the Reefers and Fuel Tankers Licensing Regulations of 1990 and the Domestic Fishing and Local Fishing Vessel Licensing Regulations of 1991, remains in force. In addition, fisheries conservation and management measures can be found in Title 23 of the FSM Code on Resource Conservation.

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

- 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

Fisheries legislation in the states is in the process of being modified. In 1996 draft legislation was prepared for each State in consultation with State officials. The draft legislation was intended to enable community or traditional participation in fisheries management, and to harmonize key provisions among states and with the national government for effective management and enforcement purposes. Since that time, there have been changes in personnel, political administrations and priorities in the states. There has been uneven progress in revising the fisheries laws. Presently, only Kosrae had enacted the new fisheries legislation.

FIJI



1. GENERAL GEOGRAPHIC AND ECONOMIC DATA

Area	18 376 km^2
Water area	1 290 000 km^2
Shelf area	(no continental shelf)
Length of continental coastline	5 010 km (length of the coast of islands)
Population (July 2007)	834 278
GDP at purchaser's value (2007)	USD3.29 billion[56]
GDP per head (2007)	USD3 945
Agricultural GDP (2007)	USD389 million[57]
Fisheries GDP (2007)	USD56.2 million[58]

[56] 2007 average exchange rate: USD1 = FJD 1.60; GDP source: Fiji Islands Bureau of Statistics, unpublished data; GDP at current market price.

[57] The contribution to GDP of agriculture, forestry and fisheries.

[58] Fishing contribution to GDP; From Gillett (2009). The Contribution of Fisheries to the Economies of Pacific Island countries and Territories.

2. FISHERIES DATA

2005	Production	Imports	Exports	Total supply	Per caput supply
	tonnes liveweight				kg/year
Fish for consumption by residents[59]	15 098	41 149	25 768	30 479	36.8
Fish for consumption by non-residents	23 000				n.a.
Fish for animal feed and other purposes	2 001	2 870	4 745	126	

Estimated employment (2005)	
(i) Primary sector (including aquaculture)	6 900[60]
(ii) Secondary sector	1 900[61]
Gross value of fisheries output (2007)	USD103.4 million[62]
Trade (2007)	
Value of fisheries imports	USD34.3 million
Value of fisheries exports	USD68.8 million

3. FISHERY SECTOR STRUCTURE

3.1 Overall fishery sector

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 is 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.

The country's fisheries can be placed into six categories. These categories and the associated production in 2007 are:

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-cased[63]	Fresh-water	Aquaculture	
						Tonnes	Pieces
Volume of production (metric tonnes or pieces)[64]	9 500 t	17 400 t	13 744 t	492 t	4 146 t	247	48 100
Value of production (USD)	33 750 000	33 812 500	29 293 750	527 500	4 287 500	1 749 375	

Source: Gillett (2009). The figures include production of non-food organisms.

[59] Data from FAO food balance sheet of fish and fishery products (in live weight).

[60] From ADB (2005); includes employment in the offshore fishery, inshore artisanal, subsistence marine aquarium, aquaculture, and game fishing.

[61] From ADB (2005); This figure is for employment in post-harvest aspects of fisheries.

[62] From Gillett (2009); includes the six fishery production categories: (2) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally-based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing, and (6) aquaculture.

[63] This is the catch in the Fiji zone by vessels based outside the country.

[64] The production of the most important aquaculture product, black pearls, is measured in pieces (individual pearls) rather than in weight.

3.2 Marine sub-sector

The marine fisheries have two very distinct components, offshore and coastal:

- Offshore fisheries consist almost exclusively of tuna longlining, from vessels that are both local and foreign based.
- Coastal fishing is carried out for subsistence purposes, for sale in local markets, and for export. The distinction between subsistence and commercial fishing in the larger, less isolated islands is often blurred as the fishing activity is becoming increasingly monetized in those areas.

3.2.1 Marine catch profile

The annual catch from locally-based offshore fisheries has ranged in recent years between about 12 000 and 22 000 metric tonnes. About 80 percent of the catch is tuna, with various species of bycatch making up the remainder. The foreign-based offshore fleet fishing in Fiji's waters usually catches annually between 100 and 1 000 tonnes of tuna and bycatch.

Estimates of catches from the coastal fisheries vary widely. The Fisheries Department statistics reported to FAO on coastal commercial fishing are estimated from a statistical system that only covers a portion of the commercial catch and the Fisheries Department estimates of subsistence catch are based on a crude 1979 small-scale fishing survey which only covered the main island. Using various sources of data (including non-fishery surveys), it has been recently estimated that Fiji's coastal fishery production consists of about 17 400 tonnes by subsistence fishing and 9 500 tonnes by commercial fishing. Subsistence fishing is greatest away from the urban centres, while the commercial fishing is geared at supplying urban food markets and for export. The exports consist of both food items (e.g. finfish) and non-food commodities (e.g. trochus for buttons, aquarium fish).

3.2.2 Marine landing sites

All locally-based offshore vessels unload their catch in Suva, the capital and largest urban area. The foreign-based offshore vessels dispose of their catch either at their home port (mainly in Asia), at the tuna cannery in Levuka (located on the island of Ovalau, near Suva), or is transshipped at Suva or a port outside the country.

Landings from the coastal commercial fishery are made mostly at population centres. It is estimated that the three main urban areas (Suva, Lautoka, Labasa) are the landing points for two-thirds of the coastal commercial production of the country. The Suva urban area receives nearly half of the total commercial landings, or about 4 500 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.

3.2.3. Marine fishing production means

Virtually all the production from the offshore fisheries is by longline gear. Locally-based longliners usually undertake fishing trips from 5 to 15 days in length, using ice to preserve the catch. In recent years the fleet size has ranged from 40 to 100 operational vessels, with 58 vessels licensed to fish in 2007. Most of the local longline vessels are between 20 and 35 metres in length. Almost all the catch by foreign-based vessels is by longline gear, using mechanical refrigeration to freeze the catch during voyages that can last up to several months. A small amount of tuna purse seining by American vessels occurs sporadically in the northern part of the Fiji's zone.

Coastal fishing uses a wide variety of fishing techniques, and involves about 1 300 mainly small outboard-powered vessels.[65] The most common commercial means are gillnetting, hook-and-line fishing, and

[65] Fisheries Department (2008). 2007 Annual Report of the Fisheries Department.

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.

3.2.4 Main resources

The main offshore resources are four species of tuna and several species of bycatch, including swordfish, marlins, dolphinfish, wahoo, and sharks. The catches in recent years are:

Total catch by the locally-based offshore fleet in Fiji

	Albacore	Bigeye	Yellowfin	Total tuna	Bycatch[66]
2003	6 881	889	2 482	10 252	2 062
2004	11 290	1 254	4 164	16 708	5 579
2005	8 901	423	1 989	11 313	4 182
2006	11 802	771	2 231	14 804	5 903
2007	9 395	839	2 852	13 086	2 995

Units: metric tonnes

The coastal fisheries catch a large number of finfish and invertebrate species. Over 100 species of finfish and 50 species of invertebrates are included in Fiji's fish market statistics. The catch from the coastal subsistence fisheries is even more diverse. According to recent reports from the Fisheries Department, the most commonly targeted food finfish are *Lethrinidae* (emperors), *Serranidae* (groupers), *Carangidae* (trevallies), *Lutjanidae* (snappers), *Mugilidae* (mullets), *Scombridae* (tunas), *Acanthuridae* (surgeonfishes), *Scaridae* (parrotfishes) and *Sphyraenidae* (barracudas). The common invertebrates are bivalve molluscs, sea cucumbers, seaweeds, prawns and lobsters and octopus.

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.

Aquaculture produces (in descending order of 2007 production value) pearls, tilapia, freshwater shrimps, brackishwater shrimps, and seaweed.

3.2.5 Management applied to main fisheries

Fiji is a member of the Western and Central Pacific Fisheries Commission that 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.

Management objectives

The objectives of fisheries management in Fiji do not appear in the fisheries legislation, and therefore the objectives must be obtained or inferred from other sources:

The *broad objectives* of management interventions in the fisheries sector are suggested in the mission statement of the Fisheries Department: "to provide sustainable management and development of the nation's fishery with the aim to create employment, increase foreign exchange earnings, and improve the standards of the rural people through capture fisheries development and a well-coordinated support service programme".

[66] From Amoe (2008)

For the *offshore fisheries*, management objectives are given in the "Fiji Tuna Development and Management Plan" that was adopted in 2002 and is still in force. The plan states: "The objectives of the Plan are to provide for maximum sustainable benefits to Fiji from the resource. This implies setting the harvest levels that will not damage the stock and putting into practice a licensing policy that will ensure the maximum benefits from fishing are enjoyed by Fijians. The government has also taken the opportunity to use the Plan to help improve the disparity within the segments of the Fijian population by providing preferential criteria for indigenous Fijians to have access to licences." From 2007 onwards the objective of indigenous promotion has been less prominent.

For the *coastal fisheries*, there are no formal objectives in the legislation or management plans, but judging by 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 the *subsistence fisheries*, there are no formal objectives for most of the 406 traditional management areas, but subsistence fisheries are managed generally for the protection of village food supplies. Recent initiatives sponsored by international NGOs involve promotion of biodiversity conservation as a management objective in the management of village resources.

For *aquaculture* no formal objectives have been established but it is evident that increasing aquaculture production, especially by village level operations, has been the government's primary objective in the sub-sector. Various policy documents indicate that the increased production is intended to improve the nutritional status of rural populations, generate supplementary income, diversify activities, stem the flow of migration from rural to urban areas, and reduce inshore fishing pressure.

Measures and institutional arrangements

The Fisheries Department has the mandate to manage the country's fisheries. The management measures and institutional arrangements for the offshore fisheries are detailed in the "Fiji Tuna Development and Management Plan". The plan specifies a total allowable catch, a limit on the number of licences to be issued, and criteria for distributing available licences among applicants. One of the management measures (subsidies to indigenous operators) was an important component of the management system until early 2007 when it was discontinued by the new government.

In 2002 Cabinet established an inter-departmental committee to review specific applications for licences. This committee is made up of the Permanent Secretaries of Fisheries and Forests, Finance, Home Affairs, Foreign Affairs and National Planning.

For the coastal commercial fisheries, there are no formal management plans and therefore the management measures and institutional arrangements are less clear. The Department has an advisory role to the customary fishing rights owners and is responsible for legislation and enforcement and to provide support as regards commercial viability. The Department issues and regulates licences to fish in customary fishing areas upon prior approval of the head of the designated ownership unit.

Under the Fisheries Act, the Minister responsible for fisheries is given wide powers to make regulations, including input and output measures. The process whereby an issue is developed into a regulation is not formally specified, but it is often triggered by a crisis or resource depletion. In practice, licensing, the most important management measure for coastal commercial fishing, involves procedures that are different for fishing inside demarcated areas (customary fishing rights areas, involves negotiation with traditional authorities) and outside demarcated areas (involves negotiation with government authorities). Apart from licensing, other important management measures are area restrictions, minimum size requirements, bans on destructive fishing, restrictions on taking some species, restrictions on exports, and restrictions on fishing gear.

Measures for the management of the subsistence fisheries are diverse. Traditional authorities, usually a single hereditary chief, in each of the 406 fisheries management areas characteristically make management decisions after considering the views of their resident stakeholders. 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 bans on the use of gillnets, commercial fishing on Sunday, and diving compressors. A recent trend is for some of the areas to have an external partner (such as the local branch of an international NGO) who assists in management activities, often by promoting the concept of marine protected areas. In recent years communities and management partners have been formalized into a network, the Fiji Locally Managed Marine Areas (FLMMA).

Measures for aquaculture management are not well-developed. Various promotion schemes, many that involve subsidies, are used to attain the objective of increasing small-scale aquaculture production. A recent review of aquaculture in Fiji recommended that the management of aquaculture needs to shift towards the control of environmental impacts.

3.2.6 Fishermen communities

The concept of "fishermen communities" is not very relevant to Fiji. 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, the Suva urban area. Coastal commercial fishers are found in all urban areas, but they do not reside in specific 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'. Most of the small-scale aquaculture ponds are in the inland part of the two largest islands, but that is an artifact of the promotion activities of the Fisheries Department, rather than a congregation of households interested in aquaculture.

3.3 Inland sub-sector

Compared to the marine fisheries of Fiji, the production from inland fisheries is quite small. Inland fishing is mainly for home consumption, with some market and roadside sales. Recent studies indicate that inland fishery production is about 4 000 tonnes.

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.

The most important species by weight is the freshwater mussel (*Batissa violacea*). *Batissa* fishing is carried out by women and takes place in the shallow parts of rivers, where the shells are located by hands and feet. Surveys by the Fisheries Department in the mid-2000s show that about 2 500 tonnes of *Batissa* is marketed annually.

Other significant inland fishery resources are eels, various freshwater crustaceans, and introduced fish such as tilapia and carps. Flagtails (*Kulia* spp.) and a number of gobi species were formerly important for interior villages, but abundance has decreased in recent years.

All inland fishing is carried out with very small-scale gear. This consists of 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.

3.4 Aquaculture sub-sector

There has been considerable aquaculture work in Fiji (marine, brackishwater, freshwater) 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 current annual aquaculture production of the country is, however, quite small.

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

Recent reports from the Fisheries Department show that in 2007 the following was produced: 143 tonnes of tilapia, 24 tonnes of giant freshwater prawn, 13 tonnes of giant tiger shrimp, and 67 tonnes of *Eucheuma* seaweed. About 50 000 black pearls were harvested and sold. The total value of the 2007 Fiji's aquaculture production has been estimated to be USD1.7 million, of which about 38 percent was from pearls.

About 90 percent of the 2007 pearl production came from one commercial farm off the island of Vanua Levu. Although there were four commercial brackishwater shrimp farms in Fiji in 2007, all 2007 production of these shrimp came from one operation on the island of Viti Levu. Most of the tilapia and seaweed production is from village-level operations.

4. POST-HARVEST USE

Offshore fishing in Fiji is export oriented. The main target markets for the tuna catch are Japan and the USA. The 2007 Annual Report of the Fisheries Department states that Fiji exported 51 percent of sashimi grade tuna (yellowfin and bigeye) to Japan and America, with the remaining 49 percent sent to destinations such as China, Australia, New Zealand, and the European Union. In May 2008, a directive came into effect that banned the export of fishery products from Fiji to the European Union. The albacore landed in Fiji is sent to canneries, primarily the PAFCO cannery in Fiji and those in American Samoa. Much of the non-sashimi tuna and the bycatch is marketed in Fiji. Industry participants indicate that about 12.5 percent of the production from Fiji's locally-based offshore fisheries is not exported, but rather marketed domestically in the greater Suva area. This equates to an annual supply of fish to Suva residents from the local offshore fleet of about 10.4 kg per capita.

The catch from coastal commercial fisheries is for both local consumption and export:

- Domestic sales mainly involve finfish (both pelagic and reef-associated) and invertebrates and take place either in (a) municipal markets, (b) non-municipal markets (fish shops, butchers and supermarkets and hotels), or occur by the roadside. There are 16 municipal markets in the Fiji, seven in the central division, four in the western division, and five in the northern division.
- The major export commodities include bêche-de-mer (to Asia), aquarium fish (USA), deepslope bottomfish (USA), and trochus shells (Asia, Europe), with sporadic exports of live food fish (China).
- 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 of the valuable species captured – if a market exists (e.g. lobster to a resort).

5. FISHERY SECTOR PERFORMANCE

5.1 Economic role of fisheries in the national economy

A recent study by the Asian Development Bank attempted to quantify the fishery-related benefits received by Fiji in various categories. The study gave the available information (focused on 2007) on the contribution of fishing/fisheries to GDP, exports, government revenue, and employment. The results can be summarized as:

- Official estimates show that fishing in 2007 was responsible for 1.9 percent of Fiji's GDP. A recalculation shows it to be 1.7 percent.

- Exports of fishery products are about 9.1 percent of all exports.
- Access fees paid by foreign fishing vessels represent 0.03 percent of all government revenue.
- Jobs directly related to fisheries represent about 3.8 percent of the total number of jobs in Fiji (wage, salaried, self-employed).

From the above it can bee seen that fisheries make a relatively important contribution to exports and employment.

5.2 Demand

The per capita consumption of fish in Fiji, based on the 2005 FAO food balance sheet, is 36.8 kg. Various other studies have made estimates ranging between 44.0 and 62.0 kg.[67] Considering Fiji's population, 40 kg of fish consumption per capita translates into a 2010 demand for 34 200 tonnes of fish.

Factors influencing the future demand for fish are a rising population, an increase in the price of fish (over-exploitation of inshore areas, devaluation of the Fiji currency, fuel cost increases), and relative cost of fish substitutes.

5.3 Supply

The government has several strategies to increase the national fish supply. This involves facilitating private sector growth, promotion of aquaculture, encouraging the harvesting of tuna resources by small-scale fishers, and supporting the marketing of fishery products landed in remote parts of the country.

Major factors affecting the local supply of fish are overfishing, siltation, destructive fishing, transport links to the outer islands, the availability of FADs, the production of non-export grades of fish by the offshore fleet. In the past an important factor was the taxation of fish imports.

5.4. Trade

The Reserve Bank of Fiji publishes information on the values of fishery exports. These are shown in the table.

Fishery exports of Fiji, 2004-2007

	Value of fishery exports (USD millions)	Value all Fiji exports (USD millions)	Fishery exports as % of total exports
2004	49.1	696.2	7.1%
2005	50.9	705.5	7.2%
2006	56.9	694.2	8.2%
2007	63.3	518.0	12.2%

Most of the fishery exports of the country are the targets or bycatch of offshore fishing. In the mid-2000s the composition of the exports was about 60 percent tuna/bycatch, 18 percent aquarium items, 10 percent bêche-de-mer, and 2 percent trochus, with a large number of other fishery products making up the remainder.

5.5 Food security

Fish, both local and imported, is an important element of food security in Fiji. The results of the 2004 Fiji National Nutrition Survey[68] show a high frequency of seafood consumption. Daily consumption of fresh

[67] The estimate of fish consumption in Fiji is complicated by re-exports of fish, poor estimates of subsistence production, and fish consumption by the large tourist population.

[68] NFNC (2007). 2004 Fiji National Nutrition Survey. National Food and Nutrition Centre, Suva.

fish in indigenous Fijian households was shown to be 23.4 percent. Consumption of imported fish (mainly canned mackerel, tuna, and sardine) is high.

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 can devastate food crops. The effects on fishery resources are much less and the food production from fisheries in recovery periods is quite important.

5.6 Employment

There have been several studies of employment in Fiji's fisheries. Most of the studies have been focused on specific sub-sectors, but there was a comprehensive study of fisheries employment in 2004 by the Asian Development Bank:

Estimate of fisheries employment in 2004[69]

Category	Employment (full-time equivalents)
Offshore fishery	510
Inshore artisanal	2 137
Subsistence	3 000
Marine aquarium	650
Aquaculture	550
Game & charter fishing	60
Tuna cannery	800
Other fish processors	639
Input suppliers	185
Fish markets	340
Department of Fisheries	243
Slipways/ports	30
Total	**9 144**

Combining the above fishery employment estimates with a national employment study of all economic sectors indicates that the estimated 9 144 fisheries jobs represent about 3.8 percent of the total number of jobs in Fiji (wage, salaried, self-employed).

An important component of fisheries employment in Fiji are those jobs related to offshore fishing. A study by the Forum Fisheries Agency tracked the number of Fiji citizens employed in Fiji's offshore fishing industry (both onboard and in processing plants) over a seven-year period:

Employment in Fiji's tuna industry[70]

	2002	2006	2008
Local jobs on vessels	893	330	150
Local jobs inshore facilities	1 496	2 200	1 250
Total	**2 389**	**2 530**	**1 400**

These results indicate that employment in Fiji's offshore fishing industry is important but highly variable.

[69] ADB (2005). Republic of the Fiji Islands: Fisheries Sector Review. Asian Development Bank, Manila, 95 pages.

[70] Gillett, R. (2008). A Study of Tuna Industry Development Aspirations of FFA Member Countries. Forum Fisheries Agency. Honiara, 70 pages.

5.7 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 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. This includes the provision of ice plants, jetties, and slipways, mechanical workshops, and vehicles for transportation of fish and fisheries products to markets. Centres have been recently established in Wainikoro in Macuata, Levuka in Lomaiviti, Kavala in Kadavu, and two centers in Lau (Vanua balavu and Lakeba).

Aquaculture development is also associated with rural development. Fiji's "Freshwater Aquaculture Sector Plan, 2005-2010" states 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.

6. FISHERY SECTOR DEVELOPMENT

A major fisheries development issue facing Fiji, and many other governments of the Pacific Islands region, is reconciling the government's need and desire to secure more benefits from the fisheries sector with the reality that most accessible fisheries resources are fully exploited.

6.1 Constraints and opportunities

Some of the major constraints of the fisheries sector are:

- Fully-exploited nature of many of the inshore resources, especially those close to the urban markets.
- Difficulties for small-scale fishers in accessing the offshore fishery resources.
- Difficulties associated with marketing products from the remote areas where abundance is greatest to the urban areas where the marketing opportunities are greatest.
- Competition by offshore vessels for access to limited infrastructure and services.
- Fuel cost increases which have a disproportionate effect on the small-scale motorized fisheries.
- Slow development of aquaculture for contribution to 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 development limitations and the consequences of over-exploitation.
- Limited dialogue and understanding between the Fisheries Department and the tuna industry.

The opportunities in the fisheries sector include:

- Value-adding to the fishery products, for both domestic consumption and for export
- Greater linkages to the expanding tourism industry
- Expansion of the marine aquarium fishery
- Exploitation of the offshore resources outside of the Fiji EEZ
- Greater use of fish aggregating devices to promote offshore fishing by small-scale fishers
- Greater use of management partnerships (community, government, NGO) in the management of coastal fisheries
- Increasing the effectiveness of the Fisheries Department by enhancing stakeholder input.

6.2 Government and private sector policies and development strategies

Judging by recent activities, the Fisheries Department sees considerable fisheries development potential in several areas. This includes expanding fisheries production in the more remote areas of the country – to be developed using rural service centres. Also perceived to be important is (a) aquaculture production – to be developed by support to small-scale aquaculture operations – and (b) harvesting of tuna by small-scale fishers – to be developed by a more active programme of fish aggregation devices and subsidies for boats.

Recent reviews of Fiji's fisheries sector emphasize the growing role that management should play in preserving current benefits from fisheries – and a decreasing role for efforts in expanding fishing production.

For coastal commercial fishing, the private sector activities are driven to a large extent by the short-term interplay between market prices (both local and export) and production costs, with little emphasis by fishery participants on long-term formal strategies. For offshore fishing, the private sector sees little potential for further development through fleet expansion, but rather believe the participation in the fishery should be limited through the strict adherence to policies and measures in the government-approved tuna management plan.

6.3 Research

A large amount of fisheries research has been undertaken in Fiji over the years. Much of that is listed in the Fiji Fisheries Bibliography[71] and the research carried out on 44 of the main fishery resources in Fiji is summarized in the Fiji Fisheries Resources Profiles.[72] More recent research projects by the Fisheries Department are given in the annual reports. Presently, the Department has significant involvement in research dealing with inshore fisheries, offshore fisheries, and aquaculture. This work is supported by both the Department's budget, and external funding.

The main aim of the Fisheries Department's Research Division is, according to the Department's latest annual report, "to promote applied fisheries research and conservation". The Division has 4 major components: (1) Marine Resource Inventory Survey Section, (2) Pearl Oyster Project, (3) Fiji Locally Managed Marine Area Network, and (4) Makogai Mariculture Research Station.

Research needs for Fiji's offshore tuna fisheries are very different from those for inshore fisheries or aquaculture. Due to the regional nature of the tuna resources, the great expense of tuna research and the high level of expertise required for data analysis, much of the research on tuna is undertaken in collaboration with the Oceanic Fisheries Programme of the Secretariat of the Pacific Community, a regional organization located in New Caledonia.

The University of the South Pacific (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, deepwater shrimps and marine algae, and also carries out social, economic and post-harvest research relevant to fisheries.

6.4 Education

Education related to fisheries in Fiji 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.

[71] McDowell, R. 1993). Fiji Fisheries Bibliography. Pacific Islands Marine Resources Information Network, University of the South Pacific.

[72] Richards, A. (1994). Fiji Fisheries Resources Profiles. Report No. 94/4. Forum Fisheries Agency, Honiara.

- Practical aspects of fisheries and certification of vessel officers is undertaken at the Fiji Institute of Technology in Suva.
- Training courses are frequently organized by the following regional organizations: the Secretariat of the Pacific Community in New Caledonia and the Forum Fisheries Agency 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 received advanced degrees in fishery-related subjects at overseas universities, especially those in Australia, Japan, and the United Kingdom.

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 Nation agencies. The regional organizations serving Pacific Island countries, including the Forum Fisheries Agency, the Secretariat of the Pacific Community, the South Pacific Regional Environment Programme, the Forum Secretariat, and the South Pacific Applied Geoscience Commission have also been active in supporting Fiji's fisheries sector. International NGOs, such as the Worldwide Fund for Nature and the Wildlife Conservation Society, also have programmes in Fiji.

The major areas receiving donor support in recent years are aquaculture, fisheries wharves, community-based management, rural service centres, turtle conservation, tuna data management, and marine biodiversity conservation.

A significant amount of donor assistance to Fiji, including that related to fisheries, was suspended following the military coup in December 2006.

7. FISHERY SECTOR INSTITUTIONS

The Ministry of Primary Industries has four departments, one of which is the Fisheries Department. This department is further divided into several divisions. These are:

- Administration and Finance
- Training and Education
- Fisheries Research
- Management Services Tuna
- Fleet and Technical Services
- Capture Fisheries Extension
- Aquaculture Extension

The Fisheries Department is headed by the Director of Fisheries. According to the latest annual report, the Fisheries Department has a total of 162 posts (119 salaried, 43 wage) in the approved establishment. About half of the staff are based in Lami on the outskirts of Suva.

Fisheries stakeholders 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, creating difficulties for an effective government-industry dialogue.

Some of the important internet links related to fisheries in Fiji are:

- www.fisheries.gov.fj – Details of the Fiji government's Fisheries Division
- www.spc.int/Coastfish/Countries/fiji/fiji.htm – Information on Fiji's fisheries, links to other sites concerning Fiji and its fisheries, and some SPC reports on Fiji's fisheries
- www.paclii.org/cgi-paclii – Text of Fiji's fishery legislation

8. GENERAL LEGAL FRAMEWORK

The laws governing the use of marine resources in Fiji are set out in Chapters 158 and 158A of the Laws of Fiji. Chapter 158 is also known as the Fisheries Act. The main features of the Act are that it:

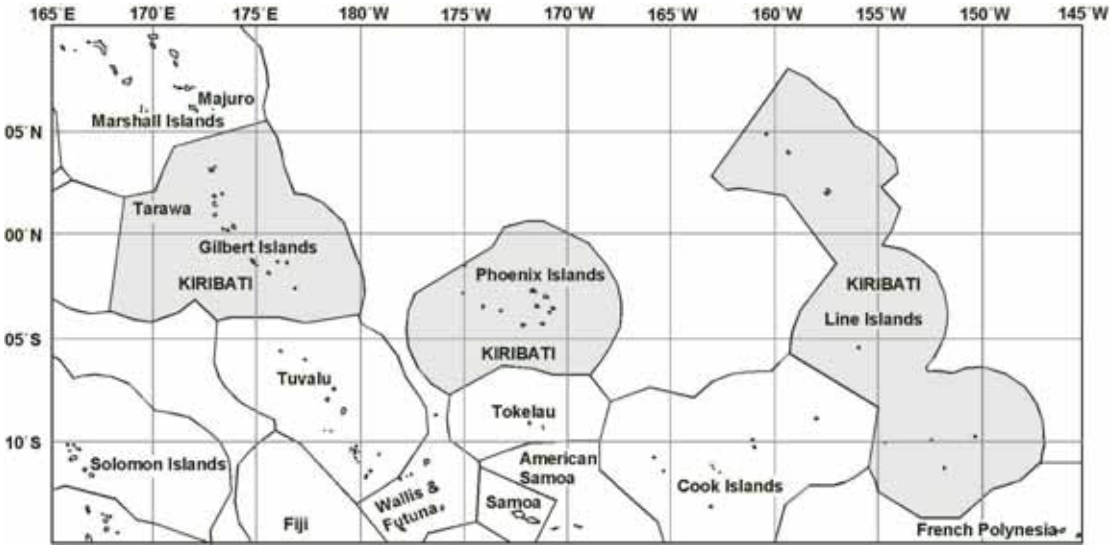
- Defines the Fiji's fisheries waters as all internal waters, archipelagic waters, territorial seas and all waters within the exclusive economic zone
- Establishes a Native Fisheries Commission charged with the duty of ascertaining the customary fishing rights in each province of the Fiji
- Prohibits 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 the 31st 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 law 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.

Several fisheries regulations have been made under the Fisheries Act. These have been consolidated into the Fisheries Regulations 1992. The regulations cover licences/registration, prohibited fishing methods, mesh limitations, size limits, and exemptions. These regulations were modified twice in 1997. (Notices 17/97, and 65/97).

The Marine Spaces Act (Cap. 158A) establishes the archipelagic waters of Fiji and a twelve nautical mile territorial sea. The Act also establishes a 200 nautical mile exclusive economic zone over which Fiji has sovereign rights for the purposes of exploring and exploiting, conserving and managing the natural resources of the seabed, subsoil and superjacent waters.

KIRIBATI



1. GENERAL GEOGRAPHIC AND ECONOMIC DATA

Area	810 km^2
Water area	3 550 000 km^2
Shelf area	[no continental shelf]
Length of continental coastline	1 296 km (length of the coast of islands)
Population (2007)	95 000
GDP at purchaser's value (2008)	136 million USD[73]
GDP per head (2008)	1 390 USD
Agricultural GDP (2008)	35.0 million USD[74]
Fisheries GDP (2008)	11.8 million USD[75]

2. FISHERIES DATA

2007	Production	Imports	Exports	Total supply	Per caput supply
	tonnes liveweight				kg/year
Fish for direct human consumption[76]	8 041	1 743	2 648	7 136	75.1
Fish for animal feed and other purposes	13 562	–	–	–	

[73] 2007 average exchange rate: US$1 = Australia $1.19; GDP source: Unpublished data kindly provided by the Kiribati National Statistics Office (R. Takarie, personal comm., October 2008); Note: subsistence activities (including subsistence fishing) were not included in the official 2007 GPD calculations.

[74] In the official GDP calculations, the contribution of agriculture does not include fishing.

[75] This is the official fishing contribution to GDP – which includes seaweed culture, but does not include subsistence fishing activities. A recalculation shows the total fishing contribution (including subsistence fishing and seaweed) to be USD$37.7 million: Gillett (2009). The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories. Pacific Studies Series, Asian Development Bank, Manila.

[76] Data from FAO food balance sheet of fish and fishery products.

Estimated employment (2005)	
(i) Primary sector (including aquaculture)	936[77]
(ii) Secondary sector	Unavailable
Gross value of fisheries output (2007)	244.2 million USD[78]
Trade (2006)	
Value of fisheries imports	583 thoudand USD
Value of fisheries exports	5.0 million USD

Kiribati is an archipelagic nation comprising 33 islands with a total land area of only 810 sq km but with a surrounding EEZ of about 3.5 million sq km that includes some of the most productive tuna fishing grounds in the Pacific. All the islands are of coralline origin and are surrounded by fringing or barrier coral reefs. The country is divided into three widely separated island groups – the Gilbert Group in the west, the Phoenix Group in the centre, and the Line Islands in the east – each surrounded by their own discrete portion of the EEZ. Several islands in the Line and Phoenix Groups are uninhabited. The distance between the eastern and western extremes of the EEZ is over 4 500 km. There are no rivers, lakes or other freshwater impoundments in Kiribati.

3. FISHERY SECTOR STRUCTURE

3.1 Overall fishery sector

Subsistence and small-scale commercial fishing is conducted throughout the islands using traditional canoes driven by sail or paddle, from plywood canoes powered by outboard motor and from larger outboard-powered craft. Small-scale commercial fishing is concentrated around Tarawa where a sizable population, some ice and cold store facilities, and a cash-oriented economy create better 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.

The small land area and poor soil result in limited agriculture production. There is a great 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.

The fisheries in the waters of Kiribati can be placed into several categories. These categories and the associated production in 2007 are estimated as:

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based[79]	Fresh-water	Aquaculture		
						Milkfish (tonnes)	Seaweed (tonnes)	Pieces[80]
Volume of production (metric tonnes or pieces)	7 000	13 700	0	163 215	0	5	1 112	100
Value of production (USD)	18 487 395	28 571 429	0	197 051 374	0	75 630		

[77] This is the number of employed cash workers in "agriculture/fishing" as determined by the 2005 national census. In some respects this number is misleading. The subject of fisheries-related employment is covered in greater detail in a section below.

[78] From Gillett (2009); includes the six fishery production categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally-based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing, and (6) aquaculture.

[79] This is the catch in the Kiribati zone by vessels based outside the country. Normally, in FAO reporting on production in world capture fisheries, this catch will be reported as the catch of the nation(s) in which the vessel(s) is (are) registred.

[80] Pearls are commonly measured in pieces, rather than kg.

The main trends and important issues in the fisheries sector

The main trends in the sector include:

- Increasing exploitation of the inshore resources, especially those close to the urban markets in South Tarawa.
- A steady total value of the annual catch in the offshore fisheries in the mid-2000s by foreign fleet – about USD200 million.
- A drop in the seaweed production in the 2000s.
- Increasing enthusiasm for tuna management and development arrangements with neighbouring Pacific Island countries.
- An increasing reliance by the Kiribati Government on offshore fishery licensing fees.
- Increasing small-scale commercial landings at non-Tarawa locations in recent years due to increasing ice production in outer islands.
- Continued high consumption of fish throughout the country.

Some of the major issues in the fisheries sector are:

- The difficulties of transferring fish economically from the outer islands (where they are abundant and where cash income is badly needed) to South Tarawa (where 44 percent of the total Kiribati population lives).
- The weak nature of the current coastal fishery management measures.
- The inability of the national fishing company to compete internationally.
- Balancing the promotion of domestic tuna industry development with the need for access fees for government revenue; the difficulties associated with using access to leverage domestic development.
- The interaction between the industrial offshore tuna fishery and the small-scale coastal tuna fishery.

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 foreign-based purse seine, longline, and pole-and-line vessels. Domestic fishery in this areas is sporadic and very limited.
- 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, mainly aquarium fish and beche de mer.

3.2.1 Marine catch profile

The estimate of the volume and value of the marine catch taken within the Kiribati EEZ by fleets based outside the country is estimated based on the iformation in FFA (2008) [81] and Gillett (2009) as:

Volume of catch of foreign-based offshore fleets in the Kiribati EEZ

	2003	2004	2005	2006	2007
Volume foreign longline catch	13 367	37 369	14 016	15 041	6 149
Volume foreign purse seine catch	84 827	105 023	216 567	174 406	156 938
Volume foreign pole/line catch	236	600	0	0	128
Total (tonnes)	98 429	142 992	230 583	189 447	163 215

Source: Gillett (2009) and FFA (2008)

[81] FFA (2008). The Value of WCPFC Tuna Fisheries. Unpublished report, Forum Fisheries Agency, Honiara.

Value of catch of foreign-based offshore fleets in the Kiribati EEZ

	2003	2004	2005	2006	2007
Value catch of foreign longliners	39 016 404	129 919 299	46 696 204	57 090 431	22 359 622
Value catch of foreign purse seiners	52 702 832	77 498 588	164 567 058	138 670 788	174 498 702
Value catch of foreign pole/line	263 689	752 910	0	0	193 051
Total (USD)	91 982 925	208 170 797	211 263 262	195 761 219	197 051 374

Source: Gillett (2009) and FFA (2008)

An important point about tuna fishing in Kiribati concerns the oceanographic conditions and their effect on tuna purse seining. During El Niño periods, the favourable fishing areas for seining shift from Papua New Guinea and the Federated States of Micronesia eastward toward the Kiribati EEZ, resulting in large tuna catches in the Gilbert, Phoenix, and Line Islands.

The estimation of the catch of the coastal fisheries is open to considerable speculation. Gillett (2009) examines previous estimates, export data, annual reports of the Fisheries Division (2003-2006) and the results of the 2006 household income and expenditure survey. Selectively using these sources of information, the 2007 volumes and values of coastal commercial and coastal subsistence fishery production were estimated:

	Coastal commercial	Coastal subsistence
Volume of production (tonnes)	7 000	13 700
Value of production (USD)	18 487 395	28 571 429

No discussion of fishing in Kiribati would be complete without some mention of (1) the government fishing company, (2) the tuna troll fishery of Tarawa, and (3) the ark shell fishery.

Domestic industrial fishing activity in the country during the 1980s and early 1990s was dominated by Te Mautari Limited (TML), a wholly government-owned company established in 1981 to develop a pole-and-line tuna fishery in Kiribati's EEZ. Technical and economic difficulties associated with Kiribati's remoteness, lack of infrastructure and variability in resource abundance have, however, plagued TML's operations. Despite landing good catches in some years the company has rarely made a profit, and has required continued Government support. In May 2001 Central Pacific Producers Ltd. (CPPL) was set up to incorporate three entities: TML, another government fishing company on Christmas Island, and the Outer Island Project. At that time CPPL had a new processing facility, complete with ice plants and generators in Betio and the company exported about 2 tonnes of tuna and other pelagic fish species to Hawaii in 2001. In April 2008 the company employed 70 people, including 20 women.

One of the most productive small-scale commercial fisheries in the Pacific Islands is the tuna troll fishery of Tarawa. In 2008 an informal survey of that fishery was undertaken (Box).

Preston (2008)[82] describes the fishery for "te bun", the ark shell or blood cockle *Anadara maculosa*. This shell inhabits sandy lagoon floors and seagrass beds and supports a fishery of traditional importance in several atolls, including Tarawa, where harvests in 1992-1993 were of the order of 1 000 tonnes per year by subsistence collectors, and a similar quantity by commercial harvesters. However over-collection appears to have caused resource depletion in Tarawa and other areas. Recent estimates are now of the order of 222 tonnes per year in South Tarawa, about 10 percent of previous levels.

[82] Preston, G. (2008). Coastal Fisheries Development and Management. Working Paper 3, Institutional Strengthening Scoping Study Report, Forum Fisheries Agency, Honiara.

The Tarawa tuna troll fishery

Discussions with fish sellers, staff of the Ministry of Fisheries and Marine Resources Development, and key individuals in communities in South Tarawa indicate the main aspects of the Tarawa troll fishery:

- 126 active full-time commercial tuna troll fishing craft operate out of South Tarawa; 88 troll tuna fishing craft also participate in tuna fishing on a sporadic basis.
- There are average three fishermen and 1.5 women fish handlers/sellers for each of the 126 full-time commercial tuna troll fishing craft. There will normally be two women involved, but one will alternate with the other (i.e. taking ice chest of tuna to the road by hand cart, changing with each other through the day to accommodate domestic responsibilities.
- About 189 women are involved full-time in the sale of tuna (full-time equivalent; 2 half time is equivalent to one full-time). Some men are involved in tuna sales, primarily buying fish from several fishing operations.
- About 6 300 kg of tuna and related pelagic species sold on an average day, or 126 mt per month. To these commercial sales, approx 5 percent should be added for domestic use, to give total landings of tuna of about 132 tonnes per month.
- The commercial fishing is carried out by only men and 99.5 percent of fish sellers are women who are normally the wives of the fishermen.
- The present market price of tuna is $2.65 kg, and tuna sales account for about $334 000 per month, or $4 million per year. This represents about $21 000 in sales annually for each of the 189 full-time sellers.

Source: Savins (2008)[83]

3.2.2 Marine landing sites

Catches taken by foreign fleet within the Kiribati EEZ are not offloaded in Kiribati. For purse seining, depending on the flag of the vessel, tuna catch is either transshipped for transport to a cannery (seiners from Taiwan and Korea), delivered directly to Pago Pago (US vessels), or delivered to a port in Japan (Japanese vessels). Pole-and-line vessels deliver their catch directly to port in Japan. The longliners either make deliveries to Asian ports or transship at a port in Kiribati or neighbouring Pacific Island country.

The catches from small-scale commercial fishing are mostly landed at a site in South Tarawa, but much smaller quantities are landed at villages throughout Kiribati. Small-scale commercial landings at non-Tarawa locations have expanded in recent years due to increasing ice production in outer islands. Many islands now have cold storage (14 islands out of 33 total in Kiribati), 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.

3.2.3 Marine fishing production means

Tumoa (2008) reviews foreign fishing activity in the Kiribati EEZ. In 2007 a total of 337 foreign fishing vessels were licensed to fish in Kiribati EEZ. The fleet consisted of 160 longliners, 171 purse seiners, and 6 pole-and-line vessels. Fisheries Division (2009)[84] states the licensed fleets in 2008 were: 186 longliners, 178 purse seiners, and 25 pole-and-line vessels. There is one Kiribati-registered purse seiner but, according to Fisheries Division, the vessel has not come to Tarawa in several years and is managed

[83] Savins, M. (2008). The Tuna Troll Fishery of South Tarawa. A Report prepared for GPA Ltd.

[84] Fisheries Division (2009). Annual Report to the Commission's SC5 Meeting, Port Vila, Vanuatu 10-21 August 2009. WCPFC-SC5-AR/CCM-10. Western and Central Fisheries Commission.

by an office located overseas. The Fisheries Division has periodically used a 13 metre catamaran (Tekokona II) for trial fishing and training, but it never achieved a commercial production level.[85]

Information on the production means of the very active Tarawa troll fishery is given in the box in Section 3.2.1 above.

Subsistence and small-scale artisanal fishing is conducted throughout the islands, from traditional canoes driven by sail or paddle, from plywood canoes powered by outboard motor and from larger outboard-powered skiffs. Fishing is by bottom hand-lining, trolling, pole-and-line fishing, mid-water hand-lining, spearing, trapping, netting and reef gleaning.

3.2.4 Main resources

Fisheries Division (2009) gives the catches by species in the 2008 purse seine fishery based on raised logsheet data as: 90.7 percent skipjack, 4.7 percent yellowfin, 4.2 percent bigeye, and 0.4 percent other species.

The corresponding data for the longline fleet catch in the Kiribati EEZ for 2008 are incomplete but for the 2007, the reported catch (Section 3.2.1. above, 6 149 tonnes) was about 40 percent yellowfin and 60 percent bigeye.

The pole-and-line catch in the Kiribati EEZ was about 95 percent skipjack and 5 percent yellowfin.

The catch of the coastal commercial and subsistence fisheries is extremely diverse.

Sullivan and Ram-Bidesi (2008)[86] give the main finfish species sold in Tarawa – which is indicative of some the important finfish in the coastal fisheries.

Common fish species sold on South Tarawa

Local name	English common name	Latin species name
Bokaboka	leather jacket fish	*Siganus sp.*
Bawe	red tail snapper	*Lutjanus fulvus*
Okaoka	orange striped emperor fish	*Lethrinus obsoletus*
Ikanibong	paddletail snapper	*Lethrinus gibbus*
Morikoi	Spangled emperor	*Lethrinus nebulosus*
Ati	Skipjack	*Katsuwonus pelamis*
Ingimea	Yellowfin tuna	*Thunnus albacares*
Ikarii	Bonefish	*Abula glossodonta*

Invertebrates are quite important, especially in the subsistence fisheries. "Te bun", the ark shell is described in Section 3.2.1 above. Other significant invertebrates are various species of crabs (especially the coconut crab, *Birgus latro*), bivalves, and gastropods.

3.2.5 Management applied to main marine fisheries

Offshore fisheries management

Kiribati is a member of the Western and Central Pacific Fisheries Commission that 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.

[85] Source: Barclay, K. and I. Cartwright (2007). Capturing Wealth from Tuna: Case Studies from the Pacific. Asia Pacific Press.

[86] Sullivan, N. and V. Ram-Bidesi (2008). Gender Issues in Tuna Fisheries – Case Studies in Papua New Guinea, Fiji and Kiribati. DevFish Programme, Forum Fisheries Agency, Honiara.

In the early 2000s Kiribati Tuna Development and Management Plan 2003-2006 was formulated with assistance from the Forum Fisheries Agency (FFA). Because the document was not officially adopted, it cannot be relied upon to provide accurate information on national tuna fishery management arrangements. Nevertheless some insight can be obtained by examining aspects of the Plan.

- The *objectives* targeted by this Plan are given to be: promoting longline development, maximizing government revenues, securing more jobs and more business from foreign vessels, developing large scale servicing for fleets operating in the region, promoting industrial scale tuna fishing and processing, and the establishment of the fisheries licensing and law enforcement authority.
- The *ten key elements* of the plan are: institutional strengthening; improved consultation and coordination; provision of economic incentives; participation in international fisheries arrangements; revision of national legislation; social impact mitigation measures; conservation issues; small-scale longline development; medium and large-scale longline development; and a three-phased strategy for development.

In 2009 the FFA analyzed the strengths and weaknesses of the Kiribati Tuna Development and Management Plan:[87]

- *Strengths:* The plan was formulated with extensive consultation and was focussed precisely on the priorities of the mainly government stakeholders involved in the process. The consultations created a heightened awareness of opportunities, constraints and issues related to tuna resources, management, and development. The plan formulation process resulted in many fisheries officers having substantial contact with regional and international tuna fisheries specialists and allowed those officers to create useful networks. The Process brought together much of the important information on Kiribati tuna (e.g. tuna resources, legal, MCS)
- *Weaknesses:* The plan was not adopted by Cabinet. Reasons cited by various stakeholders included: The plan (presumably Vols. 1 and 2 together) was too large and not readily digestible by non-technical people involved in the decision process, Government was uneasy about the creation of an authority that may be costly and have some negative impact on the flow of funds from access arrangements, the change of Government that occurred just after plan formulation, the decision-making body was too large and it was difficult to collect all the players together, and lack of incentives for government officials to embrace the plan. Not enough attention was given in the plan to specific interventions to achieve the objective of maximising revenue

From an historical perspective, most national offshore fishery management efforts have been focused on the objective of generating revenue for the Kiribati Government through licensing foreign fishing vessels. These efforts have been quite successful: The license fees received from foreign fishing made up 24 percent of total recurrent revenue for 2007 and 41 percent in 2008 (Gillett 2009).

There has been a large amount of regional cooperation in the management of offshore fisheries. This has been exercised primarily through the Parties to the Nauru Agreement (PNA) – in which Kiribati is an important member (see Box).

The PNA has implemented a number of management arrangements. These include a set of non-negotiable minimum terms and conditions for foreign fishing vessel access and a limit on the number of purse seine vessels operating in the region under bilateral licensing arrangements. Currently the PNA countries (including Kiribati) are implementing a limitation on purse seine effort based on the number of vessel days.

[87] Gillett, R. (2009). Tuna Management Plans in the Pacific Ocean – Lessons Learned in Plan Formulation and Implementation. Forum Fisheries Agency, Honiara, 45 pages.

The PNA[88]

In February 1982 the Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest (hereafter referred to as the Nauru Agreement) 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: PNG, FSM 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.

Coastal fisheries management

Preston (2008) reviews coastal fisheries management in Kiribati. Management of coastal fisheries is poorly developed at the national level in Kiribati. Resource-specific regulations exist only for lobsters and, since February 2008, for bonefish on Christmas Island. There are no size limits for coastal marine resources other than lobsters, no quotas, no limits on the number of licences issued, no gear restrictions, and only two formally-established local fishery management areas (in North Tarawa, and in Christmas). A fisheries management plan is in preparation for the beche-de-mer fishery but discussions with fisheries staff indicate that this is likely to be based on a national total allowable catch (TAC) which involves no spatial allocation and which may therefore be insufficient to prevent over-exploitation on any given island. A management plan is also being developed for the aquarium fish industry in Christmas, again using a TAC which may be based on previous export volumes rather than any objective assessment of the resource base, and which may also not provide sufficient resource protection to ensure sustainability.

There appears to be a perception among the population in general, and among many government officers, that coastal marine resources are essentially limitless, or at least sufficiently abundant that no management is needed, especially as regards the outer islands. This situation may have arisen because over-exploitation of inshore resources has not until recently been perceived as a problem area. Historically, inshore resources have primarily been seen as development opportunities, while most management effort has been directed towards oceanic tuna fisheries.

The situation in regard to management of coastal fisheries is nevertheless changing. The combination of growing population, increasing market demand for certain products (especially beche-de-mer and shark fins) and improved international and domestic transportation linkages and market access in some cases means that coastal resources are nearing or may have exceeded their sustainable production limits. Some resources (deepwater snappers, coastal tunas) may have potential for further development, but in the case of lagoon and reef species the future focus will need to be on conserving, managing and, in some cases, restoring stocks.

Institutional arrangements for fishery management

In Kiribati the main institution involved with fishery management is the Ministry of Fisheries and Marine Resources Development. The role of this agency is covered in more detail in a section below.

[88] Source: Tarte, S. (2002). The Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest – A Review of the Agreement and an Analysis of its Future Directions. A Consultancy Report prepared for the Forum Fisheries Agency and the Parties to the Nauru Agreement.

3.2.6 Fishermen communities

The concept of "fishermen communities" has limited applicability to Kiribati. Nearly all households in the country are involved in fishing activities. It could therefore be stated that all villages in Kiribati are "fishing communities".

3.3 Inland sub-sector

There are no freshwater fisheries in Kiribati.

3.4 Recreational sub-sector

The only significant sport fishery in Kiribati is on Christmas Island, where overseas tourist anglers visit to fish for bonefish and, to a lesser extent, for large coastal pelagic species such as trevallies, wahoo, tunas and, occasionally, marlins. Christmas also attracts small numbers of divers. Tourists originate mainly from the United States, Japan and, since the commencement of flights from Fiji a few years ago, Australia and New Zealand. The sport fishery generates economic benefits for Christmas through sport-fishing licence fees, jobs for about 70 professional fishing guides, and tourist expenditure in the island's hotels. Fly-casting for bonefish operates under a catch-and-release system, and so has a limited impact on bonefish stocks, unlike the artisanal gillnet fishery which targets the same species. (Preston 2008)

3.5 Aquaculture sub-sector

ADB (2008)[89] describes some of the main aquaculture operations in Kiribati:

- *Pearls:* Kiribati began investigating the culture of black pearls twelve years ago. After an encouraging start and the harvesting of a number of pearls of marketable quality, the project has had several difficult years, and its future appears uncertain. The Fisheries Division became fully responsible for the project in 2007. Funding and staff resources for further work to overcome identified problems are reported to be inadequate.
- *Seaweed:* The history of seaweed in Kiribati is similar in some respects to that of ventures elsewhere that seek to exploit a niche market opportunity on the basis of what appears to be a comparative advantage derived from resource endowment, but that are unable to compete with bigger and better placed suppliers whose subsequent entry drives down prices below the smaller producer's cost of production. The government has been subsidising seaweed prices in a similar way to the copra subsidy but on a much smaller geographical scale, to encourage people to make a living in outer islands. This has propped up production, and Kiribati still exports small quantities of dried seaweed, mainly from Tabuaeran and Christmas, where it makes a useful addition to household incomes, but the industry has not fulfilled the hopes originally held for it.
- *Milkfish:* In 2004 the tidal ponds east of Parliament at Ambo were allocated for development of an aquaculture research and experimental station in collaboration with the Fisheries Division. Substantial infrastructure has been constructed, and programmes are underway to culture and distribute milkfish to farmers for further growth as foodfish for sale; to establish the feasibility of commercial prawn cultivation – recognized to be one of the most difficult things to do in Pacific aquaculture; and to develop fish quarantining techniques to support the export trade in aquarium fish (petfish). Meanwhile, the old fish ponds and surrounding earthworks at Temaiku which were originally intended to grow baitfish for the export tuna fishery, have been resurrected under the control of the Fisheries Division with technical and financial assistance from Japan's Overseas Fisheries Cooperation Foundation. The project now operates as Temaiku Ecofarm, an integrated aquaculture/agriculture enterprise supplying fish, chickens, eggs and pork to the local market on a semi-commercial basis, i.e. sales revenue covers direct operating costs.

[89] ADB (2008). Kiribati: Managing Development Risk – A report in ADB's Pacific Islands Economic Reports series. Asian Development Bank, Manila.

Kiribati reported 10 tonnes of milkfish and 1 788 tonnes of *Eucheuma seaweeds* from aquaculture in 2009 and the estimated total value of aquaculture was about USD163 000.

Aquaculture production as reported to FAO (mt)

	2005	2006	2007	2008	2009
Milkfish (*Chanos chanos*)	12	12	5	12	10
Seaweed (*Eucheuma* sp.)	5 000*	8 837	1 112	1 083	1 788

* Seaweed production in 2005 was estimated by FAO.

4. POST-HARVEST USE

4.1 Fish utilization

The catch taken by various foreign *purse seine* fleets operating in the Kiribati EEZ is almost all for canning, but the mechanisms for getting their catch to the canneries shows considerable variation. The Japanese purse seiners return to Japanese ports to offload the catch. US purse seiners 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. This transshipment occurs either in Tarawa Lagoon, Christmas Island, or in a port in a neighbouring country – often Pohnpei in the Federated States of Micronesia or Majuro in the Marshall Islands. *ole-and-line* vessels operating in the Kiribati EEZ deliver their catch directly to port in Japan, for mainly consumption in Japan in various forms. *ongline vessels* operating in the Kiribati EEZ either make deliveries to Asian ports or transship at a port in Kiribati or neighbouring Pacific Island country. The higher grade tuna is mainly used for sashimi in Japan, the lower grades for mainly for canning for EU and USA markets, and the intermediate grades for sashimi in non-Japanese markets.

Sullivan and Ram-Bidesi (2008) give information on the post-harvest aspects of the small-scale fishery for tuna in Kiribati. The report states that there is almost no processing of the tuna from the artisanal fishery as the fish is sold fresh on the day when it is caught. The only significant processing done in recent years has been the production of tuna jerky by a few private individuals. The government fishing company is now undertaking some quasi-commercial sales of processed tuna. In the past, Tarawa's artisanal tuna trade was adversely affected by fish discarded from transhipping vessels. While in the Kiribati EEZ, these vessels are required to transship inside Tarawa lagoon rather than offshore. Frozen discards were collected on the wharf and resold in direct competition with small-scale fishermen. Consumers could see that the fresh fish were much better quality but still bought the discards because they were cheaper. As a result, prices slumped temporarily. The town councils now control the price of market fish whilst the government fishing company maintains an exclusive claim on all discards from transshipments.

In the outer islands catches are mainly used for home consumption, or shared, although some excess catch may be salted and dried for later consumption or sale. Many islands now have cold storage (14 islands out of 33 total in Kiribati), enabling storage for local sale and shipment to Tarawa. In the past the schemes to transport fish to urban markets met with limited financial success due to the difficulties and cost of maintaining the infrastructure and transporting the product.

Some of the Tarawa tuna catch is processed into jerky. A small processing/exporting company was established in 1990 and began exporting tuna jerky in 1993. Exports of this product reached a maximum in 1996 when 1 380 kg worth USD57 960 was sent to Australia, New Zealand, Korea, Japan, and Hawaii. Jerky exports are currently sporadic. The aquarium fish are exported to distributors in the mainland United States via Hawaii.

4.2 Fish markets

Catches taken by small-scale commercial fishers in South Tarawa are mainly sold alongside the road from insulated ice boxes. Some are disposed of through small commercial fish markets.

In 2004 a study was undertaken by WorldFish on the fisher sellers of Tarawa. Box 4 summarises some of the results of the study – which emphasise the difficulties and constraints faced by the sellers.

The fish sellers of TarawaWomen

Women sell most of the finfish sold on Tarawa. In total there are perhaps 60 fishmongers active in the municipality of Tarawa during periods when fish catches are high. In our sample of 15 fishmongers, most came from families that lacked formal employment. Their ages ranged from 25 to 60 years old. On average, they were caring for households that contained 10 members, including 3 children.

Pay varies for the women and pay increases are rare. More than a third of the women interviewed were earning 10 cents per dollar of fish sold and two were given 20 cents per dollar of fish sold. Three of the women were earning a flat rate of between AUD 10 and AUD 20 a day. One woman did not receive her pay personally as it was included as part of her husband's income from fishing. In another case, the employer habitually neglected to pay the woman at all, and in one case the pay scale varied. Because daily earnings generally depend on the amount of fish sold, women are encouraged to maximize sales and to work long hours. On most occasions, the women report that they earn at least $10 per day and for this they work for more than 8 hours, 6 or 7 days a week. At times when there is no fishing, fish sellers have no income. Women remain in the fish trade because they have few or no alternatives for making the money they need.

The municipal councils demand fees from all fish traders but the fees are not uniform. In Bairiki and Bikenibeu, located within the Tarawa Urban Council, the fee that is charged for each business is $5 per day while in Betio it is $3 per day. While confused about these differential rates, the women interviewed have never asked why these charges are variable or even required, since their employer already pays for an annual business license. At present, the Tarawa Urban Council, the decision-making body controlling the fish trade, is composed of 17 men and only 1 woman. The one seat occupied by a woman is reserved for the representative of a women's NGO.

Source: Tekanene 2005;[90] USD to AUD exchange rate in 2003 averaged 1.51

5. FISHERY SECTOR PERFORMANCE

5.1 Economic role of fisheries in the national economy

A recent study by the Asian Development Bank (Gillett 2009) attempted to quantify the fishery-related benefits received by Kiribati. The study gave the available information on the contribution of fishing/ fisheries to GDP, exports, government revenue, and employment. The results can be summarized as:

- Official estimates show that fishing in 2008 was responsible for 8.7 percent of the GDP of Kiribati. A recalculation using a different methodology shows the fishing contribution to GDP was about 15 times greater.[91]
- The license fees received from foreign fishing made up 24 percent of total recurrent government revenue for 2007 and 41 percent in 2008.
- There are few comprehensive reliable data on formal and non-formal employment in the fisheries sector.

[90] Tekanene, M. 2005. The women fish traders of Tarawa, Kiribati. WorldFish Center, Global Symposium on Gender and Fisheries, Penang (Malaysia),1-2 Dec 2004.

[91] The fishing contribution of USD$38 million in the recalculation is more than half of the official 2007 GDP of Kiribati. A valid comparison cannot be made however, as the official figure does not include subsistence activities of any kind.

From the above it can be seen that fisheries make a very important contribution to GDP, exports, and government revenue.

5.2 Demand

The per capita consumption of fish in Kiribati, based on the 2007 FAO Food Balance Sheet, is 75.1 kg. Various other studies have made estimates ranging between 72 and 207 kg. Considering Kiribati's population, 100 kg of fish consumption per capita translates into a 2010 demand for 10 090 tonnes of fish.

Factors influencing the future demand for fish are emigration, increase in price of fish (over-exploitation of inshore areas, fuel cost increases), relative cost of fish substitutes, changes in dietary preferences, and population changes.

5.3 Supply

The government has several strategies to increase the national fish supply. These involve supporting the marketing of fishery products in Tarawa from other parts of the country by refrigeration and transport schemes, promoting aquaculture, and discouraging foreign tuna fishing close to the islands of Kiribati.

Major factors affecting the local supply of fish are overfishing, transport links to the outer islands, the degree of domestic tuna industry development, and "leakage" from foreign industrial tuna vessels.

5.4 Trade

The National Statistics Office website does not show export data after 2004. Unpublished data from the National Statistics Office gives the exports from Kiribati by commodity through 2007. Unfortunately, the data on many important fishery exports is incomplete since 2004. Gillett (2009) considers the available data on fishery exports of the country and concludes that a crude estimate of the volume and value of the fishery exports of Kiribati in 2006 is about 4 250 tonnes, worth about USD$5 million.

5.5 Food security

Fish is an important element of food security in Kiribati. The FAO Food Balance Sheets show that in 2007 fish contributed an average of 28.8 percent of all protein to the diet and 55.8 percent of animal protein.

Sullivan and Ram-Bidesi (2008) consider much of the recent literature on fish consumption in Kiribati and make summary statement: "What is clear is that (a) fish and fish products remain a very significant part of total animal protein supply in Kiribati and (b) tuna species remain the single most common and important marine resource consumed in Kiribati."

Animal protein substitutes for fish consist mainly of various types of imported meat, much of which are extremely fatty and have negative health implications.

5.6 Employment

The 2005 Kiribati census provides some information on employment related to fisheries. In the census "working" is defined as being any activity concerned with providing the necessities of life. Respondents were coded on the questionnaire into the three mutually exclusive categories of "cash work", "village work" or "no work". A person who is employed or works mainly for cash is a cash worker. Persons doing village work are those performing a variety of tasks involved in growing or gathering produce or fishing to feed their families and are described as subsistence farmers or fishermen. The results of the census show:

- Village work (subsistence farmers or fishermen) such as growing or gathering produce or fishing to feed their families was the main activity of 39 and 36 percent of males and females

15 years and older. The proportion of village workers (of 51 percent) was much higher in the rural (Outer Islands) areas, than in South Tarawa (urban), where only 20 percent were village workers.

- By far, the majority of employed cash workers in Kiribati are employed in the Public Administration sector – 6 953 persons or 52.9 percent of the total employed (Figure 34). The only other three industry groups that have a significant proportion of the employed persons are: Transport/Communication – 1 473 (11.2 percent); Retail Trade – 1 179 (9.0 percent); and Agriculture/fishing – 936 (7.1 percent).
- Apart from Government jobs, employment on fishing vessels and especially on merchant/container boats, and tankers is the main source of employment for males.

Gillett (2008)[92] tracked the number employed in the large-scale domestic tuna industry in Kiribati over a seven-year period:

Employment in the Kiribati domestic tuna industry

	2002	2006	2008
Local jobs on vessels	39	15	15
Local jobs inshore facilities	47	80	70
Total	**86**	**95**	**85**

5.7 Rural development

In the Kiribati context, "rural development" could be thought of as any development efforts that take place outside of 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. Many of the constraints on the feasibility of the rural fisheries development schemes relate to business skills, regular maintenance of mechanical equipment, and government involvement in commercial activities.

6. FISHERY SECTOR DEVELOPMENT

6.1 Constraints and opportunities

Some of the major constraints in fisheries sector development are:

- Many of the inshore fishery resources, especially those close to the urban markets, are fully or over-exploited.
- Small-scale fishers are having increasing difficulties 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 greatest to the urban areas where the marketing opportunities are greatest.
- The lack of government orientation to a private sector which is poorly developed.

[92] Gillett, R. (2008). A Study of Tuna Industry Development Aspirations of FFA Member Countries. Forum Fisheries Agency, Honiara, 70 pages.

- For export fisheries, the relatively high operating costs compared to competing countries.
- The reluctance of the Kiribati Government to use foreign access to tuna fishery resources to leverage domestic tuna fishery development.

The 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: (1) proximity to very substantial tuna resources, and (2) abundant supply of highly productive, competitively priced labour

A report by the Forum Fisheries Agency[93] summarized the opinions on opportunities in domestic tuna industry development of (1) the senior staff of the Ministry of Fisheries & Marine Resources Development and (2) of the most experience fisher/processor in the private sector:

	Senior staff of MFMRD	Private sector fisher/processor
Tuna fishing	– Phasing out foreign fishing, and replacement with a regional fleet of purse seine, pole-and-line, and longline vessels. – The ownership of the vessels will be like in the Federated States of Micronesia – government owned but operated as private companies – Two vessels of each type for each of the 8 PNA countries	– As uneconomic foreign fleets drop out (high costs of fuel/labour) local fleets become more viable. – Due to resource and logistic considerations, most fleet expansion will occur at Christmas Island, rather than Tarawa – Domestic industrial fishing will be limited to longlining, at least in the medium-term future "learn to walking before running"
Tuna processing	– Due to cannery/loining difficulties in Kiribati, all purse seine catch will be off-loaded in neighbouring countries – Fresh tuna processing/export will only occur in countries where logistics are more favourable than in Kiribati	– The economics of tuna jerky production are improving. – With its large labour pool, loining in Tarawa is a possibility

6.2 Government and private sector policies and development strategies

As mentioned in Section 3.2.5 above, the Kiribati Tuna Development and Management Plan was not officially adopted, but it does provide some insight into government policies and strategies in domestic tuna industry development. The Plan states there will be a three-phased programme:

- in the *short term*, the priority will be on the small-scale longline development activities described above; promoting larger-scale longlining development; securing employment of Kiribati men on foreign fishing vessels; and finalizing decisions on the infrastructure needs and other long term development initiatives so feasibility studies can be commenced in preparation for such activities, e.g., fishing port complexes, etc.;
- in the *medium term*, the priority will be on improving transshipment and servicing facilities, and operations, coupled with the above noted studies; final decisions on infrastructure sites; and securing of funding for these enterprises;

[93] Gillett, R. (2008). A Study of Tuna Industry Development Aspirations of FFA Member Countries. Forum Fisheries Agency, Honiara, 70 pages.

– in the *longer term*, there will be greater scope to promote increased Kiribati participation in purse seining and industrial scale fish processing, training and the development of new large-scale vessel servicing which will include the construction of the required infrastructure and its operations.

With respect to coastal fisheries development, Preston (2008) states that the government's aim is to have development driven mostly by the private sector with the government-owned company Central Pacific Producers Ltd. (CPPL) 'trail blazing' to encourage private sector development by showing people that a certain business could work provided they know how to do it. This strategy has met with mixed success. On one hand there is a need for government catalyst where there is a weak or non-existent private sector. On the other hand, some people feel that CMML is constraining the private sector by providing government-subsidized competition.

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 usually to conduct research on marine resources that have potential for development and to coordinate collaborative research activities with regional research organizations.

A very large number of fisheries research projects have been carried out in Kiribati. Many areas of Kiribati and most types of resources have been covered by various research endeavors. The older research is listed in the Kiribati Fisheries Bibliography.[94]

More recent fisheries research is listed in the latest annual reports of the Fisheries Division. This includes research projects involving ciguatera, stock assessments of various species, post-larval fish, rapid marine resource assessments, and coral reef monitoring.

Tarawa Lagoon has been especially well-researched due to a large externally-funded project in the early 1990s. That research included assessments of shellfish, coral reef and benthic organisms, a finfish assessment, with special emphasis on bonefish, a study of primary and secondary production, along with an analysis of the food web in the lagoon water column, and a computer simulation of lagoon circulation with special emphasis on the impact of causeways. A household survey of 4 percent of the households in South Tarawa and 2 percent of the households of North Tarawa was used as a tool to understand public attitudes and lagoon use patterns. (Biosystems 1994)[95]

6.4 Education

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: the Secretariat of the Pacific Community in New Caledonia and by the Forum Fisheries Agency 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 by bilateral donors.

[94] Gillett, R., M. Pelasio, and E. Kirschner (1991). Kiribati fisheries bibliography. Document 91/8, FAO/UNDP South Pacific Regional Fisheries Development Programme, Suva, Fiji.

[95] Biosystems (1994). Tarawa Lagoon Management Plan. United States Agency for International Development.

Barclay and Cartwright (2007)[96] give information on the training of people from Kiribati (I-Kiribati) on Japanese fishing vessels (Box).

The Fisheries Training Centre

Kiribati is unusual among Pacific island countries in that it trained and recruited I-Kiribati to work on foreign fleets. This started as an offshoot from the Maritime Training Centre (MTC), which had trained and recruited I-Kiribati for the German merchant marine since the 1960s. The industry organization Japan Tuna noted the positive effects of the MTC on employment for I-Kiribati, and was also looking for a source of cheaper crews, so decided to set up something similar for training fishers. This became the Fisheries Training Centre (FTC), established in 1989.

At the FTC, Japan Tuna funded the salaries of two Japanese instructors, two local instructors and the costs of running the longline training vessel, *Tiakawa*, including the crew. Japan Tuna channelled resources for the FTC and recruited graduates from its fleet via a business called the Kiribati Fisherman's Service, with an office in Bairiki also staffed and funded by Japan Tuna. The FTC was under government obligation to train at least 72 young men between the ages of 18 and 30 each year, and usually trained only this many because Japan Tuna paid for the training and did not want to train more crew than it needed. As a result, all of the trainees had a job to go to on graduation and the course was popular among young Kiribati men because of chronic unemployment problems in Tarawa.

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, United Kingdom, and USA, and by multilateral donors including UNDP, ADB, FAO, UNCDF. Kiribati also enjoys technical assistance or the channeling of multilateral donor assistance from various regional agencies including, FFA, SPC, SOPAC, and the University of the South Pacific. Significant assistance projects in the past several decades have included:

- Japanese funding for Outer Island Fish Centres, a pilot bêche-de-mer hatchery, funding for the Tarawa Fishermen's Cooperative, provision of a cargo and passenger vessel to help link outer island fisheries centres, and assistance in the establishment and upgrading of Te Mautari Limited and Central Pacific Producers;
- Australian funding for the overseas training of fisheries personnel, a pilot black-lipped pearl oyster hatchery, and provision of fish processing equipment for a private venture on Tarawa;
- New Zealand assistance in the overseas training of fisheries personnel, and support to the establishment of *Eucheuma* seaweed farming, including the formation of the Atoll Seaweed Company;
- British funding of management personnel for Te Mautari Limited and assistance to Outer Islands Project activities on Butaritari, Abemama and Abaiang;
- United Nations Development Programme support to the establishment of milkfish farming on Tarawa, initial design of Te Mautari fishing vessels, an artisanal boat building project, overseas training for fisheries personnel, and a brine shrimp project on Christmas;
- Asian Development Bank assistance has been provided for a study of export market development, institutional strengthening of the Environmental Unit and a soft loan to the Development Bank of Kiribati to support a fishing vessel credit scheme; and
- European Union funding of a Marine Resource Sector Review and support to the Atoll Seaweed Company.

[96] Barclay, K. and I. Cartwright (2007). Capturing Wealth from Tuna: Case Studies from the Pacific. Asia Pacific Press.

7. FISHERY SECTOR INSTITUTIONS[97]

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 the Mineral Resources Division. The Fisheries Division is by far the larger of the two, employing some 88 staff as opposed to 4 in the Mineral Resources Division. The total establishment of the Ministry is 115 staff, with the remaining 23 being employed in administration, financial management and other non-technical functions.

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; and
- the Aquaculture Research and Development Branch (ARDB), which was previously a Section of the Coastal Fisheries Branch but which has now been separated out 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 and the Line Islands. Administratively this falls under the ARDB, although the Unit's activities cut across all functional areas of the Fisheries Division, both Oceanic and Coastal. The Division's Extension and Research vessel is also administratively placed under the ARDB.

There are several other institutions in Kiribati that are considered as fishery stakeholders. These include both government ministries and other agencies:

- Ministries: The Ministry of the Environment and Social Development 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 Commerce, Industry and Tourism is charged with evaluating foreign investment in the marine resources sector, local companies involved in marine product export, and supporting private sector development. The Ministry of Home Affairs is responsible for internal affairs, including Outer Island Development activities and the Ministry of Line and Phoenix Groups oversees all developments in those islands. The Ministry of Finance is the recipient agency of the foreign fishing access fees.
- Other agencies: The Fisheries Training Centre, the Council of Churches, the Central Pacific Producers Limited, the current government fish processing centre, private sector processors/ exporters, the Development Bank of Kiribati, and fishers associations.

Some of the important internet links related to fisheries in Kiribati are:

- www.spc.int/coastfish/countries/Kiribati/kiribati.htm Contains a large amount of information on fisheries of Kiribati, including many reports by SPC and others.
- www.wcpfc.int/meetings The section on the Scientific Committee contains the annual reports on the tuna fisheries of Kiribati.

[97] Information in this section is from Preston (2008) and Vunisea, A. (2003). Social and Gender Considerations. Working Paper for Kiribati Tuna Fishery Development and Management Planning Exercise, Secretariat of the Pacific Community, Noumea.

- www.fao.org/docrep/006/y5121e/y5121e0b.htm Information about the sea safety of Kiribati's fishers.
- www.janeresture.com/ki33/fishing.htm Contains considerable information about traditional fisheries of Kiribati and some social perpsectives.

8. GENERAL LEGAL FRAMEWORK

The basic fisheries law of Kiribati is the Fisheries Act. In this legislation the "Minister may take such measures as he shall see fit to promote the development of fishing and fisheries in Kiribati to ensure that the fisheries resources of Kiribati are exploited to the full for the benefit of Kiribati."

Important aspects of the Act are:

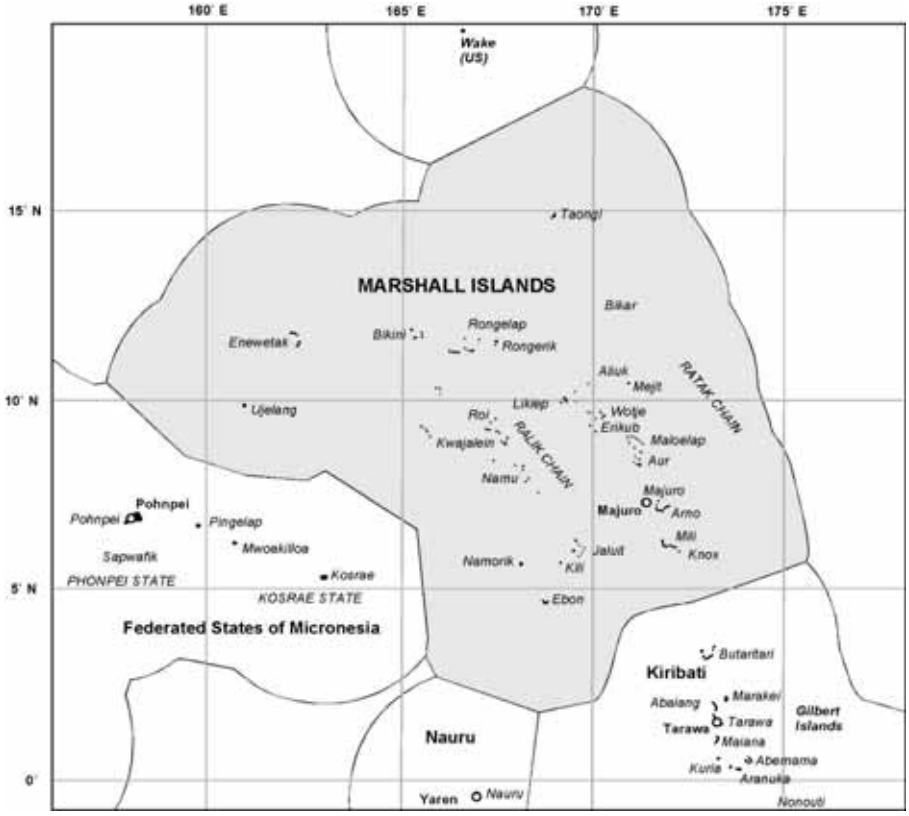
- The Minister is empowered to appoint a Chief Fisheries Officer and licensing officers for the purposes of carrying out the provisions of the Act.
- The President, acting in accordance with the advice of the Cabinet, has wide powers to make regulations relating, inter alia, to the licensing of foreign fishing vessels, the conditions to be observed by foreign fishing vessels, the conservation 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.
- A regulatory framework for the operation of fish processing establishments is created.
- There is a provision to prohibit 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 by the Minister in his discretion.
- 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 was in 2008 when changes were made to extend the fishery limits so as to incorporate all Kiribati waters, to increase penalties for certain offences, to provide for administrative penalties, and to clarify the forfeiture provisions.

Other legal instruments relevant to fisheries include:

- The Marine Zones (Declaration) Act 1983 which defines and establishes a twelve nautical mile territorial sea and a 200 nautical mile exclusive economic zone.
- The Fisheries (Pacific Island Parties' Treaty with United States of America) Act 1988 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 gives legal recognition to ownership of fish traps, reefs and fish ponds.
- Many of the island councils throughout Kiribati have rules concerning fishery practices.

MARSHALL ISLANDS



1. GENERAL GEOGRAPHIC AND ECONOMIC DATA

Area	181 km^2
Water area	2 131 000 km^2
Shelf area	[no continental shelf]
Length of continental coastline	2 106 km (length of the coast of islands)
Population (July 2007)	52 701
GDP at purchaser's value (2007)	156.1 million USD[98]
GDP per head (2007)	2 692 USD
Agricultural GDP (2007)	[not available][99]
Fisheries GDP (2007)	679 000 USD[100] 41.8 million USD[101]

[98] Source: EPPSO (2008). Statistical Tables. Economic Policy, Planning and Statistics Office, Majuro.

[99] GDP estimates are not available for the agriculture sector, but rather for "copra production", "subsistence", and "other". Source: EPPSO (2008). Statistical Tables. Economic Policy, Planning and Statistics Office, Majuro.

[100] This is the official contribution from EPPSO (2008) – which omits subsistence fishing and small-scale commercial fishing.

[101] Re-calculation of fishing contribution to GDP; From Gillett, R. (2009). The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories. Pacific Studies Series, Asian Development Bank, Manila.

2. FISHERIES DATA

2005	Production	Imports	Exports	Total supply	Per caput supply
	tonnes liveweight				kg/year
Fish for direct human consumption[102]	56 664	485	28 901	668[103]	11.7
Fish for animal feed and other purposes	–	–	–	–	–

Estimated employment (2007)	
(i) Primary sector (including aquaculture)	281[104]
(ii) Secondary sector	[unavailable]
Gross value of fisheries output (2007)	108.1 million USD[105]
Trade (2007)	
Value of fisheries imports	[unavailable]
Value of fisheries exports	37.3 million USD[106]

3. FISHERY SECTOR STRUCTURE

3.1 Overall fishery sector

The Republic of the Marshall Islands consists of an archipelago of 29 atolls and five low coral islands. The two island chains, the eastern Ratak (Sunrise) and western Ralik (Sunset) lie 129 miles apart in a northwest to southeast orientation. Nineteen atolls and four islands are inhabited.

Fish has historically been an important component of the diet of Marshall Islands residents. Although imported food has gained importance since the 1960s, the consumption of fish remains substantial – and is critically important in the outer islands. The money obtained from licensing foreign fishing vessels to operate in the Marshall Islands zone forms a large component of government revenue. Employment related to servicing fishing vessels and processing fish has become significant in the last decade.

The country's fisheries can be placed into six categories. These categories and the associated production in 2007 are:

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based	Fresh-water	Aquaculture	
						Tonnes	Pieces
Volume of production (metric tonnes of pieces)	950 t	2 800 t	63 569 t	12 727 t	0 t	–	25 000
Value of production (USD)	2 900 000	4 312 000	81 210 390	19 572 712	0	130 000	

Source: Gillett (2009)

[102] Data from FAO food balance sheet of fish and fishery products (in live weight).

[103] Corrected to reflect actual supply.

[104] Source: EPPSO (2008b). Preliminary Employment Statistics for Fiscal Year 2007. Economic Policy, Planning and Statistics Office, Office of the President, Majuro, Marshall Islands. Note: The cited number of jobs is likely to be a large under-estimate as it is based on social security records and therefore omits employment in small-scale commercial fishing.

[105] From Gillett (2009); includes the six fishery production categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally-based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing, and (6) aquaculture.

[106] Source: www.intracen.org/appli1/TradeCom/TP_TP_CI.aspx?RP=584&YR=2002.

Main trends and important issues in the fisheries sector

The main trends in the fisheries sector include:

- A relatively steady number of foreign longline, purse seine, and pole-and-line vessels licensed to operate in the Marshall Islands zone during the present decade.
- A large increase in the fishing contribution to GDP and in the fishery exports of the Marshall Islands during the present decade.
- A general perception among fishery stakeholders that the quality of fisheries governance in the country has improved in the present decade.

Some of the major issues in the fisheries sector are:

- Balancing the benefits from the basing of foreign fishing vessels in Majuro with the environmental and social costs.
- Achieving the appropriate balance between promoting domestic tuna industry development and maximizing government revenue from licensing foreign tuna fishing activity.
- The difficulties of competing internationally in tuna processing from a relatively high-wage location.
- Expansion of Marshallese-flagged industrial fishing fleet in such a way that it does not undermine regional efforts to reduce overall fishing effort.
- Reconciling the costs and the benefits of institutionalizing a grouping of countries within the Forum Fisheries Agency – known as the Parties to the Nauru Agreement (those countries in which most of the tuna resources are found).
- The degree of government support that should be allocated to small-scale fisheries in the outer islands and to aquaculture development.

3.2 Marine sub-sector

The marine fisheries have two very distinct components, offshore and coastal:

- Offshore fisheries are focussed on tuna and consist of longlining, purse seining, and pole-and-line fishing. These are conducted by vessels that are both local and foreign based.
- Coastal fishing is carried out for subsistence purposes and for sale in local and export markets.

3.2.1 Marine catch profile

The annual catch from locally-based offshore fisheries has ranged in recent years between about 44 000 and 88 000 metric tonnes. Over 90 percent of the catch is tuna, with various species of bycatch making up the balance. In 2007 the foreign-based offshore fleet caught about 12 700 tonnes of tuna and bycatch in the Marshall Islands zone.

There is much inter-annual variation in the amount of tuna captured by purse seine gear in RMI. A climatic event known as El Niño tends to move the fishery to the east of the Marshall Islands zone.

There is considerable uncertainty concerning the levels of catches from the coastal fisheries. Available information on which estimates could be based 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 the exports of fishery products. Using these sources, the production from coastal subsistence fishing is likely to be about 2 800 tonnes and from coastal commercial fishing about 950 tonnes. The latter consist of both food items (e.g. finfish) for domestic consumption and non-food commodities (e.g. trochus, aquarium fish, coral) for export.

3.2.2 Marine landing sites

Locally-based longline vessels unload their catch in Majuro, the capital and largest urban area. Locally-based purse seine vessels transship in Majuro or a port outside the country. Some purse seined tuna is offloaded for processing in Majuro. The foreign-based offshore vessels dispose of their catch either at their home port (mainly in Asia), or is transshipped at Majuro or a port outside the country.

Most coastal commercial catches are landed at the islands which have urban areas: Majuro and Kwajalein. In addition, the government purchases fish in some of the outer islands for transport for sale in urban areas. The outer islands where such purchasing occurs include Arno, Jaluit, Maloelap, Aur, Ailinglaplap, Namu, Likiep and Ailuk.

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

3.2.3. Marine fishing production means

In the offshore fisheries of the Marshall Islands:

- About three-quarters of the catch by locally-based offshore vessels is from purse seining, with the remainder from longlining. Local purse seiners are in the size range of 57 m to 71 m length over all (LOA). The longliners are mostly 26 m to 32 m LOA.
- The catch by foreign-based offshore vessels in the Marshall Islands zone is made by purse seining (in 2007 about 62 percent of the total by volume), pole-and-line fishing (35 percent), and longlining (3 percent). The vessel size is more diverse than the locally-based fleet. Purse seiners range from about 55 m to 90 m LOA. Longliners range from 15 m to 50 m. Pole-and-line vessels (all Japanese) range from 48 m to 65 m LOA.

Capture methods in the coastal fisheries for food fish are diverse, and include spearing, hand-lining, 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 to 40 hp. range.

The two most important non-food fisheries in the country are that for aquarium fish and for trochus:

- 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 free-diving 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 responsible for most of the Marshall Islands trochus catch. Trochus is collected either by free-diving on the reef or gleaning while walking on the reef.

3.2.4 Main resources

The Marshall Islands Marine Resources Authority (MIMRA 2008)[107] gives the catch composition of the offshore catch in 2007:

- The purse seine catch was about 90 percent skipjack, with the balance being mainly small yellowfin and bigeye.
- The longline catch was about 66 percent bigeye and 23 percent yellowfin, with the balance being mainly sharks, albacore, and miscellaneous finfish.
- The pole-and-line catch was over 99 percent skipjack.

[107] MIMRA (2008). Marshall Islands Tuna Fisheries. Working Paper 16, Fourth Regular Session, Scientific Committee of the Western and Central Pacific Fisheries Commission, 11-22 August 2008, Port Moresby, Papua New Guinea.

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. The table shows the 15 most important finfish and 10 most important invertebrates landed by the project in recent years.

Important species capture by the Arno Atoll Fisheries Development Project[108]

English name	Scientific name	English name	Scientific name
Finfish		Invertebrates	
Forktail rabbitfish	*Siganus argenteus*	Elongated clam	*Tridacna maxima*
Rainbow runner	*Elagatis bipinnulata*	Bear's paw clam	*Hippopus hippopus*
Humpback snapper	*Lutjanus gibbus*	Scaly clam	*Tridacna squamosa*
Parrotfish (white)	*Scarus longiceps* and *S.* spp.	Pacific asaphis	*Asaphis violascens*
Marbled grouper	*Epinephelus fuscoguttatus*, *E. microdon* and spp.	Smooth beach clam	*Atactodea* sp.
Yellowfin tuna	*Thunnus albacares*	Turban shell	*Turbo* spp.
Parrotfish (blue & green)	*Scarus* spp.	Trochus	*Trochus niloticus*
Rudderfish	*Kyphosus cinerascens* and *K. bigibbus*	Money cowries	*Cypraea moneta* and *C. annulus*
Surgeonfish (black)	*Acanthurus olivaceus* and *A.* spp.	Ellodid snail	*Pila luteus*
Dash-dot goatfish	*Parupeneus barberinus*	Octopus	*Octopus* spp.
Convict surgeonfish	*Acanthurus triostegus*		
Skipjack	*Katsuwonus pelamis*		
Orangespine unicornfish	*Naso lituratus*		
Yellowstripe goatfish	*Mulloidichthys vanicolensis*		
Bigeye emperor	*Monotaxis grandoculis*		

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 the 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 on the Arno atoll (listed on the table above), excepting species (mainly skipjack) that are caught by motorized fishing craft trolling outside the reef. These species are less common in subsistence catches.

3.2.5 Management applied to main fisheries

Marshall Islands is a member of the Western and Central Pacific Fisheries Commission that 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.

Management objectives

The Marine Resources Act Republic of the Marshall Islands has a section titled "Objectives and purposes for fisheries management and development". That section states:

> The Marshall Islands Marine Resources Authority shall take into account the following objectives and purposes [in making] management decisions, including the approval of fisheries management and development plans in accordance with this Act: a) establish priorities for the utilization of the

[108] Source: MIMRA (unpublished data).

fisheries resources which will provide the greatest overall benefits to the country; (b) ensure the proper conservation of the fishery resource through the prevention of overfishing and the taking of a precautionary approach toward harvesting when information and data about the fishery resource are lacking; (c) base management practices on sound management principles and the best scientific information available, to be gained through national and international research programmes; (d) minimize, to the extent practicable, fishing gear conflicts among users; and (e) develop the fisheries sector in accordance with the best interests of the country.

MIMRA (2009)[109] indicates that fishery management objectives of the Marshall Islands are "to support responsible, sustainable fisheries development; and to ensure the preservation of coastal, reef and lagoon resources primarily for nutrition, food security and small-scale sustainable income earning opportunities for the community." With respect to the tuna fisheries, the document states that the objectives 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.

Measures and institutional arrangements

The management measures for the offshore fisheries of the Marshall Islands are detailed in the "The Marshall Islands Tuna Management and Development Plan". The two main measures are: (a) a longline licence limit of 65 annual licences to attain bigeye conservation objectives, and (b) unspecified mechanisms for "Reduction of foreign fishing effort to allow for the expansion of domestic fleets". In addition to the measures documented in the plan, there is also a sub-regional measure that is used by the Marshall Islands and other Pacific Island countries that have a significant amount of tuna purse seine activity: a limitation on purse seine effort in the form of a maximum number of purse seine fishing days in each country.

The Marshall Islands Marine Resources Authority (MIMRA) has the institutional responsibility for offshore fishery management. The Authority formulates and implements management measures as per the Marine Resources Act, Republic of the Marshall Islands.

Management measures for coastal fisheries are not well documented. Although MIMRA responsibilities include coastal fisheries management, the Authority's current interventions in coastal fisheries are largely oriented to assistance with developing resource management institutional arrangements in the outer atolls, and with fish transporting and marketing arrangements. In practice, the authority for fisheries management is devolved to local island governments. Management measures vary considerably between islands, from virtually no measures to various types of bans. Perhaps the best known ban is the prohibition of taking trochus except during short open seasons.

According to the Marshall Islands mariculture development plan,[110] a number of outer island communities are now working actively to develop community-based fisheries management plans and establish Marine Protected Areas to protect their marine resources, fish stocks and fish habitats. Key components of these efforts are new initiatives to develop alternative sources of income.

Beger *et al.* (2008)[111] state that marine fisheries management in the RMI was traditionally accomplished at the direction of local chiefs, but this has changed dramatically over the years. One important traditional fisheries management tool implemented by chiefs was the establishment of a "mo". A mo, like a modern

[109] MIMRA (2009). The Marshall Islands Tuna Management and Development Plan (2009-2011). The Marshall Islands Marine Resources Authority, Majuro.

[110] Anon (2004). Policies and Priority Actions for Sustainable Mariculture Development in the Republic of the Marshall Islands. The Marshall Islands Marine Resources Authority, Majuro.

[111] Beger, M.D. Jacobson, and S. Pinca (2008). The State of Coral Reef Ecosystems of the Republic of the Marshall Islands. In: The State of Coral Reef Ecosystems of the United States and Pacific Freely Associated States: 2008. National Oceanic and Atmospheric Administration, Technical Memorandum NOS NCCOS 73.

marine reserve, was essentially a spatial management tool that instituted taboos against fishing in particular areas in order to conserve food resources and for the community to live in harmony with the environment. The rules and regulations for mo varied across the archipelago and would often involve rituals and chants. There was the belief that failure to observe the mo could have significant negative consequences, such as a bad storm for the homeward journey or a tragic accident for a member of the visiting party. Other methods for conserving natural resources included seasonal harvesting of different species and other restrictions.

3.2.6 Fishing communities

The concept of "fishermen communities" is not very relevant to the Marshall Islands. 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, the Majuro urban area. Coastal commercial fishers are found mostly in the two urban areas, but they do not reside in specific communities. Nearly all households in coastal villages are involved in coastal fishing activities. It could therefore be stated that all non-urban communities in the Marshall Islands are 'fishing communities'.

3.3 Inland sub-sector

There are no inland fisheries in the Marshall Islands.

3.4 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 Majuro and Kwajalein there is some sportfishing (mainly offshore trolling). One hotel/retail company operates a sport charter vessel. The Marshall's Billfish Club holds an annual fishing tournament (the 2008 tourament was the 26th yearly event), and several "mini-tournaments". These competitions have prize categories for billfish, tuna, wahoo, barracuda, and bottomfish.

3.5 Aquaculture sub-sector

Anon. (2004) emphasizes the major aspects of past aquaculture in the country. These include:

- The lack of major storm activity in the RMI makes for sheltered lagoons an ideal location for mariculture, especially on the leeward side of the atoll islands.
- Most aquaculture efforts in the past have focused on marine invertebrates such as black-lip pearl oysters, giant clams, trochus, and corals.
- There has been an emphasis on using locally occurring species. This means that comparatively less is known about the basic biology, culture, and ecology of these species as opposed to species such as tilapia or milkfish, which have a long history of global domestication.
- All mariculture in the RMI relies heavily on wild stock at some point in the life cycle and is conducted in sensitive habitats. Thus, even for species with relatively well known culture technology such as giant clams, there is still much to learn from experimentation and broader research.

A large number of aquaculture activities have been carried out in the Marshall Islands. The table lists many of those activities.

Aquaculture operations in the Marshall Islands

Activity	Species	Location	Time period
Public and educational			
Kwajalein Giant Clam Mariculture	Smooth giant clam from Palau (*Tridacna derasa*)	Kwajalein	1989-?
Namdrik Black Pearl Project	Black-lip pearl oyster (*Pinctada margaritifera*)	Namdrik	1990-1995
Giant Clam Hatchery/ Outer Island Farmers Programme	Fluted clam (*Tridacna squamosa*)	Ailuk, Aur, Jaluit, Likiep, Maloelap, Ujae, Wotje	1993-1995
Likiep Clam Farm	Elongated giant clam and giant clam (*Tridacna* spp.,)	Likiep	1993-present
Arrak Experimental Pearl Oyster Hatchery	Black-lip pearl oyster (*Pinctada margaritifera*)	Majuro	2001-present
Arrak Demonstration Pearl Oyster Farm	Black-lip pearl oyster (*Pinctada margaritifera*)	Majuro	2003-present
Seaweed Cultivation	Seaweed (*Eucheuma cottonii*)	Majuro Jaluit	2002-present
Arno Clam Hatchery	Elongated giant clam (*Tridacna* spp., mostly maxima) and potentially rabbitfish (*Siganus*)	Arno	2003-present
Commercial			
Giant Clam Aquaculture*	Giant clam (*Tridacna gigas*)	Mili	1988
Mili Giant Clam Farm	Giant clam (*Tridacna gigas, T. squamosa, T. gigas*)	Wau Island, Mili	1988-present
Marshall Islands Mariculture Farm	Giant clams (esp. *Tridacna maxima* and *T. crocea*), hard and soft coral, live rock	Wau Island, Majuro	1995-present
RRE Pearl Oyster Farm at Arno	Black-lip pearl oyster (*Pinctada margaritifera*)	Arno	1995-present
RRE Pearl Oyster Farm at Jaluit	Black-lip pearl oyster (*Pinctada margaritifera*)	Jaluit	2001-present
BPOM Pearl Oyster Farm at Arno	Black-lip pearl oyster (*Pinctada margaritifera*)	Arno (relocated from Majuro in 2002)	1998-present
Woja Pearl Oyster Hatchery	Black-lip pearl oyster (*Pinctada margaritifera*)	Majuro (requires modifications to be operational)	1998-present
Outer Island Project	Black-lip pearl oyster	Jaluit	2003-present

Source: Anon (2004)[112]

A recent study by the Asian Development Bank (ADB, Gillett 2009) states that in the Marshall Islands in recent years there have been two types of aquaculture with significant production, namely giant clams and black pearls:

- In 2007 there was one commercial clam farm, and two farms that operated primarily for stock enhancement purposes, but which also made some commercial sales. Giant clam production in the Marshall Islands in recent years has been 20 000 to 30 000 one-inch clams annually, with a farm-gate of about USD3.50 apiece. A production of 25 000 clams equates to USD87 500.
- The most recent harvest of cultured black pearls occurred in early 2005 when 2 000 to 3 000 pearls were harvested, each with a farm-gate value of USD50.
- Annual aquaculture production in the Marshall Islands in recent years is estimated to be about 25 000 pieces, worth USD130 000.

[112] Anon (2004). Policies and Priority Actions for Sustainable Mariculture Development in the Republic of the Marshall Islands. The Marshall Islands Marine Resources Authority, Majuro.

4. POST-HARVEST USE

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.

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 is primarily non-food, with the aquarium fish and coral for USA markets and the trochus for button factories in Asia and Europe. The major food fish exports are the shipments of fish taken as personal baggage on regular commercial flights to Honolulu, Hawaii.

5. FISHERY SECTOR PERFORMANCE

5.1 Economic role of fisheries in the national economy

A recent study by the Asian Development Bank attempted to quantify the fishery-related benefits received by the Marshall Islands in various categories. The study gave the available information (focused on 2007) on the contribution of fishing/fisheries to GDP, exports, government revenue, and employment. The results can be summarized as:

- Official estimates show that fiscal year 2007 fishing was responsible for 0.4 percent of the GDP of the Marshall Islands. A recalculation shows it to be 26.7 percent.
- By one estimate, exports of fishery products are about 4.3 percent of all exports.
- Access fees paid by foreign fishing vessels represented 5.43 percent of all government domestic revenue in fiscal year 2007.
- There have been no good estimates of the number of jobs related to fishing.

From the above it can be seen that fisheries make a relatively important contribution to GDP, exports and government revenue.

5.2 Demand

The annual per capita consumption of fish in the Marshall Islands, based on the 2005 FAO food balance sheet, is 11.7 kg. Various other studies have made estimates ranging between 38.9 and 59.0 kg. Considering the population of the Marshall Islands, 30 kg of fish consumption per capita translates into a 2010 demand for about 1 600 tonnes of fish.

Factors influencing the future demand for fish are a rising population, the price of fish, relative cost of fish substitutes, remittances from relatives in the USA, and payments by the government of the USA to the Marshall Islands.

5.3 Supply

The government has several strategies to increase the national fish supply. These involve facilitating private sector growth, promotion of aquaculture, and supporting the marketing of fishery products landed in the non-urban parts of the country.

Major factors affecting the local supply of fish are overfishing near urban areas, transport links to the outer islands, marketing assistance/subsidies, and the production of non-export grades of fish by the offshore fleet.

5.4. Trade

The International Trade Centre has an export database derived from mirror data (partner countries trade data). The ITC data for the fishery exports of the Marshall Islands are given in the table.

Marshall Islands export data from ITC (USD thousands)

	2002	2003	2004	2005	2006
All industries	227 132	197 797	155 153	778 629	873 660
Fish, crustaceans, mollusks, aquatic invertebrates	80 491	38 223	55 798	61 765	37 342
Percentage of exports of fishery products to products from all industries	35.4%	19.3%	36.0%	7.9%	4.3%

Source: www.intracen.org/appli1/TradeCom/TP_TP_CI.aspx?RP=584&YR=2002

With exports from coastal fisheries and aquaculture amounting to less than one million dollars, the vast majority of fishery exports of the country are from the offshore fisheries.

5.5 Food security

Although the national per capita fish consumption in the Marshall Islands is not high in relation to neighbouring countries, fish is important in food security. This is because the presently abundant imported food is subject to shocks (e.g. changes in levels of payments by the government of the USA). Another reason is that the most vulnerable communities in the country are those in the outer islands – and they are highly dependent on fish for daily nutrition. For example, a study carried out in 2002 by McCoy and Hart (2002) shows that the annual per capita consumption of "local marine animals" by the 1 915 people on Ailinglaplap Atoll in 2001 was 42.3 kg. It also should be noted that the Marshall Islands atoll environment is not favourable for raising protein alternatives, such as poultry or livestock.

5.6 Employment

In early 2008 the Economic Policy, Planning and Statistics Office carried out an employment survey in the country.[113] The survey obtained data from Social Security records "plus EPPSO non-reported estimates". The results showed that in 2007 there were 281 people with jobs in fishing out of a total of 10 149 jobs in the country (i.e, fishing provided 2.8 percent of the jobs). It should be noted, however, that there is likely to be a significant number of people employed in fisheries jobs that do not make Social Security contributions. The accuracy of "EPPSO non-reported estimates" for these people not captured by the Social Security system is unknown, but seems very low.

An Asian Development Bank study tracked the number of jobs related to tuna fisheries (fishing and post-harvest) over a seven-year period:

Employment in the tuna fisheries of the Marshall Islands[114]

	2002	2006	2008
Local jobs on vessels	5	0	25
Local jobs inshore facilities	457	100	116
Total	**462**	**100**	**141**

[113] EPPSO (2008). Preliminary Employment Statistics for Fiscal Year 2007. Economic Policy, Planning and Statistics Office, Office of the President, Majuro, Marshall Islands.

[114] Source: Gillett (2009).

5.7 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 to transporting and marketing fish from those areas in the urban areas of Majuro and Kwajalein.

The three latest Marshall Islands Marine Resources Authority annual reports (MIMRA 2008, 2007, 2006) give the amounts of fish purchased by the Authority in the outer islands. During the three-year period MIMRA purchased annually an average of 32.6 tonnes of fish for USD60 784.

Aquaculture development is also associated with rural development. In 2003, the Marshall Islands Mariculture Working Group and Steering Committee formulated a vision for sustainable aquaculture in the country. That vision included "Outer island aquaculture production that links with operations and transportation systems in Majuro".

6. FISHERY SECTOR DEVELOPMENT

6.1 Constraints and opportunities

Some of the major constraints of the fisheries sector are:

- Difficulties associated with marketing products from the remote areas where abundance is greatest to the urban areas where the marketing opportunities are greatest.
- Fuel cost increases which have a disproportionate effect on the small-scale motorized fisheries.
- Difficulties for small-scale fishers in accessing the offshore fishery resources.
- The high mobility of skilled Marshallese labour due to easy entry into the USA.
- Balancing the benefits from the basing of foreign fishing vessels in Majuro with the environmental and social costs.
- The difficulties of competing internationally in tuna processing from a relatively high-wage location.
- Expansion of Marshallese-flagged industrial fishing fleet in such a way that it does not undermine regional efforts to reduce overall fishing effort.

The opportunities in the fisheries sector include:

- Value-adding to the fishery products, for domestic consumption, sales to the military, and for export.
- Expansion of the marine aquarium fishery.
- Greater use of fish aggregating devices to promote offshore fishing by small-scale fishers.
- Greater use of management 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 USA.
- Taking advantage of the relatively good infrastructure: a deepwater port, extensive fuel capacity, reliable electricity, air and shipping connections, wholesalers, hotels and limited engineering facilities.

6.2 Government and private sector policies and development strategies

An FAO project reviewed fisheries policies in the Marshall Islands[115] and concluded that policies are articulated in a variety of documents, including:

- Fisheries Policy Statement of 1997;
- National Fisheries Development Plan of 1997;
- 2000 Economic Report and Statement of Development Strategies published by ADB in April 2001;
- Strategic Development Plan Framework 2003-2018 of the Vision 2018 exercise, produced in June 2001;
- Marshall Islands Fisheries Sector Master Plan produced for the Vision 2018 exercise in November 2002; and
- Policy on Sustainable Mariculture Development in RMI of August 2004.

RMI fisheries policy is premised 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 through the interventions of an enhanced fisheries agency. Accordingly, the government approved a policy for the development of fisheries about a decade ago. It directed a restructuring of the Marshall Islands Marine Resource Authority to allow it become a more autonomous and self-funding authority. The objective was to release MIMRA from the standard civil service restraints that regulate most public services, and allow it to be more corporate and commercially oriented. To further release MIMRA from these "public service" bounds, its board of directors was reconstituted (Stanley 2005).

This change to MIMRA resulted in a number of changes to the fisheries development environment in the country. One of the most significant policy-promoted changes is described by ADB (2005):[116]

> The government embraced an approach to the fisheries sector that went well beyond licensing of foreign vessels. It encouraged spending by foreign fishing boats in the local economy and prioritized establishing onshore fish processing and other support facilities. Taking a global view of the fishing industry, the Marshall Islands formed pragmatic alliances with fishing states and worked with them to improve their financial performance. Instead of trying to displace private sector participants on a small-scale, the policy environment favoured working with them and attracting investments in service and support activities on a larger-scale. The Government, once the driving force behind the domestic fisheries industry, accepted a facilitating and regulatory role.

The development of small-scale fisheries in the Marshall Islands is closely tied to Japanese government aid. The first rural fishing centre, with boats and gear, was established by Japan on Arno in 1989. Freezers, an ice plant and other infrastructure were added in the early 1990s. About this time, Japanese aid was also used to build a MIMRA dock and processing facility for coastal fisheries. MIMRA's Coastal Fisheries Division has an outer-islands fishing project that collects and helps market fish through two markets and seven fish bases, with assistance from Japan. (Barclay and Cartwright 2006).[117]

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[115] Source: Stanley, J. (2005). Fishery policy in the Marshall Islands. FAO/FishCode Review. No. 15. Food and Agriculture Organization, Rome.

[116] Source: ADB (2005). Pacific Progress – Asian Development Bank Success Stories in the Pacific Islands. Asian Development Bank, Manila.

[117] Barclay, K. and I. Cartwright (2006). Capturing Wealth from Tuna: Key Issues for Pacific Island Countries. Australian National University.

6.3 Research

The latest annual report of MIMRA indicates the following research activities:[118]

- Research on rearing of black pearl oysters at Woja
- Research on two grouper species and rabbitfish species.

Beger *et al.* (2008)[119] described the Natural Resources Assessment Surveys (NRAS). NRAS-Conservation, a local NGO, along with the College of the Marshall Islands and MIMRA began such efforts to document the status of Marshall Island reefs. NRAS expeditions comprising a team of 9-10 international and local Marshallese scientists surveyed reef habitats at Likiep (2001), Bikini (2002), Rongelap (2002-2003), Mili (2003), Namu (2004), Majuro (2004) and Ailuk (2006). The NRAS surveys include baseline data on fish, sharks, corals, invertebrates and marine algae. Summary information is available at: http://www.nras-conservation.org. NRAS rapid ecological assessments are intended to serve as baseline data for managers and scientists to aid in the establishment of marine protected areas.

Much of the research on the offshore fisheries resources is carried out in cooperation with the Oceanic Fisheries Programme of the Secretariat of the Pacific Community. 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).

Fishery resource profiles prepared by the Forum Fisheries Agency[120] in 1992 summarize much of the older research carried out on 27 categories of fisheries resources (e.g. trochus, clams).

6.4 Education

Education related to fisheries in the Marshall Islands is undertaken in a variety of institutions:

- Basic education in disciplines related to fisheries is given at the College of Micronesia in Majuro.
- Academic training in biological, economic and other aspects of fisheries is given at the University of the South Pacific in Suva, Fiji.
- Other academic training related to fisheries has been received by Marshallese in tertiary institutes in Hawaii, Guam, mainland USA, and New Zealand.
- Training courses in various fisheries-related subjects are frequently organized by the Secretariat of the Pacific Community in New Caledonia and the Forum Fisheries Agency in the Solomon Islands.

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 2008) gives information on assistance from Japan.

> The Overseas Fisheries Cooperation Foundation (OFCF) began the current series of fisheries projects in 1992. Assistance has ranged from repairs and restoration of fisheries related facilities to skills, technology and knowledge being transferred. Each year, during the annual OFCF Japan/ Pacific Island Nations Fisheries Directors Meeting on Fisheries Cooperation, OFCF receives requests from each country for projects. After conducting field surveys and consultation with each government, the scope of the projects are developed followed by a drafting and signing of the

[118] Source: MIMRA (2008) Marshall Islands Marine Resources Authority Annual Report 2006/2007. Marshall Islands Marine Resources Authority, Majuro.

[119] Beger, M.D. Jacobson, and S. Pinca (2008). The State of Coral Reef Ecosystems of the Republic of the Marshall Islands. In: The State of Coral Reef Ecosystems of the United States and Pacific Freely Associated States: 2008. National Oceanic and Atmospheric Administration, Technical Memorandum NOS NCCOS 73.

[120] Source: Smith, A. (1992). Republic of the Marshall Islands: Marine Resources Profiles. Honiara: FFA Report 92/78, Forum Fisheries Agency, 90 pp, 108 p.

Memorandum of Understanding and Implementation Plan. Recent projects implemented in the Marshall Islands include:

- Repair and Restoration of the main engine of F/V Lentanir and F/V Laintok;
- Replacement of the radio communication equipment including that of MIMRA;
- Advice on management and operation of F/V Jolok; and
- Advice to MIMRA regarding management and operation of the ice making facilities.

The main multilateral donors to the Marshall Islands in the fisheries sector are ADB and FAO. ADB has provided USD6.95 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 (ADB 2005). Recent FAO support has included a fishery policy study and the provision of technical services at the Woja Black Pearl Hatchery.

The regional organizations serving Pacific Island countries, including the Forum Fisheries Agency, the Secretariat of the Pacific Community, the South Pacific Regional Environment Programme, the Forum Secretariat, and the South Pacific Applied Geoscience Commission, have also been active in supporting the Marshall Islands' fisheries sector.

7. FISHERY SECTOR INSTITUTIONS

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 somewhat 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.

MIMRA is responsible to a board of directors, of which the Minister of Resources and Development is Chairman. 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:

- 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:

- 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 Centre
- Legal affairs

In 2005 an FAO study reviewed MIMRA. The report of the study (Stanley 2005) made several recommendations: (i) formulation of a consolidated policy statement that embraces all fisheries jurisdictions and programmes and activities in the three subsectors of ocean fisheries, coastal fisheries and mariculture; (ii) greater emphasis on collaboration with the private sector and outer island

communities in development and management of RMI marine resources; (iii) elaboration of a corporate plan for the Marshall Islands Marine Resources Authority (MIMRA); (iv) review of the Authority's existing budget layout and its possible recasting in a format that better reflects costs where incurred and outputs expected from each division; (v) adopting a cautious and transparent approach with regard to outer island income-generating activities, with attention to partnerships between communities and private business concerns and the use of incentives involving seed funding, technical assistance, transport facilitation and other support activities; (vi) action to implement operation of the MIMRA Revolving Trust Fund as soon as possible; and (vii) the need for a detailed review of capacity building and training needs for both the Authority and stakeholders in atoll communities, followed by elaboration of a long-term training and human resources development schedule as part of MIMRA's work programme.

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 – operators of the tuna processing plant
- Marshall Islands Fishing Venture – operators of locally-based longliners
- Koo's Fishing Company – operators of Marshall Islands registered purse seiners
- Numerous small-scale commercial fishers
- The Marshall's Billfish Club – comprised of gamefishing enthusiasts

Some of the important internet links related to fisheries in the Marshall Islands are:

www.spc.int/Coastfish/Countries/Marshalls/Marshalls.htm – 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.billfishclub.com – Information on the Marshall Island 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.

8. GENERAL 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/development issues, management and development of local fisheries, trade, foreign/domestic based fishing, licensing, and MCS. The section on conservation/management/development covers the following topics:

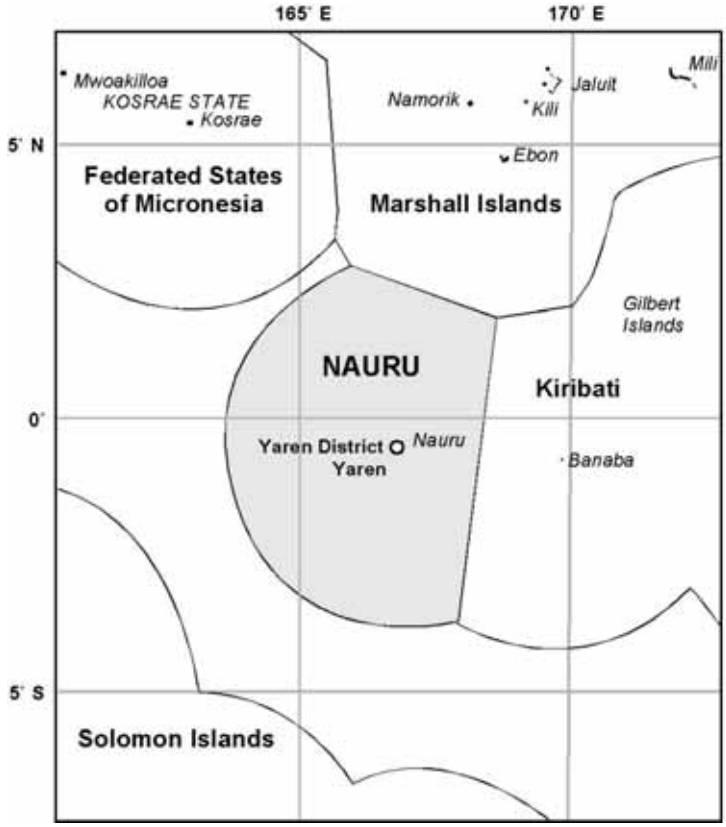
- The responsibilities of MIMRA with respect to Conservation, management and sustainable use of the fishery resources
- Objectives and purposes for fisheries management and development
- Determining total level of fishing and allocations of fishing rights
- Determining participatory rights in fishery
- 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 vessel or gear
- Use or possession of prohibited fishing gear
- Prohibition of driftnet fishing activities

With respect to the responsibilities of MIMRA, 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 sub-regional, 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 sub-regional, regional and international organizations or arrangements relating to fisheries;
- Participate in the planning and execution of projects, programmes or other activities.

NAURU



1. GENERAL GEOGRAPHIC AND ECONOMIC DATA

Area	21 km^2
Water area	320 000 km^2
Shelf area	[no continental shelf]
Length of continental coastline	24 km
Population (2007)*	10 000
GDP at purchaser's value (2006-2007 fiscal year)	21.1 million USD[121]
GDP per head (2006-2007 fiscal year)	2 408 USD
Agricultural GDP (2006-2007 fiscal year)	2.9 million USD[122]
Fisheries GDP (2006)	2.2 million USD[123]

* UN Population Division

[121] Source: http://www.spc.int/prism/country/nr/stats/Statistics/Economics/GDP/gdp_current.htm; conversion rate : 1 AUD = 0.786 USD.

[122] The agriculture contribution to GDP includes fishing.

[123] An "official" contribution of fishing to GDP has not been calculated. This is the figure that is given in ADB (2007). A recalculation shows the total fishing contribution to be USD1.0 million: Gillett (2009). The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories. Pacific Studies Series, Asian Development Bank, Manila.

2. FISHERIES DATA

2007	Production	Imports	Exports	Total supply	Per caput supply
	tonnes liveweight				kg/year
Fish for direct human consumption[124]	39	0	0	39	3.9
Fish for animal feed and other purposes	0	0	0	0	0

Estimated Employment (2005)	
(i) Primary sector (including aquaculture)	4 513 people[125]
(ii) Secondary sector	Unavailable
Gross value of fisheries output (2007)	97 million USD[126]
Trade (2007)	
Value of fisheries imports	(unavailable)
Value of fisheries exports	Zero USD[127]

3. FISHERY SECTOR STRUCTURE

3.1 Overall fishery sector

Nauru is a single, raised coralline island with a land area of only 21 sq km but with an EEZ which extends over more than 431 000 sq km. The island lies 41 km south of the equator. Nauru was formerly rich in phosphate, which has been the country's principal source of income for many years. Phosphate 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 offers limited opportunity for agricultural production, and fisheries development is considered to be a major economic prospect for the future.

Although possessed of 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. Nauru's open ocean areas are frequented by an abundance of tuna and other pelagic species. The harvests of tuna in Nauru waters is substantial, but the vast majority of the catch is taken by overseas-based industrial fishing vessels. The access fees paid by those vessels form a large portion of the government revenue.

Fisheries in the waters of Nauru can be placed into six categories. These categories and the associated production in 2007 are estimated as:

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based[128]	Fresh-water	Aqua-culture
Volume of production (metric tonnes)	200	450	0	69 236	0	8
Value of production (USD)	840 336	661 345	0	80 001 361	0	15 126

Source: Gillett (2009)

[124] Data from FAO food balance sheet of fish and fishery products.

[125] CoFish (2005) gives the results of fisheries-focused socio-economic surveys carried out in Nauru in October and November 2005. Survey results indicate an average of 3.7 fishers per household; when this is extrapolated, the total number of fishers in Nauru is 4 513. Source: CoFish. 2005. Nauru Country Report: Profile and Results From In-Country Survey Work. Pacific Regional Coastal Fisheries Development Programme (Cofish), Secretariat of the Pacific Community, Noumea.

[126] From Gillett (2009); includes the six fishery production categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally-based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing, and (6) aquaculture.

[127] Currently there are no exports of fishery products from Nauru. The last export shipment of fresh tuna from the domestic longline operation was in 2001.

[128] This is the catch in the Nauru zone by vessels based outside the country. Normally, in FAO reporting on the production in world capture fisheries, this catch will be reported as the catch of the nation(s) in which the vessel(s) is (are) registered.

Main trends and important issues in the fisheries sector

The main trends in the fisheries sector include:

- An increasing reliance on coastal and inshore fishing for food security and employment.
- A recent increase in capacity of the government fisheries agency in fisheries management and development.
- After considerable variability in offshore tuna catches in the early 2000s, the catches have been fairly steady.
- An increase in enthusiasm for tuna management and development arrangements with neighbouring Pacific Island countries.
- An increasing reliance by the Nauru Government on offshore fishery licensing fees.

Some of the major issues in the fisheries sector are:

- The rapid changes in inshore fishing brought about by the economic downturn (Box below).
- The capacity of Nauru Fisheries and Marine Resources Authority (NFMRA) to deliver its mandate at a time of financial stringency.
- The desire to progress from simply licensing foreign fishing vessels to a situation where the country is benefiting from catching and processing; i.e. capitalizing on the fact that the Nauru EEZ is one of the most favourable for tuna purse seining.
- Reconciling the costs and the benefits of institutionalizing a grouping of countries within the Forum Fisheries Agency – known as the Parties to the Nauru Agreement (those countries in which most of the tuna resources are found).
- The difficulties and expense of promoting access by small-scale fishers to the relatively large offshore tuna resources.
- The limitations of using inshore fishery resources for food security purposes.

The changes in inshore fishing due to the economic downturn[129]

With the economic downturn in Nauru, the drastic change in people's purchasing power, loss of paid employment, standardised salaries and working without wages have forced a change not only in lifestyle but also in social arrangements. There has been a rekindling of traditional systems, with people bartering food, helping out disadvantaged families and building up communal ties and social activities.

Fishing pressure and intensity have increased dramatically since the mid-2000s, with almost all households involved in fishing. Fishing and fisheries resources play a major role in sustaining people's livelihoods and have become the fall-back option for most people. The dynamics of fishing have totally changed, with children, women and men increasing fishing participation, targeted species changing depending on what people can get, and distribution systems changing with increased selling and sharing of seafood. Although fishing involvement has rapidly increased, the gear used has largely remained the same. The use of powered boats, night diving and other advanced gear is restricted by lack of fuel, lack of affordability, an inability to buy batteries, and so on. Outboard motors are rarely used and pelagic fishing is dominated by those with canoes (usually people from Tuvalu and Kiribati). People are generalists, collecting all invertebrate or finfish species they come across. They are starting to walk longer distances to fish or glean, and sometimes do not catch anything at all. There is a decrease in the size of catches, and also a decline in the number of catches. People are moving into harvesting and consuming species not harvested before (e.g. certain types of bêche-de-mer and sea urchin).

[129] Vunisea, A. (2007). Fishing to Sustain Livelihoods in Nauru. Women in Fisheries Information Bulletin #16, Secretariat of the Pacific Community, Noumea.

3.2 Marine sub-sector

The marine fisheries have two very distinct components, offshore and coastal:

- There is no domestic fleet operating in offshore area. Offshore fisheries focussed on tuna consist entirely of purse seining by foreign based vessels.
- Coastal fishing is carried out for subsistence purposes and for sale in local markets.

3.2.1 Marine catch profile

The annual catch from offshore fisheries has range in recent years between about 20 000 and 67 000 metric tonnes. Over 90 percent of the catch is tuna, with various non-tuna species making up the balance. Total catch made by foreign-based vessels using purse seine gear within the Nauru EEZ is estimated as:

Volume and values of catches by offshore fishing in the Nauru EEZ[130]

	2003	2004	2005	2006	2007
Volume total catch (tonnes)	20 387	70 660	53 542	60 172	69 236
Value total catch (USD)	13 625 102	54 680 868	43 047 300	50 749 735	80 001 361

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.

There have been three substantive attempts to estimate coastal fisheries production in Nauru in recent years:

- Dalzell *et al.* (1996) gave the following catch information: Subsistence fisheries – 98 tonnes; Commercial fisheries – 279 tonnes.
- Gillett and Lightfoot (2001) considered the surveys above and other sources of information to produce an estimate of coastal commercial fisheries production of 315 tonnes and an estimate of coastal subsistence production of 110 tonnes.
- Gillett (2009) considered the two surveys above and recent changes in Nauru (economy, population) and estimated of coastal commercial fisheries production to be 200 tonnes and that for coastal subsistence production to be 450 tonnes.

3.2.2 Marine landing sites

Catches from the offshore fishery are not offloaded in Nauru. Depending on the flag of the vessel caught tunas are either transshipped for transport to a cannery (seiners from Taiwan and Korea), delivered directly to Pago Pago (US 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 the fishers swim, wade, or walk ashore. Most of the catch from fishing further offshore from canoe and skiffs is landed at a few man-made 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.

3.2.3 Marine fishing production means

In recent years the offshore catches have been made entirely by purse seine gear. In 2008 vessels from ten countries were licensed to fish in the Nauru zone:

[130] Source: FFA (2008) with modifications by consultant; FFA (2008). The Value of WCPFC Tuna Fisheries. Unpublished report, Forum Fisheries Agency, Honiara.

Fishing vessels licensed to Nauru in 2008[131]

Country	Total number of vessels	Vessel tonnage		
		501-1 000 GRT	1001-1 500 GRT	1500+ GRT
Japan	33	1	30	2
Korea	27	11	13	3
New Zealand	3	0	1	2
Taiwan Province of China	33	18	16	1
USA	9	2	18	16
China	10	5	5	2
Vanuatu	6	0	0	3
Federated States of Micronesia	3	1	0	2
Kiribati	1	0	1	0
Marshall Islands	5	0	5	0
Total	**130**	**38**	**89**	**31**

Fishing methods used in the coastal and inshore fisheries are quite diverse. These are given in the table.

Coastal and inshore fishing methods[132]

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 overall available, 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

3.2.4 Main resources

According to NFMRA (2009), in 2008, the offshore tuna catch taken by purse seiners consisted of 80 percent skipjack, 18 percent yellowfin, and 2 percent bigeye. Other species including blue marlin, wahoo, and various sharks is characteristically about 5 percent of the entire catch.

FFA (2007) summarizes the coastal and inshore species by fishing area:

[131] Source: NFMRA (2009). Nauru – Annual Report to the Commission. WCPFC-SC5-AR/CCM-13, Nauru Fisheries and Marine Resources Authority.

[132] Source FFA (2007). Nauru Fisheries and Marine Resources Authority, Coastal Fisheries Department. Working Paper 3, Institutional Strengthening Project, Forum Fisheries Agency, Honiara.

The main species by coastal/inshore fishing area

Fishing area	Species
Reef flat, reef crest and surf zone	Molluscs, crustaceans, some bêche-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 as – scarids, acanthurids, carangids, shallow-water serranids, lutjanids and lethrinids and ranging reef-associated pelagics
Reef slope and deepwater to 400 m	Deepwater 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

3.2.5 Management applied to main marine fisheries

Nauru is a member of the Western and Central Pacific Fisheries Commission that 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.

In the early 2000s a National Tuna Fishery Strategy was prepared. In 2005 Nauru National Tuna Management and Development Plan was prepared. Neither document was officially adopted, and therefore they cannot be relied upon to provide accurate information on national management arrangements. Nevertheless some insight can be obtained by examining the management objectives in the Plan:

- 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;
- Minimising 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

From an historical perspective, most national offshore fishery management efforts have been focused on the objective of generating revenue for the Nauru Government through licensing foreign fishing vessels. These efforts have been quite successful: access fees represented 20.3-21.0 percent of government revenue in fiscal year 2006/07 and 17.2 percent in 2007/08 (Gillett 2009).

There has been a large amount of regional cooperation in the management of offshore fisheries. This has been exercised primarily through the Parties to the Nauru Agreement (PNA) – see Box.

The PNA has implemented a number of management arrangements. These include a set of non-negotiable minimum terms and conditions for foreign fishing vessel access and a limit on the number of purse seine vessels operating in the region under bilateral licensing arrangements. Currently the PNA countries (including Nauru) are implementing a limitation on purse seine effort based on the number of vessel days. According to FFA (2007), under the vessel day scheme, PNA parties are to be assigned a Party Allowable Effort, which is based 50 percent on the distribution of the relative biomass of skipjack

The PNA[133]

In February 1982 the Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest (hereafter referred to as the Nauru Agreement) 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: PNG, FSM 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.

and yellowfin tuna, calculated as the average over a 10-year period, and 50 percent on the average number of vessel days/year fished in the waters of the Parties, calculated over a seven-year period.

With respect to coastal and inshore fisheries management, there is little government intervention in the inshore fisheries (CoFish 2005).[134] This situation is summarized in the box 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 consulting communities and development of draft community fisheries legislation as the basis for community-based management for coastal fisheries.

The lack of inshore fisheries management[135]

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.

The Nauru Fisheries and Marine Resource Authority (NFMRA) provides the institutional framework for fisheries management in the country. NFMRA is a statutory corporation under the Fisheries Act 1997 that has the responsibility of overseeing, managing and developing the country's natural marine resources and environment. The role of NFMRA is covered in more detail in a section below.

3.2.6 Fishermen communities

The concept of "fishermen communities" has limited applicability to Nauru. CoFish (2005) indicates that 97 percent of the sampled households on Nauru were found to be engaged in fishing activities. In some respect, all of Nauru could be considered as one fishing community.

[133] Source: Tarte, S. (2002). The Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest – A Review of the Agreement and an Analysis of its Future Directions. A Consultancy Report prepared for the Forum Fisheries Agency and the Parties to the Nauru Agreement.

[134] CoFish (2005). Nauru Country Report: Profile and Results From In-Country Survey Work. Pacific Regional Coastal Fisheries Development Programme (Cofish), Secretariat of the Pacific Community, Noumea.

[135] Source: Vunisea (2007).

3.3 Inland sub-sector

According to NFMRA (2005),[136] there are four depressions on the Nauru plateau, the most significant one forming Buada Lagoon which is 30 000 m^2. The other water bodies, known as ponds, are on the fringing coast or just a few metres from the base of the escarpment. They range from about 40 m^2 to about 10 000 m^2, either manufactured or naturally occurring. Anabar pond, at 10 000 m^2, 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 water bodies is considered to be aquaculture.

3.4 Recreational sub-sector

Chapman (2004)[137] reports that around 50 vessels are capable of game fishing or sports fishing on the island. The Nauru Fishermen's club meets once or twice a year to discuss game fishing and sports fishing issues. Regular fishing tournaments are organized at Easter and Constitution Day, with other ad hoc competitions organized privately.

Since the time of Chapman (2004) the economy of Nauru has suffered shocks and recreational activities have been curtailed. Nevertheless, many Nauruan consider subsistence fishing as a pleasurable social activity which has value beyond just food collection.

3.5 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 had 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.

Currently there are several milkfish grow-out ponds around Nauru. These are backyard/subsistence operations, but there is no good estimate of production. The last estimate was in 2006 when it was thought that the annual milkfish production was about 8 tonnes, providing livelihoods for 30 people. (T. Adams, personal comm., November 2008).

4. POST-HARVEST USE

4.1 Fish utilization

The catch from the various foreign flagged purse seine fleets operating in Nauru is almost all for canning, but the mechanisms for getting the catch to the canneries shows considerable variation:

- Japanese purse seiners return to Japanese ports to offload the catch.
- US purse seiners 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 the lack of a suitable harbour in Nauru and a ban on

[136] NFMRA (2005). Nauru Aquaculture Development Plan, 2005-2010. Nauru Fisheries & Marine Resources Authority.

[137] Chapman, L. (2004). Nearshore Domestic Fisheries Development in Pacific Island Countries and Territories. Secretariat of the Pacific Community, Noumea.

transshipping in the zones of Pacific Island countries,[138] this transshipment usually occurs in a port in a neighbouring country – often Pohnpei in the Federated States of Micronesia or Majuro in the Marshall Islands.

The production from the coastal and inshore fisheries and aquaculture is for domestic consumption. CoFish (2005) states that local marketing of finfish is very 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 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.

5. FISHERY SECTOR PERFORMANCE

5.1 Economic role of fisheries in the national economy

A recent study by the Asian Development Bank attempted to quantify the fishery-related benefits received by Nauru. The study gave the available information on the contribution of fishing/fisheries to GDP, exports, government revenue, and employment. The results can be summarized as:

- Official estimates show that fishing in fiscal year 2006 was responsible for 10.2 percent of the GDP of Nauru. A recalculation using a different methodology shows it was 4.6 percent in 2006.
- Currently there are no exports of fishery products from Nauru.
- Access fees paid by foreign fishing vessels represented 21.0 percent of government revenue in 2006/07 and 17.2 percent in 2007/08.
- 97 percent of the sampled households on Nauru were found to be engaged in fishing activities.

From the above it can bee seen that fisheries make a relatively important contribution to GDP, government revenue, and employment.

5.2 Demand

The annual per capita consumption of fish in Nauru, based on the 2007 FAO Food Balance Sheet, is 3.9 kg. Various other studies have made estimates ranging between 46.7 and 55.8 kg. Considering Nauru's population, 50 kg of fish consumption per capita translates into a 2010 demand for 532 tonnes of fish.

Factors influencing the future demand for fish are the condition of the Nauru economy, any increase in price of fish (over-exploitation of inshore areas, fuel cost increases, changes in the population of the island, and relative cost of fish substitutes.

5.3 Supply

The government has several strategies to increase the national fish supply. These involve promoting offshore fish aggregation devices, canoe building, fish marketing, and aquaculture. There are also efforts to promote community-based management of fishery resources to mitigate over-exploitation.

Major factors affecting the local supply of fish are the limited livelihood and food security alternatives to fishing during the present economic downturn – coupled with over-exploitation of inshore fishery resources.

[138] On June 15, 1993, FFA member countries introduced a ban on fish transshipment at sea.

5.4 Trade

Currently there are no exports of fishery products from Nauru. The last export shipment of fresh tuna from the domestic longline operation was in 2001, and only seven shipments were ever made.

5.5 Food security

The FAO Food Balance Sheets show that in 2007 fish contributed an average of 6.0 percent of all protein to the diet and 17.2 percent of animal protein. Because several other estimates of fish consumption in Nauru are much higher (Section 5.2 above), the actual protein contribution of fish is probably much greater.

Animal protein substitutes for fish formerly consisted mainly of various types of imported meat, but the economic downturn sharply reduced the amount of food imports.

The large tuna harvest in Nauru waters by foreign-based fishing vessels may improve the food security situation. The National Tuna Management and Development Plan has as an objective "to improve 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."

5.6 Employment

CoFish (2005) contains the most recent information on fisheries employment in Nauru. It gives the results of fisheries-focused socio-economic surveys carried out in 11 of the 14 districts of Nauru in 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 indicate 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.

6. FISHERY SECTOR DEVELOPMENT

6.1 Constraints and opportunities

Some of the major constraints of the fisheries sector are:

- Many of the inshore fishery resources are fully or over-exploited.
- There is considerable difficulty promoting access by small-scale fishers to the large tuna resources.
- The lack of infrastructure (and the difficulties/expense of establishing that infrastructure) place a major limitation on domestic tuna industry development.
- The Nauru Fisheries and Marine Resources Authority (NFMRA) has considerable difficulty in carrying out its fisheries development functions in a time of financial stringency.
- FFA (2007) states that developing small-scale offshore fisheries targeting pelagic species is one of the few avenues for transferring effort from inshore fisheries but requires appropriate boats, equipment, gear, and fuel and increased investment in communications and other equipment for safe operations away from the island.

One of the major opportunities in the fisheries sector concerns regional cooperation: solidarity with neighbouring 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. Using this strategy, possible outcomes include: (a) increasing access fees for foreign fishing vessels and (b) leveraging domestic tuna industry development.

A study of fishery development aspirations by the Forum Fisheries Agency in 2008[139] 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.

6.2 Government and private sector policies and development strategies

FFA (2007) explores in considerable depth the government's development strategy in the fisheries sector. The report states that the Nauru National Sustainable Development Strategy 2005-2025 (NSDS) identifies the priority areas for Nauru's future. In relation to fisheries and marine resources priorities are improved governance, food security and maximizing revenue with the emphasis on partnerships. There is a draft Policy Framework for the National Fisheries Objectives and Strategies 2003-2010 that expands on the fisheries aspects of the NSDS. The priority policies and strategies are:

1. promote and facilitate human resource development through appropriate fisheries educational and training programmes in association with national, sub-regional, regional and international fisheries educational and training courses;
2. promote and facilitate the development of commercial fishing operations to generate revenue from export of fish and fish products, either through national programmes or in cooperation with neighbouring Forum Fisheries Agency member countries through sub-regional or regional arrangements, or in joint venture arrangements with foreign fishing enterprises or organizations;
3. develop an effective monitoring, control and surveillance capability through national programmes and through cooperation with other countries in the region;
4. promote and facilitate the development of the private sector in fisheries related activities, including support for the establishment and operation of a local fishermen's association or cooperative;
5. the management of the Nauru Fisheries and Marine Resources Authority and its subsidiary bodies will be cost effective, productive and efficient;
6. undertake and implement fisheries development projects, including research and development activities, through national programmes or in association with donor countries and agencies.
7. implement and enforce conservation and management measures for the coastal fisheries and marine environment;
8. to partake effectively in sub-regional, regional and international fisheries meetings and conferences and to meet its regional and international obligations effectively.

6.3 Research

Currently the Nauru Fisheries and Marine Resources Authority does not have much capability to carry out substantial fisheries research. Consequently, most research projects have involved the government cooperating with outside researchers and agencies.

[139] Gillett, R. (2008). A Study of Tuna Industry Development Aspirations of FFA Member Countries. Forum Fisheries Agency, Honiara, 70 pages.

Some of the research topics (and agencies) have been:

- Tuna stock assessment (Secretariat of the Pacific Community)
- Baseline information on the status of reef fisheries (Secretariat of the Pacific Community)
- Tilapia eradication (FAO)
- Underwater bathymetry (Pacific Islands Applied Geoscience Commission)
- Milkfish growth trials (Taiwan PC)
- Ciguatera fish poisoning (University of the South Pacific)

6.4 Education

Education related to fisheries in Nauru 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.
- Training courses, workshops and attachments are frequently organized by the regional organizations: the Secretariat of the Pacific Community in New Caledonia and by the Forum Fisheries Agency in the Solomon Islands. The subject matter has included such diverse topics as fish quality grading, stock assessment, fisheries surveillance, and on-vessel observing.
- Courses and workshop are also given by NGOs and by bilateral donors.

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. The economic downturn that began in the early 2000s has resulted in Nauru actively seeking development assistance, including that for the fisheries sector.

Presently, the main donor activity in the fisheries sector is Australia's support for capacity enhancement at the Nauru Fisheries and Marine Resources Authority – primarily through the provision of an advisor.

The Secretariat of the Pacific Community also provides substantial assistance to Nauru. In the four-year period 2005-2008 SPC's Coastal Fisheries Programme provided USD314 000 and the Oceanic Fisheries Programme, USD57 000.

The Forum Fisheries Agency has long supported fisheries activities in Nauru, including that related to fisheries surveillance, fisheries management capacity enhancement, and financial performance of fishing/marketing operations.

Taiwan Province of China recently funded a project based on combining the use of small fishing canoes and cheap, shallow-water fish aggregating devices. The project cost was USD43 000.[140] The European Union recently funded a canoe building project.

7. FISHERY SECTOR INSTITUTIONS

FFA (2007) summarizes the history and functions of the main government fishery institution in the country, the Nauru Fisheries and Marine Resources Authority:

- 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.

[140] Blanc, M. and A. Templeton (2008). Review of the Nauru Canoe and Nearshore FADs Project. Secretariat of the Pacific Community, Noumea.

- The Authority is responsible for the management of offshore fisheries, coastal fisheries and aquaculture; as well as owning the Nauru Fisheries Corporation (NFC) that acts as the commercial arm of the Authority.
- The NFMRA Board has a draft Policy Framework for the National Fisheries Objectives and Strategies 2003-2010 that expand on the NSDS.
- Under recent measures implemented by the Nauru government to consolidate all revenue sources, control of licence and foreign fishing vessel access fee revenues was transferred from the NFMRA to Treasury, requiring central agency approval of NFMRA budgets and expenditure.

In April 2010 NFMRA had a total of 59 employees on the payroll and 5 vacancies. The sections of the Authority (and the main officers) are:

- Executive Department (CEO, Deputy CEO)
- Oceanic Fisheries Department (Manager)
  - Multilateral & Bilateral Treaties Section (Senior Oceanic Officer)
  - Licensing Section (Licensing/Revenue Officer)
  - Surveillance and Compliance Section (MCS Officer, VMS Officer)
  - Catch Data/Statistics Section (Catch Data Officer)
- Coastal Department (Coastal Manager)
  - Aquaculture Section (Aquaculture Officer)
- Fisheries Support Services
  - Accounts Section
  - Administration Section
  - Information Technology Section
  - Human Resources Development Section
  - Technical Services Section
  - Maintenance
  - Safety/Communications (SAR)

Some of the important internet links related to fisheries in Nauru are:

- www.spc.int/coastfish/countries/nauru/nfmra/information.htm This contains links to 17 reports relevant to the fisheries of Nauru.
- www.sprep.org/publication/pein_nauru.asp This contains a virtual environmental library.
- www.paclii.org/nr/indices/legis/Nauru_Acts_by_Year.htm Contains the legislation of Nauru, including the fisheries laws and regulations.

8. GENERAL LEGAL FRAMEWORK

The most important laws relating the fisheries in Nauru are the Nauru Fisheries and Marine Resources Authority Act 1997 and the Fisheries Act 1997.

The most significant aspects of the NFMRA Act are establishing:

- *Objects of the authority*
  - 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; and
  - 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; and

- ❍ 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, in accordance with any law relating to fisheries or marine resources.

– *Functions of the authority*
  - ❍ 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; and
  - ❍ to make recommendations and give advice to the Minister on matters connected with its objects; and
  - ❍ 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 this 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 of the authority, powers of the authority, limitations on powers of the authority, liability of directors, and exercise of 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. This act has provisions:

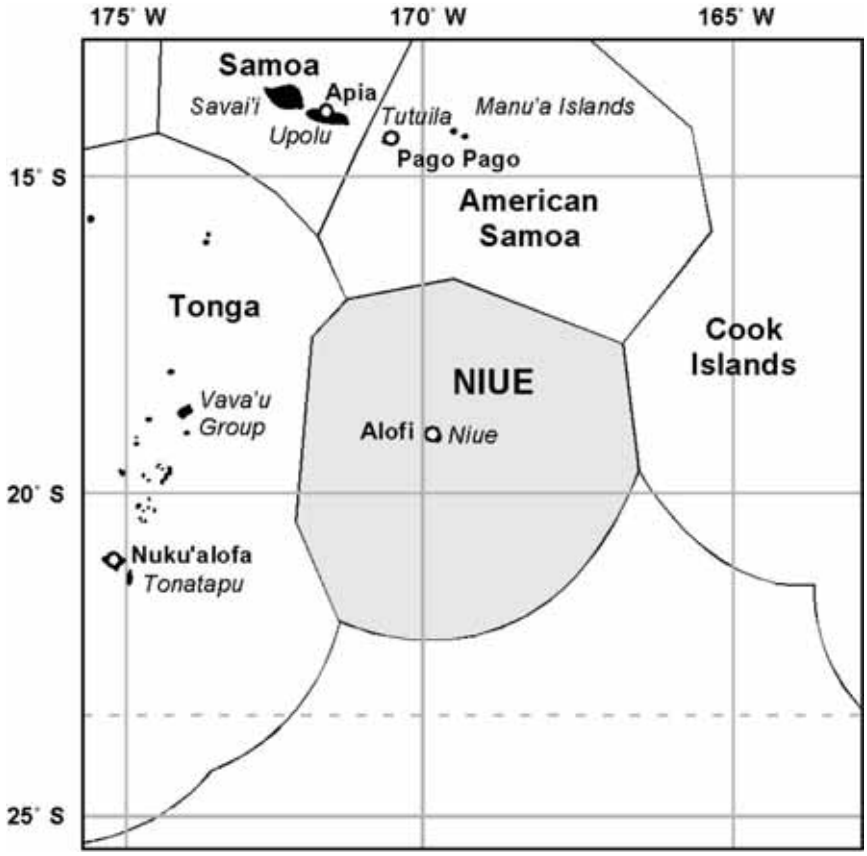
- to exercise the sovereign rights of the Republic to explore, exploit, conserve and manage those resources within the fisheries waters of Nauru in accordance with the relevant rules of international law; and
- to utilize, manage, develop, protect and conserve those resources in such a way as to conserve 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; and
- to 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
- to repeal the Marine Resources Act 1978.

Other laws and regulations important to Nauru fisheries (and a short description) are:[141]

- NFMRA Amendment Act 2004 (Transfers receipt of NFMRA revenue from NFMRA to Treasury)
- Fisheries Regulations 1998 (Describes requirements for vessel registration and licencing, 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 coordinates of Nauru EEZ)

[141] Source: www.spc.int/coastfish/countries/nauru/nfmra/information.htm

NIUE



1. GENERAL GEOGRAPHIC AND ECONOMIC DATA

Area	259 km^2
Water area	390 000 km^2
Shelf area	[no continental shelf]
Length of continental coastline	64 km (length of the coast of the island)
Population (2007)*	2 000
GDP at purchaser's value (2006)	13.4 million USD[142]
GDP per head (2006)	7 902 USD
Agricultural GDP (2006)	3.2 million USD[143]
Fishing GDP (2006)	0.4 million USD[144]

* UN Population Division

[142] Source: http://www.spc.int/prism/Country/NU/stats/Economics/GDP/gdp.htm, current convergence : 1NZD = 0.65 USD.

[143] This is the contribution to GDP of agriculture, hunting, forestry, and fishing in FY 2003.

[144] This is the official fishing contribution to GDP; A recalculation shows the total fishing contribution to be USD$445,349: Gillett (2009). The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories. Pacific Studies Series, Asian Development Bank, Manila.

2. FISHERIES DATA

2007	Production	Imports	Exports	Total supply	Per caput supply
	tonnes liveweight				kg/year
Fish for direct human consumption[145]	200	0	0	200	100
Fish for animal feed and other purposes	0	–	0	–	

Estimated employment (2003)	
(i) Primary sector (including aquaculture)	5 [146]
(ii) Secondary sector	(Unavailable)
Gross value of fisheries output (2007)	2 520 588 USD[147]
Trade (2007)	
Value of fisheries imports	(unavailable)
Value of fisheries exports	(unavailable)[148]

Niue is an uplifted coralline island with the greater part of its coast comprised of an ancient, raised reef platform forming cliffs which 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 Secretariat of the Pacific Community to be about 620 ha.

Although the island's land area is only 259 sq km, Niue's EEZ extends over an area of 390 000 sq km.[149] Located in this zone about 125 nautical miles southeast 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 neighbours.

There are 14 coastal villages in Niue. The population of Niue continues to drop – from 5 200 in 1966 to about 1 476 in mid-2010.

3. FISHERY SECTOR STRUCTURE

3.1 Overall fishery sector

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. The 2007 production can be estimated as:

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based[150]	Fresh-water	Aqua-culture
Volume of production (metric tonnes)	10	140	640	0	0	0
Value of production (USD)	58 824	617 647	1 844 118	0	0	0

Source: Gillett (2009)

[145] Data from FAO food balance sheet of fish and fishery products.

[146] The report of the 2002 Household Income and Expenditure Survey states that five people were working for pay in "fishing, fish farms, service activities to fishing". Source: HIES 2002 Final Report. Economic, Planning, Development, and Statistics Unit, Premier's Department. Government of Niue.

[147] From Gillett (2009); includes the six categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally-based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing, and (6) aquaculture.

[148] Unpublished data from Customs Niue indicates that fish exports were 88.5 mt in 2005, 403.6 mt in 2006, and 602.2 mt in 2007 – but no values have been assigned.

[149] Some sources cite 450 000 sq km as the size of the Niue zone.

[150] This is the catch in the Niue zone by vessels based outside the country.

The main trends and important issues in the fisheries sector

The main trends in the sector include:

- A decreasing subsistence catch with the declining population
- The rise and fall of locally-based longliners and tuna processing
- Maintaining an active fish aggregation device (FAD) deployment programme
- A decline in the frequency of air service to the islands, impacting on the exports of fish and the arrival of tourists, many of whom come for recreational fishing and diving.
- Increasing attention to the use of fisheries management plans and to the ecosystem approach to fisheries management.

Some of the major issues in the fisheries sector are:

- Niue is a high cost location from which to operate longline vessels
- Labour is scarce and expensive
- Infrequent and costly air cargo constrains export opportunities
- Although it is recognized that wharf infrastructure constrains some opportunities, there is reluctance to spend money on its upgrading – structures could be wiped out in a cyclone.

3.2 Marine sub-sector

The marine fisheries have two very distinct components, offshore and coastal:

- Offshore fisheries have been undertaken on an industrial scale by locally and foreign-based vessels operation within the Nauru until 2003.
- Coastal fishing is primarily carried out for subsistence purposes, with some local sales.

3.2.1 Marine catch profile

Since 2003 there has been no authorized foreign fishing in Niue's zone. US purse seine vessels are permitted under a multilateral treaty to fish in the Niue, but actual fishing in Niue waters by those vessels has not occurred in many years. Tafatu (2006)[151] states that at the beginning of 2005 Niue began licensing longline vessels to fish under charter arrangement. Production from those boats reached a maximum in 2006 and early 2007. Fishing operations stopped in December 2007.

Niue reported longline catch to WCPFC since 2005 and in 2009, 182 tonnes of tunas and tuna-like species were caught with three longliners. The corresponding figures for 2006, 2007 and 2008 were 229 tonnes (10 boats), 212 tonnes (7 boats), and 18 tonnes (3 boats), respectively.

Using FFA reports, it is estimated that the 2006 and 2007 catches taken from Niue EEZ were about 640 tonnes annually, worth about USD1.6 million.[152] The catch by the offshore fleet in the Niue EEZ in 2008 was zero.[153]

Much of the costal fishing in Niue is undertaken by fishing off the reef (i.e. spear fishing, line fishing, gleaning) or fishing from small craft just outside of the reef. In recent times the largest fishing vessels in Niue have been Samoa-style catamarans. These vessels are stored on land at Niue's only wharf at Alofi.

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[151] Tafatu, J. (2006). Country fisheries report – Niue. Western and Central Pacific Fisheries Commission, Scientific Committee Second Regular Session, Manila, Philippines, 7-18 August 2006.

[152] This amount is lower than that list on the table in Section 3.1 due to different exchange rates in 2006 and 2007.

[153] According to the Niue Fisheries Division, the 2008 catch catches of tuna by the sole longliner operating out of Niue was 16 tonnes – but this fishing (due to the size of vessel and fishing area) is considered in this report to be coastal commercial fishing.

Gillett and Lightfoot (2001) estimated that the annual catch from coastal commercial fisheries was 12 tonnes (worth NZ$96 000) and that the coastal subsistence catch was 194 tonnes (worth NZ$315 640). This estimate has been updated by:

- The results of the 2002 household income and expenditure survey
- Population changes
- A recent fisheries-focused survey
- Discussions with the Director of Niue's Department of Agriculture, Forestry and Fisheries

Selectively using the above information, the 2007 coastal catch has been estimated as:

- Coastal commercial: 10 tonnes, worth USD58 824
- Coastal subsistence: 140 tonnes, worth USD617 647

3.2.2 Marine landing sites

The only wharf is at Alofi, the main urban area. This part of Niue is sheltered from the prevailing south-easterly tradewinds, but 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 (e.g. cyclone Heta in January 2004) much of the exposed wharf equipment has been 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 offloads its catch at this wharf, as well as many other smaller boats.

Two other sites have some improvements to facilitate the landing of canoes and small boats. Fishing craft also land catches at many unimproved landings around Niue. The distribution of vessels in the table in Section 3.2.3 is indicative of the importance of the various areas as landing sites.

3.2.3 Marine fishing production means

Tafatu (2006)[154] states that the chartered longliners that began operating in the mid-2000s ranged in size from 10-29 metres. These vessels fished into the new government joint venture fish processing facility, Niue Fish Processors Ltd. (NFP). In 2006 there were 13 longliners based in Niue, but all industrial-scale longlining ceased in late 2007. The only longliner to operate in 2008 was a 9-metre aluminium catamaran of the Samoan *alia* design.

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 spear fishing.
- Fishing from boats close to the island includes shallow-water handlining and the traditional catching of *Decapterus* (*ulihega*, see Box).
- Further offshore, fishing activity is mainly trolling or vertical longlining with a few other methods of hook gear. Fishing effort is predominantly focused around anchored FADs which are located within 3 nautical miles of the island (Fisheries Division 2009).[155]

[154] Tafatu, J. (2006). Country fisheries report – Niue. Western and Central Pacific Fisheries Commission, Scientific Committee Second Regular Session, Manila, Philippines, 7-18 August 2006.

[155] Fisheries Division (2009). Niue Annual Report. Paper WCPFC-SC5-AR/CCM-16, Scientific Committee, Western and Central Fisheries Commission, Pohnpei.

Fishing for scads 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 five 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 (1987)[156]

Niue has a small-scale fleet comprising of traditional outrigger canoes and small (3.7 to 8.0 m) aluminium boats. The number, types, and location of small-scale fishing vessels can give considerable insight on the means of production. Information from the 2006 census (Census . 2007)[157] is used to construct the table below.

Numbers and types of fishing vessels by village

Village	Canoe	Aluminium dinghy	Inflatable dinghy	Wood boat	Outboard-powered skiff	Total
Makefu	11	0	0	4	0	**15**
Tuapa	12	6	0	1	6	**25**
Namukulu	1	0	1	0	1	**3**
Hikutavake	6	0	0	0	0	**6**
Toi	0	0	0	0	0	**0**
Mutalau	9	1	0	0	1	**11**
Lakepa	3	2	0	0	3	**8**
Liku	3	1	0	1	2	**7**
Hakupu	1	1	0	0	0	**2**
Vaiea	3	4	0	1	7	**15**
Avatele	24	10	0	2	9	**45**
Tamakautonga	11	4	2	0	6	**23**
Alofi South	29	28	1	12	30	**100**
Alofi North	9	9	1	2	12	**33**
Total	**122**	**66**	**5**	**23**	**77**	**293**

Tuara (2000)[158] gives information on the fishing production means of women in Niue. During low tide women harvest on the reef flat, collecting octopus, alili (turbo snail), ugako (tube worms), sea urchins, sea cucumbers and shellfish using their hands, steel hooks, spanners, axes hammers, screw drivers, and sticks. The metal tools are used to chip away at the reef and dislodge the tubeworms, and clams. Kama kama (crabs) are collected manually or with the assistance of spears and knives. Two types of limu (seaweed) are collected by hand from rock pools in the reef. Hihi vao (sea snail) are collected by hand, primarily to make shell necklaces, while hihi uli (sea snail) are collected for food and for shell necklaces. Reef gleaning is carried out during the day when the tide is low. At night the women hunt for crabs,

[156] Gillett, R.D. (1987). Hawaiian-Style Decapterus Fishing Trials in Niue. Document 87/4, FAO/UNDP Regional Fishery Support Programme, Suva, 24 pages.

[157] Census 2006. 2007. Economic, Planning, Development, and Statistics Unit, Premier's Department, Government of Niue.

[158] Tuara, P. (2000). An Assessment of The Role of Women in Fisheries in Niue. Secretariate of the Pacific Community, Noumea.

lobster (when in season), and reef fish, using their hands, bush knives, or long spears. A coconut frond torch or a battery-operated torch is used to light the way. Most Niuean women are content to reef glean for seafood, having no desire to fish in the deeper waters surrounding the island.

3.2.4 Main resources

WCPFC Yearbook indicated that the catch composition of Niue longliners is dominated by albacore (60-80 percent), followed by yellowfin (10-30 percent).

The estimated catch composition for Niue's single-vessel longline fishery in 2008 was dominated by catches of yellowfin (48 percent) and albacore (35 percent), with "others" making up 22 percent. In 2007 when many more longliners operated, the catch composition was albacore (65 percent), yellowfin (14 percent), bigeye (1 percent), and others (20 percent). Marlins (blue, striped, black, in that order) made up most of the "others" category.

Fishbase (www.fishbase.org) lists 212 finfish species that are found on Niue. Invertebrates are quite important in Niue, relative to neighbouring countries. Lambeth and Fay-Sauni (2001)[159] carried out research on invertebrates and seaweeds in Niue and recorded Niuean names for a total of 63 Niuean invertebrate and 3 seaweed, 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 splendidens*), three-spot reef crab (*Carpilius maculatus*), giant clam (*Tridacna squamosa* and *T. maxima*), the green snail (*Turbo setosus*), and caulerpa seaweeds or sea grapes (*Caulerpa racemosa* and *C. cupressoides*).

Trochus were introduced to Niue in August 1992 in an attempt to establish a commercially-exploitable population of this species. A total of 223 shells from Fiji were placed on reefs at Hakapu (99 shells), Namakulu (77) and Tamakautoga (47). In August 1996 another 311 shells from Tonga (progeny of an earlier transplant from Fiji) were placed on reefs at Namakulu and Tamakautoga.

3.2.5 Management applied to main marine fisheries

In considering current fisheries management in Niue, it is important to consider the historical context. Pasisi (1995)[160] 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.*

Offshore fisheries

Niue is a member of the Western and Central Pacific Fisheries Commission that 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.

In the early 2000s a draft tuna and billfish management plan was prepared. The plan was not officially adopted but used as a working plan by the Department of Agriculture, Forestry and Fisheries. The objectives in that plan are given as:

- 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;

[159] Lambeth, L. and L. Fay-Sauni (2001). Niue's Reef-Flat Invertebrate Fishery – information and recommendations for inclusion in a Niue inshore fisheries management plan. Secretariat of the Pacific Community, Noumea.

[160] Pasisi, B. (1995). Country Statement – Niue Island. Country Paper 9, Workshop on the Management of South Pacific Inshore Fisheries. South Pacific Commission, Noumea.

- 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; and
- Ensure that all activities undertaken as part of this Tuna and Billfish Fishery Plan are implemented and administered efficiently and cost-effectively.

Documentation jointly prepared by the Department and the Forum Fisheries Agency in the early 2000 provides some additional insight into the Department's thinking on tuna fishery management:

- The Territorial Seas and Exclusive Economic Zone Act provides a sound basis for the development of a fisheries management plan.
- The primary objective for a management plan is the conservation and management of tuna stocks within the Niue EEZ. However, additional objectives might include economic factors such as maximizing the benefits (employment, foreign exchange earnings, development and protection of the local small-scale fishery etc.) to Niue from the exploitation of tuna resources within the EEZ.
- A variety of management measures based on a choice between input and output controls are available. Input control options include setting a limit on vessel numbers, setting a limit on days fishing and setting a limit on the number of hooks set. Output controls might be done by setting an overall catch level allowing free competition between vessels and monitoring the catch, closing the fishery when the target catch level is reached.

Coastal fisheries

With respect to coastal fisheries, the Niuean National Management Plan for the Coastal Fishery states the following: [as given in Chapman (2004)[161]]

> Goal: to maintain the productivity, and maximize the overall sustainable benefit to Niue, of Coastal Fisheries in all areas permitted to fishing.
>
> Objectives of the Plan:
>
> - Ensure that the utilization 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;

[161] Chapman, L. (2004). Nearshore Domestic Fisheries Development in Pacific Island Countries and Territories. Secretariat of the Pacific Community, Noumea.

- 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.

In recent years the use of marine protected areas as a tool for inshore fisheries management has increased.

Institutions

The main institution involved with fisheries management in Niue is the Department of Agriculture, Forestry and Fisheries. This agency is discussed in Section 7 below.

3.2.6 Fishermen communities

The concept of "fishermen 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".

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.

3.4 Recreational sub-sector

In the mid-2000s, Chapman (2004) examined commercial sport fishing in Niue and indicated there was one full-time charter boat, two to three vessels used for charter work occasionally, and an annual fishing tournament.

Because of the difficulties for tourists travelling to Niue in recent years, the number of vessels involved in fishing charter work has declined.

3.5 Aquaculture sub-sector

In 1994 a feasibility study was carried out with the assistance of FFA and ICLARM on the potential for farming of freshwater prawns and crayfish, and the establishment of a giant clam hatchery. The basic conclusions reached at that time were that such initiatives would be costly to set up and run and not economically viable (Fisheries Division 1999).[162]

There is currently no aquaculture activity on Niue.

[162] Fisheries Division (1999). Country Statement – Niue, Information Paper 24, 1st SPC Heads of Fisheries Meeting, Secretariat of the Pacific Community, Noumea.

4. POST-HARVEST USE

4.1 Fish utilization

In previous years (2005 until mid-2007) the majority of the catch of albacore from Niue was exported to the two canneries in American Samoa with small quantities of yellowfin and bigeye exported as chilled sashimi grade products to the USA and Hawaii, as well as frozen loins of other species to New Zealand markets and local consumption. Catches for 2008 has been destined for consumption on the local market in both fresh and frozen form (Fisheries Division 2009).

No discussion of post-harvest aspects of fisheries in Niue would be complete without mention of the tuna processing plant (Box). Although that facility is not currently operating (it closed in late 2007), it is noteworthy due to several features, including the possibility of re-opening in the future.

Locally-based foreign processing companies in Niue

Niue has offered 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, that 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 resources 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 6 Niuean staff and 3 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, 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)[163]

With respect to coastal fisheries, most of the fisheries production is consumed at home. Some, however, is sold.

4.2 Fish markets

Tuara (2000) states that most seafoods are for family consumption. 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.

[163] Campling, L., E. Havice, and V. Ram-Bidesi (2007). Pacific Island Countries, the Global Tuna Industry and the International Trade Regime – A Guidebook. Forum Fisheries Agency, Honiara.

5. FISHERY SECTOR PERFORMANCE

5.1 Economic role of fisheries in the national economy

A recent study by the Asian Development Bank attempted to quantify the fishery-related benefits received by Niue. The study gave the available information on the contribution of fishing/fisheries to GDP, exports, government revenue, and employment. The results can be summarized as:

- Official estimates show that fishing in 2003 was responsible for 4.2 percent of the GDP of Niue. A recalculation using a different methodology shows it was 4.4 percent in 2003.
- Provisional 2007 export data suggests that fishery exports made up over 90 percent of the value of all exports in 2007.
- Access fees paid by foreign fishing vessels represent 2.3 percent of all government revenue.
- The five commercial fishers in Niue represent 0.4 percent of Niue's labour force.

From the above it can be seen that fisheries make a relatively important contribution to GDP, exports, and government revenue.

5.2 Demand

The annual per capita consumption of fish in Niue, based on the 2007 FAO Food Balance Sheet, is 100.0 kg. Various other studies have made estimates ranging between 49.0 and 118.9 kg.

Factors influencing the future demand for fish are emigration, increased price of fish, relative cost of fish substitutes, and changes in dietary preferences.

5.3 Supply

The government has several strategies to increase the national fish supply. These involve efforts to conserve inshore fisheries resources and increase the production from offshore resources through support for fish aggregation devices. The government's efforts to promote the processing of tuna in Niue have the side effect of increasing the fish supply.

Major factors affecting the local supply of fish are the cost of fuel, the weather (i.e. access to the sea), alternative employment, and the offloading of fish by the offshore fleet.

5.4 Trade

Unpublished data from Customs Niue indicates that fish exports were 88.5 tonnes in 2005, 403.6 tonnes in 2006, and 602.2 tonnes in 2007. The provisional 2007 export data suggests that fishery exports made up over 90 percent of the value all exports in that year. With the closing of the processing and associated longline fishing activity in December 2007, this level of fish exports has fallen considerably.

5.5 Food security

Fish is an important element of food security in Niue. The FAO food balance sheets show that in 2007 fish contributed an average of 27.9 percent of all protein to the diet and 42.8 percent of animal protein.

Animal protein substitutes for fish consist mainly of various types of local and imported meat, much of which are extremely fatty and have negative health implications.

5.6 Employment

The report of the 2002 household income and expenditure survey (HIES 2002)[164] contains information relevant to fisheries employment. The "annual fish income" is estimated to be USD$13 358. This represents

[164] HIES 2002 Final Report. Economic, Planning, Development, and Statistics Unit, Premier's Department. Government of Niue.

0.9 percent of all income in Niue for the year (USD$1 526 113). 12 percent of all households have "fish income". The survey also states that five people were working for pay in "fishing, fish farms, service activities to fishing".

The number of fishing vessels (table in Section 3.2.3 above) gives some information of participation in fishery activities. The total of 293 fishing vessels gives an indication of the minimum number of people involved in types of fishing that require a vessel.

The Director of Niue's Department of Agriculture, Forestry and Fisheries indicates that in late 2008 there were five or six people that could be considered full-time commercial fishers. Considering the total labour force of Niue was about, the five commercial fishers therefore represent 0.4 percent of Niue's labour force.

5.7 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, the subject of the next section.

6. FISHERY SECTOR DEVELOPMENT

6.1 Constraints and opportunities

Some of the major constraints of the fisheries sector are:

- The limited reef area
- The high cost of operating longline vessels from such a remote location
- Labour that is scarce and expensive
- Infrequent and costly air cargo
- Inadequate wharf infrastructure
- The highly destructive cyclones that occasionally batter the island, and, especially, the exposed fishery infrastructure

The opportunities in the fisheries sector include:

- Commercial sportfishing, 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 neighbouring Pacific Island countries to increase the value of the tuna resources.

Although the fishery resources of Beveridge Reef may have considerable development potential, the distance from Niue Island, the cost of travel, and the large vessel required to make the trip, severely constrains the current fisheries value of the reef.

6.2 Government and private sector policies and development strategies

The Corporate Plan 2009-2013 of the Department of Agriculture, Forestry and Fisheries (Government of Niue 2009)[165] contains several types of strategies. Those that are applicable to the fisheries development are:

- Develop and implement a National Fisheries Management and Development Plan and ensure it aligns with the ecosystem approach to fisheries management.
- Ensure the principles of the ecosystem approach to fisheries management is institutionalized and applied to the development of fisheries management and development plans.

[165] Government of Niue (2009). Corporate Plan 2009-2013, Department of Agriculture Forestry, Fisheries.

- Assist in the repair and development of the wharf infrastructure and utilities to cater for the fishing and tourist industries.
- Pursue the re-establishment of the Government fishing joint venture.
- Update the infrastructure and services report aimed at enhancing the operating environment for commercial longline fisheries.
- Develop the sport fishery in support of tourism development.
- Strengthen the implementation of the Niue FAD Programme in support of local fishermen and ensuring the protection of food and nutritional security.
- Maintain and strengthen the deployment, maintenance and research into FAD developments to maximize the domestic fishing production of the pelagic fishery.
- Develop and institutionalize a National Vaka Programme dedicated to ensuring the traditional practise and methods of fishing are maintained.

6.3 Research

Fisheries and aquaculture 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 (some of these are given in Section 6.5 below). Most of FFA research in Niue has been oriented to economics. FAO has sponsored studies on *Decapterus*, coconut crab, and development potential.

6.4 Education

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, on a credit and non-credit extension basis.
- Training courses, workshops and attachments are frequently organized by the regional organizations: the Secretariat of the Pacific Community in New Caledonia and by the Forum Fisheries Agency 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 by bilateral donors.

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: the Secretariat of the Pacific Community and the Forum Fisheries Agency. 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 shellcraft, setting up a marine reserve, setting up a household fishing and consumer survey, establishing port sampling programme. The FFA has been especially active in support to establishing a domestic tuna industry.

7. FISHERY SECTOR INSTITUTIONS

Responsibility for fisheries and marine resource matters is vested in the Department of Agriculture, Forests and Fisheries. The Corporate Plan 2009-2013 of the Department of Agriculture, Forestry and Fisheries (Government of Niue 2009) gives the mission statement of the Fisheries Division:

> Actively facilitate the utilization of Niue's marine resources through sustainable and environmentally sound fisheries development strategies at all levels.

The Plan sets seven objectives in fisheries:

- Objective 1: Ensure that Niue's inshore and offshore fisheries resources are sustainably managed in line with national, regional and international standards.
- Objective 2: Adopt a strategic approach to fisheries development by way of institutionalizing policies and development plans to guide private sector development and encourage employment and income generating opportunities in a sustainable manner.
- Objective 3: Maintain and implement development plans for identified inshore and offshore fisheries, in particular to support the national Tuna industry development plan and activities.
- Objective 4: Maintain an active research programme into appropriate fishing technologies such as Fish Aggregating Devices, advances in gear technology and fishing methodologies in support of local stakeholders.
- Objective 5: Develop and implement effective monitoring, control and surveillance programmes across all fisheries waters, legislation, and licensing and management systems.
- Objective 6: Maintain and implement effective licensing and data collection programmes for both offshore and inshore fisheries.
- Objective 7: Maintain an effective maintenance programme for all department plant, vehicles, machinery, winches, FADs and moorings, as well as providing fisheries related repairs and support services for the general public.

The Department of Agriculture, Forests and Fisheries is currently headed by a fisheries specialist. The Department has a number of Divisions, one of which is the Fisheries Division. The Fisheries Division presently has four officers:

- Principal Fisheries Officer
- MCS and Development Officer
- Maintenance Officer
- Fisheries Officer

Some of the important internet links related to fisheries in Niue are:

- www.spc.int/coastfish/countries/Niue/niue.htm – Contains information on legislation, management plans, applications for licences, publications, contact details for key fisheries officials
- www.sprep.org/att/publication/000544_IWP_PTR38.pdf – Niue sustainable coastal fisheries pilot project: Literature review and pilot baseline survey)
- http://catalogue.nla.gov.au/Record/1329462 – The report of a fisheries resources survey of the island of Niue by SPC.

8. GENERAL LEGAL FRAMEWORK

Fisheries in Niue are regulated by the Domestic Fishing Act 1995, the Domestic Fishing Regulations 1996, and the Territorial Sea and Exclusive Economic Zone Act 1996.

The domestic Fishing Act 1995 covers three main areas:

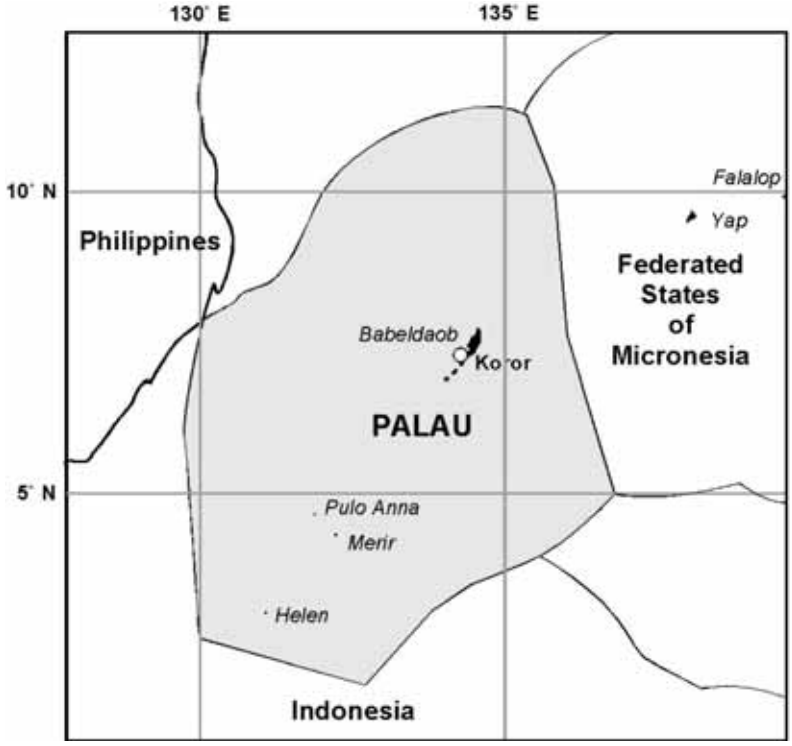
- Protection of fish: prohibited use of illegal fishing means, marine reserves, restriction on taking of certain species, prohibited exports, and catch/size limits.
- Sunday fishing ban: Sunday fishing is prohibited between certain hours.
- Safety at sea: all vessels, including fishing vessels propelled 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.

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 twelve nautical miles and a 200 nautical mile exclusive economic zone of approximately 390 000 sq km in size. In addition, the act covers fisheries management and development (designated fisheries, management/development plans), unauthorised fishing, prohibited fishing methods, access agreements, and licensing.

PALAU



1. GENERAL GEOGRAPHIC AND ECONOMIC DATA

Area	488 km^2
Water area	629 000 km^2
Shelf area	[no continental shelf]
Length of continental coastline	430 km (length of 200 m isobath)
Population (2007)	20 000
GDP at purchaser's value (2006)	USD156 614 000[166]
GDP per head (2006)	USD7 812
Agricultural GDP (2006)	USD1 927 000[167]
Fisheries GDP (2006)	USD3 047 000[168]

2. FISHERIES DATA

2007	Production	Imports	Exports	Total supply	Per caput supply
	tonnes liveweight				kg/year
Fish for direct human consumption[169]	1 003	461	332	1 354[170]	67.7
Fish for animal feed and other purposes	0	–	0	–	

[166] Source: unpublished data, Office of Planning and Statistics.

[167] In the official statistics of Palau [Bureau of Budget & Planning (2008). 2006 Statistical Yearbook. Ministry of Finance, Republic of Palau] the "agriculture" component of GDP does not include fishing.

[168] This is the official fisheries contribution to GDP as per Bureau of Budget & Planning (2008). 2006 Statistical Yearbook. Ministry of Finance, Republic of Palau.. A recalculation shows the total fishing contribution to be USD9.6 million (Gillett 2009).

[169] Data from FAO food balance sheet of fish and fishery products.

[170] Corrected to reflect actual supply.

Estimated employment (2008)	
(i) Primary sector	460[171]
(ii) Secondary sector	(unavailable)
Gross value of fisheries output (2007)	USD24.1 million[172]
Trade (2007)	
Value of fisheries imports	(unavailable)
Value of fisheries exports	USD19.1 million

3. FISHERY SECTOR STRUCTURE

3.1 Overall fishery sector

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 Island can be found within Palau. The most distinguishing features of the coastal area of Palau as compared to most other Pacific Island countries are the large amount 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 for the export market.

The major marine habitats of Palau and their approximate sizes are:

- Mangroves – 45 sq km
- Inner reef – 187 sq km
- Outer reef – 265 sq km
- Lagoon – 1 034 sq km

With respect to the current fishery production, Palau's fisheries can be placed into six categories. Estimates for production per category in 2007 are as follows:

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based[173]	Fresh-water	Aquaculture	
						Tonnes	Pieces[174]
Volume of production (Tonnes or pieces)	865	1 250	3 030	1 464	1	2	3 100
Value of production (USD)	2 843 000	2 511 000	13 779 656	4 947 496	8 000	50 000	

Source: Gillett (2009)

[171] In addition, the 2005 census indicates that 305 people reported income from selling fish and 933 people reported some subsistence fishing.

[172] From Gillett (2009). The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories. Pacific Studies Series, Asian Development Bank, Manila. Includes the six fishery production categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally-based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing, and (6) aquaculture.

[173] This is the catch in the Palau zone by vessels based outside the country.

[174] Pearls and giant clams are commonly measured in pieces, rather than kg.

The above estimates include landings by foreign flagged vessels operating within the EEZ of Palau.

The main trends and important issues in the fisheries sector

The main trends in the sector include:

- Increasing exploitation of the coastal resources, especially those close to urban markets.
- Continuing substantial involvement of local and international NGOs in the management of coastal marine resources.
- Growing realization of the inability of Palau's coastal resources to feed local residents and tourists, and support commercial exports.
- Increasing interaction between fishing activities and Palau's thriving tourist trade.

Some of the major issues in the fisheries sector are:

- A large investment in aquaculture development activities over the last 37 years has yielded disappointing results.
- The opportunity to link fisheries with a large and expanding tourism industry.
- The regional/global move to ecosystem-approach to fisheries management, however desirable, is clashing with the practical realities of undertaking fisheries management in Palau.
- It is sometimes difficult to balance the benefits and costs of locally-based foreign fishing activity, especially in an environment where tourism is important.
- The regular monitoring of the landings from coastal fishing is not simple or cheap.

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 foreign longline vessels and sporadically by one domestic pole-and-line vessel.
- Coastal fishing is primarily carried out for subsistence purposes and for sales for local markets. In addition, there are some coastal fisheries that are export oriented: trochus and aquarium fish.

3.2.1 Marine catch profile

Estimates of the volumes and values of the catches of the main commercial species of tuna in Palau have been made by the Forum Fisheries Agency,[175] using data sourced from the Oceanic Fisheries Programme of the Secretariat of the Pacific Community (see table below). Total tuna catches from Palau water have been estimated by adding in volumes and values of bycatch. No catch of tuna or tuna-like species have been reported for 2007 by vessels flying the Palau flag.

Catch volumes and values for the Palau-based offshore fleet

	2003	2004	2005	2006	2007
Volume total catch (tonnes)	1 889	2 016	4 107	5 935	3 030
Dockside value total catch (USD)	7 933 600	8 885 365	19 381 857	27 683 684	13 779 656

[175] FFA (2008). The Value of WCPFC Tuna Fisheries. Unpublished report, Forum Fisheries Agency, Honiara.

Estimates of catches from the coastal fisheries vary widely. In 2008 the Asian Development Bank examined a large number of studies on coastal fishing in Palau, and made catch estimates by selectively using certain reports, especially a survey by the Palau Conservation Society.[176] Accordingly, it was determined that crude estimates of the recent annual production from Palau's coastal fisheries would be:

- Coastal commercial fisheries: 865 tonnes; At a price to the fisher of USD2.87 per kg, this is worth USD2 843 000.
- Subsistence fisheries: 1 250 tonnes; Using the "farm gate" system of valuing subsistence production, (discounting prices for commercial fish by 30 percent), this would be worth USD2 511 000 to the producer.

3.2.2 Marine 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 small-scale commercial fishing is offloaded, mainly at Koror. Some is landed at other locations (i.e. on several locations 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.

3.2.3 Marine fishing production means

Almost all offshore tuna catches in the Palau zone are currently made by locally-based foreign longliners. These vessels range in size from about 16 to 27 metres in length. Most vessels are registered in Taiwan Province of China, with smaller numbers registered in Belize, Indonesia, and Vietnam. In 2007 about 100 such vessels were based in Koror and licensed to fish in the Palau zone. Some tuna is occasionally caught around Palau by purse seining (405 tonnes in 2007), but the zone is located to the west of where most tuna purse seining in the Pacific Islands region occurs.

Coastal fishing in Palau is carried out by using various types of vessels and gears – on a commercial and subsistence basis. Techniques used include simple hand-collection to hook-and-line fishing, underwater spear-fishing, net fishing and trolling, most of which are conducted almost exclusively by men.

Boat-based coastal fishing 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.

Another aspect of coastal fishing in Palau are the occasional commercial fishing trips from the urban centre of Koror to the southwest islands – an activity that periodically produces spikes in national coastal fish production.

3.2.4 Main resources

The main targets of longlining in the Palau zone are three species of tuna. In recent years about half of the longline tuna catch was bigeye, with yellowfin about a third, and the remainder albacore.

[176] PCS (2000). Profiles of Palau's Inshore Fisheries, 1989-1998. Palau Conservation Society.

The Palao Conservation Society (PCS 2000)[177] gives the important species in Palau's coastal fisheries:

Important species in Palau's coastal fisheries

Category	Species
Local pelagic fish	Carangidae: *Selar crumenophthalmus* (bigeye scad/*terekrik*) *Elagatis bipinnulatus* (rainbow runner/*desui*) Sphyraenidae: (barracudas/*ai/mordubech/lolou*) Scombridae: *Rastrelliger kanagurta* (striped mackerel/*smach*) *Scomberomorus commerson* (spanish mackerel/*ngelngal*) *Euthynnus affinis* (kawakawa/*soda*) *Acanthocybium solandri* (wahoo/*keskas*)
Mangrove crab	*Scylla serrata* (mangrove crab/*chemang*)
Lobster	*Panulirus longipes (melech)* *P. penicillatus (raiklius)* *P. versicolor (bleyached)*
Trochus	*Trochus niloticus (semum)*
Giant clam	all Tridacnidae, including: *Tridacna crocea (oruer)* *T. derasa (kism)* *T. gigas (oktang)* *T. maxima (melibes)* *T. squamosa (ribkungel)* *Hippopus hippopus (duadeb)* *H. porcellanus (duadeb)*
Sea cucumber	all Holothuriidae, including: *Actinopyga mauritiana (badelchelid)* *A. miliaris (cheremrum)* *Holothuria fuscogilva (bakelungal cherou)* *H. nobilis (bakelungal)* *H. scabra (molech)* *Stichopus variegatus (ngims)* *Thelenota ananas (temetamel)*
Other invertebrates	*Birgus latro* (coconut crab/*ketat*) *Cardisoma* spp. (land crabs/*rekung el beab*) *Anodonia philippina* (mangrove clam/*ngduul*) *Gafrarium* spp. (nut clam/*delebekai*) *Octopus* spp. (octopus/*bukitang*) *Tripneustes gratilla* (sea urchin/*ibuchel*) *Loligos* spp. (squid/*luut*) *Sepia* spp. (cuttlefish/*milengoll*) *Nautilus* spp. (nautilus/*kedarm*)

3.2.5 Management applied to main marine fisheries

The management of the offshore fishery is undertaken through the framework of a management plan. The management of other coastal fisheries is less formalized.

The "Palau National Tuna Fisheries Management 2001" is a 39-page document. The first 18 pages are dedicated to descriptions of the fisheries, resources, and legal regime. The substantive elements consist of the aims of the plan, the scope of the plan, and seven main objectives. The plan has proven useful in balancing tradeoffs, especially between fishery and tourism objectives.

[177] PCS (2000). Profiles of Palau's Inshore Fisheries, 1989-1998. Palau Conservation Society.

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 & 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 having considerable impact on the fisheries management strategy in Palau is the balancing of nutritional, tourism, and export benefits of coastal resources (Box). There is a growing sentiment in Palau that, given the realities of coastal fisheries management in Palau, the most appropriate course of action would be to simply ban the export of coastal food fish. Non-government organizations, especially the Palau Conservation Society, exert considerable influence in coastal fisheries management.

Palau is a member of the Western and Central Pacific Fisheries Commission that 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.

Box: Fish for nutrition, tourism, and exports

"The following strategy has been recommended as a basis for inshore fisheries management: '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 sports 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."

Source: Dr Paul Callaghan, Palau, 1994; cited in Chapman (2004)[178]

Management objectives

The Palau National Tuna Fisheries Management Plan specifies the objectives for the management of the country's offshore fisheries:

- Conserving fishery resources by controlling harvesting within international and regional recognized sustainable limits.
- Establishing an efficient government framework to harmonize application of fisheries management policies and practices.
- Minimizing detrimental impacts of fishing on coastal and inshore environment.
- Attaining an optimum balance in relation to access to the resource between all stakeholders.
- Enhancing 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.
- Promoting Palauans in professional, administrative, research and development positions in the fishery and related industries and government agencies.
- Adhering to Palau's regional and international marine 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.

Palau is a member of the Western and Central Pacific Fisheries Commission that was established by the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean, which entered into force in June 2004.

[178] Chapman, L. (2004). Nearshore Domestic Fisheries Development in Pacific Island Countries and Territories. Secretariat of the Pacific Community, Noumea.

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 coordinated by the Forum Fisheries Agency, including:

- Regionally harmonized minimum terms and conditions for foreign fishing vessel access (Box)
- A limit on the number of tuna purse seine vessels allowed to fish in the region in the Palau Arrangement for the Management of the Western Pacific Purse Seine Fishery.

Box: Minimum terms and conditions for foreign fishing vessel access

Pacific Island countries (PICs), including Palau, developed a set of Harmonized Minimum Terms and Conditions for Foreign Fishing Vessel Access (MTCs) that apply to all foreign fishing vessels seeking access to EEZs of the Pacific Island Countries. Currently, the application of these MTCs is both widespread and comprehensive by PICs 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 PIC 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.

In the management of coastal fisheries, a number of management measures at the national level are used. Many are specified in the legislation. These include mesh sizes, bans on types of fishing gear, minimum size limits, catch bans, export bans, and closed seasons. Palau has been a pioneer in the region in the use of marine protected areas for fishery and other purposes.

There are also management measures implemented at the local level. As examples, a World Bank study[179] identified management measures at six sites in Palau:

[179] World Bank (2000). Voices from the Village. Number 9, Pacific Island Discussion Paper Series, World Bank, Washington DC, 175 pages.

Perceived threats and local management measures

Village	Threats Identified by the Community	Local management measures
Ngiwal	Road construction, the disturbance caused by outboard motors, commercial pressure leading to over-harvesting, and siltation	– Prohibition on entry or harvesting in the conservation area. – Ban on dynamiting. – Ban on cutting mangrove for use out of state. – Requirement that outsiders ask permission to fish in the site.
Kayangel	Speedboat disturbances, oil spills, and pollution/rubbish in the lagoon	– No entry/harvesting in the conservation area. – Ban on commercial fishing in Kayangel Atoll lagoon. – Restrictions on taking giant clam placed in front of the village. – Restrictions on taking turtle in excess of domestic needs. – Ban on the use of gillnets.
Peleliu	Overfishing, outboard motors, speedboats, exhaust oils, destructive fishing methods, disturbances caused by fishing activities, and mangrove clearing for fish ponds	– Prohibition of net fishing in certain areas within the reef. – Tourist catch-and-release law.
Koror	Sewage, dredging, erosion, oil spills, tourism, and the chemicals used to clean boats	– Requirement to register boats and motors. – Dive permit requirement. – Fishing licence fees. – Ban on cutting trees in Rock Islands. – Special requirement for permission for access to Ngemelis/Ngerchong.
Melekeok	Overfishing, sediment run-off from dirt roads, beach erosion, siltation on reefs and sea grass beds, trash from village dump, past dredging, and disturbance caused by outboard motors	– Banning of net fishing in the rocky/coral lagoon floor next to the reef. – Prohibition of cutting mangrove trees for sale out of the state. – Law designating a portion of the reef for clam conservation
Ngeremlengui	Speedboats, erosion, extraction of coral for lime production, overfishing and destructive fishing	– Mangrove crabs seasonal harvest restrictions – Marine conservation area – Prohibition of exporting mangrove trees out of the site

Institutions

The national-level management measures are implemented through the Bureau of Marine Resource of the Ministry of Natural Resources, Environment and Tourism. Lower level management measures are implemented by the 16 state governments which, under the constitution, control all resources from the shoreline up to 12 nautical miles offshore (except for the tuna resources).

The Palau Conservation Society is an important institution affecting the management of marine fisheries. Founded by a former fisheries officer, the Society has been active in advocating fisheries management, conducting studies in support of fisheries management, and promoting alternatives to extractive uses of the marine environment.

3.2.6 Fishermen communities

The concept of "fishermen 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".

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 amount of freshwater shrimp are taken and consumed.

3.4 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 gamefishing association. One major fishing derby and a few small fishing derbies are held each year in Palau.

There are about 10 vessels which occasionally participate in commercial sports fishing for tourists, but only a few vessels are employed primarily in this business. Most commercial sports fishing for tourists involves pelagic trolling outside the reef, but there has been promotion of inshore catch-and-release sports fishing by the Palau Conservation Society.

There is no active management of the recreational sub-sector, except for the general applicability of the national/state legislation (e.g. some spatial bans on fishing activity).

3.5 Aquaculture sub-sector

The Micronesian Mariculture Demonstration Centre was established in 1973 to serve Palau and other US-affiliated Pacific islands by developing, demonstrating and promoting mariculture technology. Later renamed the Palau Mariculture Demonstration Centre the facility also serves as a sub-regional mariculture training centre and a marine science research laboratory.

During four decades the culture in Palau of a large number of organisms has been attempted, both at the Centre and in independent efforts. Despite these activities significant aquaculture production in Palau is presently confined to giant clams and milkfish. In 2007, hatcheries in Palau produced about 0.4 million giant clam juveniles and 0.2 million milkfish fingerlings . About 4.1 tonnes of milfish were produced through aquaculture. This aquaculture production is mostly dependent on government subsidies.

The main aquaculture management measure is the requirement for an aquaculture permit for all facilities.

4. POST-HARVEST USE

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 destined to canneries and the bycatch for domestic and export 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 by travelers 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.

4.2 Fish markets

In Palau all fresh chilled sashimi-grade tuna, once offloaded and packed, are air-freighted within 24 hours to sashimi markets in Japan (95 percent), US mainland, and Taiwan Province of China. The albacore for canning goes mostly to Asian canneries (mainly in Thailand) but occasionally 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 in mainly the Koror urban area, but some small markets exist in the main residential areas of the states.

The 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 USA.

5. FISHERY SECTOR PERFORMANCE

5.1 Economic role of fisheries in the national economy

A recent study by the Asian Development Bank[180] attempted to quantify the fishery-related benefits received by Palau. The study gave the available information on the contribution of fishing/fisheries to GDP, exports, government revenue, and employment. The results can be summarized as:

- Official estimates show that fishing in 2006 was responsible for 2.2 percent of the GDP of Palau. A recalculation using a different methodology shows it was 6.1 percent in 2006.
- Exports of fishery products are about 100 percent of all export in 2007.
- Access fees paid by foreign fishing vessels represent 3.2 percent of all government revenue.
- The 2005 census indicates that, of the 13 800 people reporting income in 2004, 305 people (2.2 percent) reported income from selling fish; of 14 154 people over 18 years old in 2004, 933 people (6.6 percent) reported some subsistence fishing activity.

From the above it can bee seen that fisheries make a relatively important contribution to GDP and exports.

5.2 Demand

The per capita consumption of fish in Palau, based on the 2007 FAO food balance sheet, is 67.7 kg. Various other studies have made estimates ranging between 33.4 and 135.0 kg. The determination of fish consumption in Palau is complicated by a large tourist population.

Considering Palau's expected population growth and an hypothetical average annual consumption of 65 kg of fish per capita, the demand for fish fish in 2010 would amount to about 1 365 tonnes of fish.

Major factors influencing the future demand for fish are emigration, increases in the price of fish, the state of the tourism industry, and the general prosperity of Palau. The latter is greatly affected by payments by the USA under the arrangements in which Palau obtained its political independence.

[180] Gillett, R. (2009). The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories. Pacific Studies Series, Asian Development Bank, World Bank, Forum Fisheries Agency, Secretariat of the Pacific Community, and Australian Agency for International Development, 362 pages.

5.3 Supply

The government has several strategies to increase the national fish supply. These involve supporting the development of aquaculture, and facilitating the capture of under-exploited tuna and bottomfish, and provision of ice at fisheries centres to facilitate marketing. The government is now contemplating a ban on the export of inshore food fish, with one objective being to prevent a decrease in fish supply for domestic consumption.

Major factors affecting the local supply of fish are overfishing, transport links from the non-urban parts of the country, and the offloading of fish by the offshore fleet.

5.4 Trade

The International Monetary Fund (IMF 2006)[181] states that 100 percent of all exports of Palau in recent years were fish. Tuna make up most of the exports of fishery products from Palau. Other items include ornamental fish, giant clams, and trochus.

5.5 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 (USD7 812), implying considerable ability to purchase food, much of the national prosperity is based on payments from the USA – 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.

5.6 Employment

The 2005 census contains some information on employment in fisheries:

- Of the 13 800 people reporting income in 2004, 305 people (2.2 percent) reported income from selling fish
- Of 14 154 people over 18 years old in 2004, 933 people (6.6 percent) reported some subsistence fishing activity
- Of the 933 subsistence fishers, 186 (19.9 percent) were female.

For coastal commercial fishing, PCS (2000)[182] reports that there were 200 commercial and 1 100 non-commercial fishers in Palau in the late 1990s. With a gradual movement of people out of fishing employment and into jobs related to tourism, the number of commercial fishers has decreased over the last decade to an estimated 460 fishers in 2008.

Considering the size of the locally-based tuna industry (over 100 vessels, plus processing/shipment facilities) the tuna-related employment is quite small. Gillett (2008)[183] tracked the number of people employed in the tuna fisheries of Palau (fishing and post-harvest) over a seven-year period:

Employment in the tuna fisheries of Palau

	2002	2006	2008
Local jobs on vessels	1	0	0
Local jobs inshore facilities	11	5	20
Total	**12**	**5**	**20**

[181] IMF (2006). Public Information Notice on the Executive Board Discussion and Statement by the Executive Director for the Republic Palau. International Monetary Fund, Washington.

[182] PCS (2000). Profiles of Palau's Inshore Fisheries, 1989-1998. Palau Conservation Society.

[183] Gillett, R. (2008). A Study of Tuna Industry Development Aspirations of FFA Member Countries. Forum Fisheries Agency, Honiara, 70 pages.

5.7 Rural development

The Bureau of Marine Resource of the Ministry of Natural Resources, Environment and Tourism has several activities that are relevant to rural development, including placement of two or three fish aggregation devices (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 fishing Development Project, in cooperation with the US 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 sportfishing industry, primarily in the non-urban areas of Palau.

6. FISHERY SECTOR DEVELOPMENT

6.1 Constraints and opportunities

Some of the major constraints of the fisheries sector are:

- 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 opportunities in the fisheries sector include:

- Enhancement of the input of the private sector into the functioning of the Bureau of Marine Resource.
- Enhancing linkages between the fisheries and tourism sectors, including sports 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.

6.2 Government and private sector policies and development strategies

Provisions in the Constitution of Palau suggest that some of the over-arching elements of the fishery policy in Palau are: [184]

- Subject to national regulation, the states own the living and non-living marine resources from land up to twelve nautical miles seaward from the baselines;
- The national government owns and manages the resources outside of twelve nautical miles;
- The national and state governments are responsible for managing all living and non-living marine resources for the general welfare and security of the citizens of Palau;
- Traditional fishing rights and practices are not to be impaired; and,
- The conservation of the natural environment shall be undertaken for the economic benefit, health and social welfare of the citizens of Palau.

[184] Kuemlangan, B. (2004). Report on Assistance to Palau in Drafting Fisheries Legislation. Technical Cooperation Programme, Food and Agriculture Organization of the United Nations, Rome.

In late 2009 the Secretariat of the Pacific Community began preparation to assist Palau in the development of a national fisheries policy. Presently, the government's policies and development strategies in the offshore fisheries appear to be best reflected in the objectives of the current tuna management and development plan:

- 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.
- Adherence to Palau's regional and international marine agreements.

The coastal fisheries policies can be inferred from recent activities of the Bureau of Marine Resource. These include:

- Emphasizing the realignment, restructuring and strengthening of national fisheries laws, policies, institutions and programmes.
- Improving the quality of coastal fishery products through improved handling/marketing.
- Diverting fishing effort from coastal areas to the less exploited offshore tuna and bottomfish resources.
- Giving attention to improved management of the trochus fishery.

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 expanding but rather surviving during a period of poor profitability – as has been the case for the last few years.

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 the Palau Marine Resources Bibliography.[185] The results of many of the research projects are summarised by resource in the Palau Fisheries Profiles.[186]

Current fisheries research in Palau by the Bureau of Marine Resource and other government agencies includes research on tuna, bycatch, marine biology of the Northern Reefs, efficacy of several marine protected areas, 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.

Other institutions in Palau carry out research that is relevant to the fisheries sector. This includes the Palau Conservation Society, Palau International Coral Reef Centere the Palau Community College, and the Nature Conservancy.

[185] Izumi, M. (1988). Palau Marine Resources Bibliography. Field Document 88, UNDP Regional Fishery Support Programme, Suva.
[186] Nichols, P. (1991). Republic of Palau Marine Resources Profiles, Fisheries Development Section, Forum Fisheries Agency, Honiara.

6.4 Education

Education related to fisheries and marine resources in Palau is undertaken in a variety of institutions:

- Basic aspects of fisheries science are taught in the Palau Community College's (PCC) Environment and Marine Sciences Programme. 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 the South Pacific in Suva.
- Training courses are frequently organized by the major regional organizations involved in fisheries: the Secretariat of the Pacific Community in New Caledonia and the Forum Fisheries Agency 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, and mainland USA.

6.5 Foreign aid

Palau has enjoyed fisheries sector assistance from a range of multilateral and bi-lateral donors. Support has included the funding of expatriate staff positions within the Bureau of Marine Resource, construction of aquaculture facilities, fisheries infrastructure (docks, refrigeration facilities), equipment costs, the provision of vessels, collaborative research, sector planning studies, and travel costs for training and attendance at meetings.

Important donors have included the US Department of the Interior (through Sea Grant), the US Department of Commerce (Saltonstall-Kennedy allocations), the US 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, Australia, New Zealand, and Canada.

Much of the fisheries sector assistance in the past has been channeled through the Bureau of Marine Resource. 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. These include the MacArthur Foundation, Packard Foundation, and Wallis Foundation that are based in the United States, and the Keidanren Foundation in Japan.

7. FISHERY SECTOR INSTITUTIONS

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 Resource (which formerly concentrated on monitoring, research, and aquaculture). The Bureau is guided primarily by the Marine Protection Act of 1994. The coastal fisheries work mandated by the Act and other legislation is translated into institutional functions through the 1996-2020 Palau National Development Master Plan and the 2001 Bureau of Marine Resource Immediate and Medium Term Plan. However, operational policy is guided by precedent and implemented through the day-to-day decisions of senior BMR staff.[187]

[187] Source: Palau Coastal Fisheries Action Plan.

The mission of the Bureau of Marine Resource (BMR) is to provide support and a favourable environment for the sustainable use of the marine resources of Palau by the subsistence, commercial, mariculture, and recreational sectors for the benefit of the people of Palau. To achieve the aim outlined in its Mission Statement, the Bureau has a work programme covering a range of different activities in the field of fisheries and marine conservation. These activities are organized within three branches:[188]

- The Fisheries Development Branch
- The Fisheries Management Branch
- The Aquaculture and Mariculture Branch
- The BMR also operates two separate programmes: the Vulnerable Marine Species Conservation Programme, and the Marine Conservation and Protected Areas Programme.

The BMR is currently administratively under the relatively new Ministry of Natural Resources, Environment and Tourism. The Bureau is headed by a Director and has a staff of about 35 people. The BMR currently has a government-funded budget of approximately USD500 000, of which 80 percent is to cover salaries, with most of the rest covering basic operational costs and utility bills.

Other agencies with involvement in the fisheries sector of Palau include:

- 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 is carried out in conjunction with the Palau Conservation Society, the Palau International Coral Reef Centre, 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.

Some of the important internet links related to fisheries in Palau are:

- www.spc.int/coastfish/Countries/palau/palau.htm – General information on fisheries in Palau, including the work of the Secretariat of the Pacific Community in Palau fisheries.
- www.spc.int/coastfish/news/Address_Book/Address_book.htm – Marine resource-related addresses in Palau.
- www.palaugov.net – Provides an overview of the Palau government, including the Bureau of Marine Resource.
- www.sprep.org/publication/pein_palau.asp – Palau environment library.

[188] Source: SPC (2008). The Palau Bureau of Marine Resources. Secretariat of the Pacific Community, Noumea.

8. GENERAL LEGAL FRAMEWORK

The main law relevant to the fisheries sector in Palau is the "Marine Protection Act of 1994." The stated purpose of the Act is to promote sustainably and develop the marine resources of the Republic while also preserving the livelihood of the commercial fishermen of the Republic.

The 17-page document defines important terms, specifies certain prohibited acts (the main regulatory provision of the law, see Box), gives the requirements for permits for taking aquarium fish, gives the power to the Minister to make regulations to carry out purposes of the Act, stipulates a requirement regulations for export labeling/reporting, specifies the enforcement provisions, and establishes penalties.

Box: 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, katuu'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;

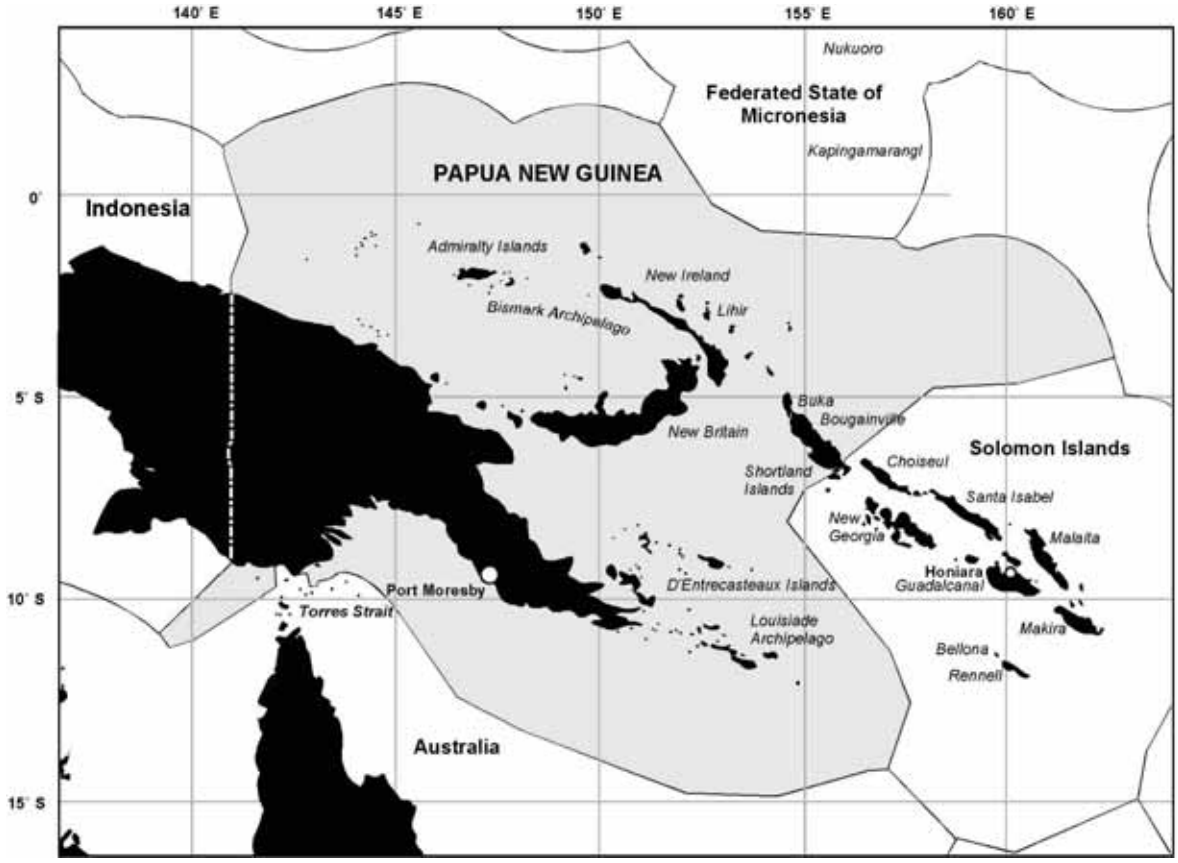
(14) retain possession of, or abandon, a kesokes net having a mesh size of less than three(3) inches measured diagonally or with a bag portion having a mesh size less than three(3) inches measured diagonally. This subsection will come into effect two years after the effective date of this Act;

(15) until such time as the regulations promulgated pursuant to Section 5 are in effect, take aquarium fish.

Some recent events related to the Marine Protection Act of 1994 are:

- In 2004 FAO carried out a comprehensive review of all existing Palau fisheries legislation, with particular emphasis on features that would enable the implementation of community based fisheries management, aquaculture and fish health management in coastal fisheries.
- In 2005 the Marine Protection Act was amended to clarify that the prohibitions of the Marine Protection Act apply to activities that take place anywhere within the Republic of Palau and to make possession and receipt violations of the Act.
- In 2007 The Secretariat of the Pacific Community (SPC) prepared a public awareness brochure for the Bureau of Marine Resource that explains the major provisions of the Marine Protection Act (available at www.spc.int/coastfish/Countries/palau/PalauDomestic2007.pdf).

PAPUA NEW GUINEA



1. GENERAL GEOGRAPHIC AND ECONOMIC DATA

Area	462 243 sq km
Water area	3 120 000 sq km
Shelf area	[not determined]
Length of continental coastline	17 000 km
Population (2007)*	6 423 000
GDP at purchaser's value (2005/06 financial year)	5 521 million USD[189]
GDP per head (2006)	891 USD
Agricultural GDP (2006)	1 740 million USD[190]
Fisheries GDP (2006)	185 million USD[191]

*UN Population Division

[189] Staff of the PNG National Statistics Office provided information on GDP (K. Geberi, personal comm., September 2008). The average PNG Kina to USD exchange rate in 2006 was 3.06.

[190] Includes agriculture, forestry, and fishing.

[191] This is the official fishing contribution to GDP. A recalculation shows it to be about 15 percent greater. Source: Gillett, R. (2009). The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories. Pacific Studies Series, Asian Development Bank, Manila.

2. FISHERIES DATA

2007	Production	Imports	Exports	Total supply	Per caput supply
	tonnes liveweight				kg/year
Fish for direct human consumption[192]	228 458	28 355	143 207	113 606	17.7
Fish for animal feed and other purposes	35 502	–	–	–	

Estimated employment	
(i) Primary sector (including aquaculture)	unavailable[193]
(ii) Secondary sector	Unavailable
Gross value of fisheries output (2007)	812 millions USD[194]
Trade (2007)	
Value of fisheries imports	21.6 millions USD
Value of fisheries exports	138.7 million USD

3. FISHERY SECTOR STRUCTURE

3.1 Overall fishery sector

The small-scale fisheries of Papua New Guinea (PNG) reflect the diversity of the country's coastal environments. Along the mainland and high island coasts and in the smaller island communities fishing activities include the harvesting of the reef flats, spear fishing, shallow-water hand-lining from dugout canoes, netting, and trapping in the freshwater reaches of large rivers. In the swampy lowland areas net fisheries for barramundi, catfish, and sharks occur, while in the Gulf of Papua and parts of the Northern Islands Region there are also village-based lobster fisheries. Collection of invertebrates, both commercially (bêche-de-mer, trochus and other shells) and for subsistence purposes is extensive, and may exceed finfish harvesting. Commercial shrimp-trawling operations take place in the Papuan Gulf and other parts of southern PNG. A small number of vessels use longline gear to catch sashimi-grade tuna for export to overseas markets by air. By far the largest fishery in the country is the purse seine tuna fishery, in which both locally-based and foreign-based vessels participate.

With respect to the current situation, fisheries in the waters of PNG can be placed into six categories. These categories and the associated production in 2007 are estimated as:

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based[195]	Fresh-water	Aqua-culture
Volume of production (metric tonnes)	5 700	30 000	256 397	327 471	17 500	200
Value of production (USD)	27 027 027	35 472 973	345 976 228	386 361 944	16 554 054	675 676

Source: Gillett (2009)

[192] Data from FAO food balance sheet of fish and fishery products.

[193] One reference states that 120 000 people are involved with fishing at least once per week and there are 2 000 to 4 000 part-time artisanal fishers. Source: Diffey, S. (2005). Market and Market Linkages Study. Rural Coastal Fisheries Development Project, National Fisheries Authority, Government of Papua New Guinea, and the European Union. A survey funded by the Australian Centre for International Agriculture Resaerch (ACIAR) concluded that there were 8 000 freshwater fish farmers in the country in 2006.

[194] From Gillett (2009); includes the six fishery production categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally-based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing, and (6) aquaculture.

[195] This is the catch in the EEZ zone of the PNG by vessels based outside the country. Normally, iIn FAO reporting on production in world capture fisheries, this catch will be reported as the catch of the nation(s) in which the vessel(s) is (are) registered.

The main trends and important issues in the fisheries sector

The main trends in the sector include:

- A large increase in the amount of the tuna caught in PNG, and an increasing proportion of the tuna catch being processed in PNG.
- An increasing number of tuna processing plants operating in the country and a large increase in the number of people being employed in tuna processing.
- Decreasing number of locally-based longline vessels and associated employment in the present decade.
- Greater use of fisheries management plans to manage the major fisheries in the country.
- The country becoming increasingly assertive in Pacific Islands regional fishery affairs.

Some of the major issues in the fisheries sector are:

- Keeping management plans for specific fisheries current and functional is a great challenge.
- Although the national-level fisheries agency represents a very positive model that is being emulated by other Pacific Island countries, the capacity of the fisheries staff at the provincial level is quite low.
- There is considerable difficulty in developing coastal commercial fisheries and the past is littered with expensive attempts.
- Reconciling the great need to create employment in the country with the reality that most of the newly created employment in the tuna industry are low-wage cannery jobs.
- The regional/global move to ecosystem-approach to fisheries management, however desirable, is clashing with the realities of fisheries management in PNG.
- The National Fisheries Authority Corporate Plan 2008-2012[196] lists the following challenges and issues: regional purse seine tuna vessel over-capacity, effective surveillance and tuna resource concerns, lack of market access, inadequate onshore support facilities (particularly for coastal fisheries), lack of availability of trained staff and crew, conducive business climate for investment good governance, unavailability of credit facilities, fuel excise, and lack of linkage with other agencies or services.

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 local and foreign purse seiners and longliners. There is also an industrial-scale shrimp fishery. In 2009 PNG reported to FAO a fishery fleet composed of 583 vessels, all larger than 12 m LOA, composed of 17 trawlers, 214 purse seiners, 83 trap setters, 30 longliners, 10 other type of liners, 153 multipurpose vessels and 76 other fishing vessels. Foreign flagged purse seiners also operate within the PNG EEZ.
- 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: bêche-de-mer, lobster, and trochus.

3.2.1 Marine catch profile

Marine catches are dominated by the tuna fisheries, primarily longline and purse seine. Catch of tuna and tuna-like species by PNG reported to the Western and Central Pacific Fisheries Commission are:

[196] NFA (2008). The National Fisheries Authority Corporate Plan 2008-2012. National Fisheries Authority, Port Moresby.

Catch of tuna and tuna-like species by the PNG tuna fleet

	Gear	2003	2004	2005	2006	2007	2008	2009
Catch volume (tonnes)	Purse seine	156 727	221 164	231 805	229 124	226 895	202 829	209 333
	Longline	3 120	4 622	4 021	4 329	3 489	3 124	3 983
	Total	**159 847**	**225 786**	**235 826**	**233 521**	**230 384**	**205 953**	**213 316**
Number of vessels	Purse seine	28	44	51	42	47	49	41
	Longline	40	41	46	35	21	17	29
	Total	**68**	**85**	**97**	**77**	**68**	**66**	**70**

Source: WCPFC Yearbook Includes foreign flagged vessels chartered to PNG.

Marine catches are dominated by the tuna fisheries, primarily longline and purse seine. Estimates of the volume and value of the catches from the PNG EEZ including those taken by foreign vessels are given in the table below.

Tuna catches by the PNG based tuna fleet

	Gear	2001	2002	2003	2004	2005	2006	2007
Catch volume (tonnes)	Purse seine	95 202	128 600	164 168	207 809	230 681	218 664	251 638
	Longline	2 830	2 857	3 895	5 939	4 354	4 135	4 759
	Total	**98 032**	**131 457**	**168 063**	**213 748**	**235 035**	**222 799**	**256 397**
Catch value (USD)	Purse seine	75 291 905	100 222 963	122 810 818	180 287 514	212 089 155	213 083 697	332 266 645
	Longline	10 436 125	10 198 339	12, 668 605	18 256 525	11 514 005	13 257 921	13 363 607
	Total	**85 728 031**	**110 421 302**	**135 479 423**	**198 544 039**	**223 603 159**	**226 341 619**	**345 630 252**

Source: estimated from FFA (2008)[197]

In recent years the tuna catch in PNG waters by foreign fishing vessels consisted entirely of fish caught by purse seine gear. Gillett (2009) estimated that this purse seine catch in 2006 was 278 459 tonnes (worth USD226 million) and in 2007 was 327 471 tonnes (worth USD386 million).

Estimates of catches from the coastal fisheries vary widely. In 2008 the Asian Development Bank examined a large number of studies on coastal fishing in PNG and concluded (a) the coastal subsistence production of PNG in the mid-2000s was about 30 000 tonnes, worth[198] USD$35 million; and (b) the coastal commercial production in the mid-2000s was 5 700 tonnes, worth USD$27 million to the producer.

PNG is unique in the Pacific Islands region in that the underwater topography of the country is appropriate for shrimp trawling. In recent decades four shrimp trawl fisheries have developed in PNG:[199]

– The *Gulf of Papua fishery* has operated commercially since the late 1960s. In 1976, three companies operated with three licences each. In 1978, two old vessels were commissioned by a joint venture company to fish inside the 3-mile limit and in the same year an old trawler returned to Japan and was not replaced. In 1981, four national companies chartered vessels to operate inside the 3-mile zone while one foreign-owned vessel operated outside the 3-mile zone. This brought the total for that year to 19 vessels. Except for 1981, however, the average number of vessels operating in the Gulf of Papua fishery has been 13-14. During 1986, the number of licensed operators increased to 21, with the introduction of Australian chartered vessels.

[197] FFA (2008). The Value of WCPFC Tuna Fisheries. Unpublished report, Forum Fisheries Agency, Honiara.

[198] Using the farm-gate method of valuing subsistence production.

[199] Source: (a) Kailola, P. 1995. Fisheries Resources Profiles: Papua New Guinea. Report No. 95/45, Forum Fisheries Agency, Honiara, Solomon Islands; and (b) Gillett (2009).

- The *Orangerie Bay fishery* is known to be seasonal and geographically restricted to an area of 15.5 sq km. It has been fished intermittently by small class vessels (9-16 m length) since 1981.
- The *Torres Strait fishery* was entirely Australian until 1987 when two PNG vessels entered and by August of that year there were four PNG vessels (Australian boats chartered to PNG companies).
- The *Western Province artisanal fishery* commenced after a 1982 survey to determine the potential for low technology fishing using small boats or canoes. Beam trawls, beach seines and light weight otter trawls were employed and fishing was conducted in 1 to 6 metres of water, from Sui on the mouth of the Fly River to Sigabaduru west of Daru. Almost all areas to within 10 nautical miles of the shore were trawlable, depending on the state of the tide.

3.2.2 Marine landing sites

In the offshore fisheries, the catch is offloaded at a variety of locations. Longliners (all locally-based) mostly offload their catch at Port Moresby – due to the relatively simple logistics of air-freighting to overseas destinations. About half of the locally-based purse seiners offload directly to a domestic processing facility, with the other locally-based seiners either transshipping the catch or offloading at a foreign port. The foreign-based purse seiners either transship to a foreign port (mainly those vessels from China, Korea, Taiwan and the Philippines) or deliver directly to their home port (mainly those vessels from Japan and USA).

Most of the shrimp trawlers vessels are based in the capital, Port Moresby, and offload their catch at that location.

The small-scale commercial catch is mainly offloaded in or near coastal urban and semi-urban areas throughout the country. The non-perishable fishery products (e.g. bêche-de-mer, trochus) are offloaded in virtually any coastal area, but mainly at the base of operations of the fishers. Subsistence fishery landings occur at coastal villages throughout the country, roughly in proportion to the distribution of the population.

3.2.3 Marine fishing production means

Most of the marine fishery production in PNG is from the offshore fisheries. In 2007 about 98 percent of the production of the locally-based offshore fleet came from purse seining, with the remainder from longlining. The box below gives information on the offshore production means.

Most of the boats in the PNG prawn trawl industry are old. None presently in the fleet are less than 15 years old and some are more than 30. Gear restrictions have been introduced limiting the boats to less than 30 m in length, with main engines not exceeding 550 hp, and towing no more than 4 nets. Fishing takes place primarily in the Gulf of Papua, as well as in smaller fishing grounds elsewhere. Most vessels are based in Port Moresby and carry 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. A regulation introduced in the 1980s, which prohibits vessels from fishing within 3 miles of the coast, is said to have resulted in lower catches.

The coastal commercial fisheries use a wide variety of production means. These range from relatively sophisticated live reef food fish operations (using large vessels capable of transporting the catch to Asia) to small-scale operators that collect invertebrates by hand for export. Although there has never been a national survey to catalogue production means, the typical means of harvesting fish for sale are lines, spears, and nets from an unpowered canoe or outboard powered skiff. Kailola (1995) states that in PNG handlining takes large and small reef-associated carnivores, underwater spearing takes large reef fish, surface spearing takes the pelagic carnivores, and netting exploits nearly all sections of the reef community, from large carnivores to small herbivores.

Box: Offshore fishery production means

Domestic longline: Papua New Guinea's longline fishery is fully domesticated, restricting the participation to only nationals or citizen companies with limited allowance for dry charter of additional foreign vessels. The longline fishery in PNG includes a distinct shark fishery which is managed under a separate Management Plan from the tuna longline. Effort for this fishery is limited to 9 vessels setting 1 200 hooks per day and a TAC of 2 000 tonnes dressed weight per year including shark catches by tuna longline vessels. The Tuna longline sector is managed under the Tuna Fishery Management Plan, which limits effort (100 vessels and 1 200 hooks per set per day) and catch limit (10 000 tonnes per year based on the combined catch of yellowfin and bigeye) for the tuna longline fishery sector. The total number of longline vessels has, however, never reached the 100 licences allowed for but has been stable at about 50 vessels (41 tuna and 9 shark vessels) in the last four years. The actual number of active vessels was 27 in 2006, 22 in 2007.

Locally-based foreign purse seine: A total of 32 vessels fish under this category. Fourteen of these are associated with the tuna cannery, and land all their catch there. Most are smaller medium-sized vessels that fish in association with fish aggregation devices. They transfer catch to carrier mother ships at sea, and again take most of their catch within archipelagic waters. These vessels are Philippine flagged but are permanently based in PNG and fish only in PNG, especially in the archipelagic waters. The other eighteen are larger vessels, mostly flagged in Vanuatu, operating widely throughout the region. These vessels are associated with present or planned onshore processing developments.

Foreign access purse seine: PNG currently has bilateral purse seine access agreements with China, Korea, Japan, Taiwan and Philippine companies, as well as being a signatory to a treaty with the United States. Several Vanuatu flag vessels are also under bilateral agreement with PNG. A total of 200 purse seine vessels are currently licensed.

Source: Kumoru (2008)[200]

The production means coastal subsistence fisheries are extremely diverse and reflect the variety 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.

3.2.4 Main resources

WCPFC Yearbook indicated that albacore and yellowfin are two major catch of the PNG longliners and consist around 90 percent of total catch, though the ratio between albacore and yellowfin varied according to the year. In the case of purse seiners, majority (around 80 percent) of catch is skipjack, followed by yellowfin.

Kumoru (2008) states the available logsheet data of offshore fisheries indicate:

- The 2007 longline catch was comprised of 1 319 tonnes yellowfin (42 percent), 104 tonnes bigeye (3 percent), and 1 564 tonnes albacore (50 percent) and 142 tonnes of other fish (5 percent).
- The 2007 purse seine catch contained about 76 percent skipjack with yellowfin making up most of the remainder.

The shrimp trawl fishery produces mainly banana prawn (*Penaeus merguiensis*) and smaller quantities of giant tiger prawn *(Penaeus monodon)*.

[200] Kumoru, L. (2008). Papua New Guinea. Working paper 23, Scientific Committee, Fourth Regular Session, 11-22 August 2008, Port Moresby, Papua New Guinea.

The small-scale coastal marine fisheries (both commercial and subsistence) take a very large number of finfish and invertebrate species. Kailola (1995) states that PNG contains some of the highest diversity of reef-associated fishes in the Indo-Pacific. The food fishes characteristically found on PNG's 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 of PNG 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.

3.2.5 Management applied to main marine fisheries

Many of the important commercial fisheries of the country are managed using formal fishery management plans. These are subsidiary legislative instruments with the same status and authority as fishery regulations. The process of management by plan began about a decade ago and flows from the Fisheries Management Act 1998 which stipulates that a fisheries management plan shall:

- Identify the fishery and its characteristics, including its current state of exploitation;
- Specify the objectives to be achieved in the management of the fishery;
- Identify any possible adverse environmental effects of the operation of fishing activities in the fishery; and
- Identify where appropriate any relevant customary fishing rights or practices.

To date, about ten fishery management plans have been formulated and implemented by the National Fisheries Authority. These include:

1. Tuna
2. Bêche-de-mer
3. Lobster
4. Gulf of Papua prawn
5. Sharks
6. Aquaculture
7. Longline tuna
8. Fish aggregating device management policy
9. Barramundi
10. Torres Strait lobster

Management objectives

The general objectives of all fisheries management in PNG are specified in the Fisheries Management Act 1998. These are: (a) promote the objective of optimum utilization and long term sustainable development of living resources and the need to utilize living resources to achieve economic growth, human resource development and employment creation and a sound ecological balance; (b) conserve the living resources for both present and future generations; (c) ensure management measures are based on the best scientific evidence available, and are designed to maintain or restore stocks at levels capable

of producing maximum sustainable yield, as qualified by relevant environmental and economic factors including fishing patterns, the interdependence of stocks and generally recommended international minimum standards; (d) apply a precautionary approach to the management and development of aquatic living resources; (e) protect the ecosystem as a whole, including species which are not targeted for exploitation, and the general marine and aquatic environment; (f) preserve biodiversity; (g) minimize pollution; and (h) implement any relevant obligations of Papua New Guinea under applicable rules of international law and international agreements.

The Fisheries Management Act 1998 also stipulates that each management plan is to include certain elements, including the objectives to be achieved in the management of the concerned fishery. The management objectives are a prominent feature of all current PNG management plans. As an example, the National Shark Longline Management Plan gives the following management objectives:

- To apply a precautionary approach to the management of the shark fishery, ensuring the harvest of shark resources is sustainable and that shark fishing has minimal impact on the marine ecosystem.
- To ensure that there are benefits to Papua New Guinea from the sustainable use of its shark resource.
- To ensure that the utilization of the shark resource does not have negative impacts on coastal communities.

PNG is a member of the Western and Central Pacific Fisheries Commission that 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.

Management measures and institutional arrangements

An important aspect of all the PNG fishery management plans is the specifying of management measures to be used to attain the objectives of the plan. As an example of actual measures, the box below gives those from the National Lobster Fishery Management Plan.

Box: Management measures Specified in the National Lobster Fishery Management Plan

License restrictions:

- Licences shall not be issued to non-citizen companies or foreign individuals.
- There shall be a maximum number of exporters and buyers licences set for each province.
- All licences shall be endorsed by the respective provincial authorities before submission to the Board for consideration and approval.
- All licence holders however, shall have their licence automatically terminated if they breach licence conditions or breach Fisheries Regulations or breach the provisions of this Management Plan.
- All lobster collected in a particular province shall be exported from that province. No product shall be moved to another province for sale without clearance from the respective Provincial Fisheries Authorities.

Size limits:

- All species of spiny rock lobster with a minimum tail length of 100 mm to total length (midsection between the eyes to tail) of 175 mm shall not be harvested and exported.
- Slipper lobster with minimum carapace length (midsection between the eyes to the base of the carapace cover) of 52 mm shall not be harvested and exported.
- All species of spiny rock lobster with a minimum of 169 gram tail weight and 409 gram total weight shall not be harvested and exported.

Restriction on egg-bearing females:

- Berried (egg-bearing) female lobster shall not be taken at any time, to protect and increase the number of recruitment of lobster.

Gear restriction:

- Specific gear restriction may apply to specific provinces and fishery in accordance with specific fishery plans for the province or fishery and in accordance with restrictions already in existence under the fisheries Regulation.

Special restrictions:

- There shall be restriction on the species of lobster caught in accordance with specific licence conditions.

Total allowable catch:

- A total allowable catch (TAC) shall be set for each province or fishery based on the estimated maximum sustainable yield as qualified by relevant economic or environmental factors, fishing patterns and related factor. A notice notifying of the TAC for each fishery will be published in the *National Gazette* by the Minister upon the recommendation of the Authority.

Closed seasons and closed areas:

- Whenever required, closed season and closed areas shall be set by the Minister upon the recommendation by the Authority.

Market standards:

- Marketing standards shall be based on the standards established by the relevant authorities and marketing requirement.

Institutions

The main institutions involved with fisheries management are the National Fisheries Authority (NFA) and its governing council, the National Fisheries Board. Under the Fisheries Management Act 1998 the NFA is given the authority to manage the fisheries within the fisheries waters of PNG. The National Fisheries Board provides general control and guidance over the exercise of the functions and powers of NFA.

NFA's management authority is conditioned to some degree by the "Organic Law", which devolved many powers (including some fisheries functions) to the provinces and local governments. The relationship between the management authority of NFA and that of lower levels of government is not always clear.

Additional information on the NFA and its powers is given in Section 7 below.

Another institution that is of considerable importance in the management of PNG's fisheries is the Fishing Industry Association. Because the Association is represented on the National Fisheries Board, it has substantial input into the fisheries management policies of the country.

3.2.6 Fishermen communities

The concept of "fishermen 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 in PNG are "fishing communities". To some extent this concept also applies to villages adjacent to significant rivers and other bodies of freshwater.

3.3 Inland sub-sector

Coates (1996)[201] describes the major features of the inland fisheries in PNG:

- Over 87 percent of the population live inland and have no direct access to marine, only freshwater, aquatic resources.

[201] Coates, D. (1996). Review of the Present Status of, and Constraints to, Inland Fisheries Development: the Pacific Island counties. IPFC Working Party of Experts on Island Fisheries, RAPA, Bangkok.

– Even in highland areas of Papua New Guinea, where fish stocks are very poor, over 50 percent of the population engage in fishing activities in many areas, traditionally for eels but more recently catches include a number of exotic species.
– Commercial exploitation of freshwaters in Papua New Guinea 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 Sepki/Ramu and the Fly/Purari, are quite extensive and provide most of the freshwater fish harvest. Except for the barramundi fishery and some commercial sales of tilapia, there has been little commercial development of freshwater fishery resources.

The production means are almost exclusively very small-scale fishing gear, with the most significant methods being trapping, netting and hand-lining from shore and dugout canoes, and spearing.

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.

The Asian Development Bank made a crude estimate of freshwater production for 2007 by expanding a mid-1990s freshwater catch estimates (by FAO) of 13 500 tonnes by 30 percent for population increase and for the effects of stocking. Accordingly, a PNG freshwater fisheries production for 2007 was estimated to be 17 500 tonnes, worth USD16.5 million.

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. The exception would be such fisheries as the Fly River barramundi fishery – for which an NFA fishery management plan has been formulated and implemented. The management objectives and measures for the other inland fisheries are not formalized. They mainly consist of local community interventions in support 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 of freshwater in general tend to run in parallel with freshwater fisheries, so interventions to improve water quality are likely to improve freshwater fisheries.

3.4 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.

Regular sport fishing activity (mainly targeting tunas and other oceanic fish) are found in the larger population centres, 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. Fish aggregating devices have been deployed by some recreational sport fishing associations (off Port Moresby and Lae to increase productivity.

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".

3.5 Aquaculture sub-sector

Freshwater aquaculture has been promoted in PNG since 1954. Attempts which have been made include culture of carp, eels, catfish, gourami, perch, tilapia, and trout. Until the mid-1990s freshwater aquaculture was the focus of a major national government programme which included the operation of common carp and rainbow trout hatcheries in highland and inland areas, restocking of natural water bodies with introduced species, and promotion of small-scale commercial aquaculture. The programme was considerably scaled down and handed over to provincial governments in late 1996. The Highlands Aquaculture Development Centre in Ayura, Eastern Highland Province became a nationally important centre for producing common carp seeds for distribution to farmers throughout the country, while rainbow trout seeds were produced and supplied to farmers by the private sector. The number of small-holder fish farmers with active ponds was estimated, through a Australian government funded survey project, to reach 8 000 in 2006, while there were possibly 2 000 or more farmers with ponds without seed for stocking.

The hatchery capacity of the Highlands Aquaculture Development Centre was improved through several externally funded projects and a number of training courses were offered to farmers by the centre. The centre also served as quarantine facility and trial farm for several exotic fish species introduced through some of the projects, attempting to boost inland fish farming and for stock enhancement in open water bodies. The introduced GIFT tilapia, following its first distribution of fingerlings to farmers in 2002 by the Centre, helped significantly to overcome the chronic bottleneck, the seed shortage, in developing fish farming in Papua New Guinea, thanks to the fish's fast growth and the ability to produce fingerlings in farmers' own ponds. Staring from 2005, the farming of tilapia boomed in the country, resulting in drastic increase in aquaculture production.

Owing to the scattered distribution of fish farmers and the terrain of Papua New Guinea difficult for easy access to many areas, the aquaculture statistics have not been well collected and reported. The existing estimates made by FAO on aquaculture production for Papua New Guinea (92 tonnes valued at USD443 000) based on limited information appear to have very much underestimated the actual level of aquaculture production in the country, especially for recent years. According to the National Aquaculture Development Manager, the level of annual production was close to 2 000 tonnes in 2009. The statistic details of this new level of production need to be reviewed and recorded.

Marine aquaculture has included farming of seaweed, giant clams, crocodile, milkfish, mullet, mussels, oysters, and prawns.

Recent initiatives in PNG aquaculture development include:

- Coral Sea Mariculture on Samurai Island – cultivation of silver-lip pearl oyster (*Pinctada maxima*)
- Coconut Product Limited in Rabaul – prawn culture in earthen ponds
- Western Province Sustainable Aquaculture in Daru – This company will focus on setting up a barramundi hatchery to produce barramundi fingerlings for restocking and conservation especially in the areas affected by the Ok Tedi mine
- The Nago Island Mariculture and Research Station (see box in Section 6.3 below)

The National Fisheries Authority 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 with aquaculture lie in developing an aquaculture industry, rather than in managing the existing aquaculture activities. Currently, NFA's aquaculture involvement is coordinated by an officer in the Fisheries Management Group.

4. POST-HARVEST USE

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, part of the catch is transshipped to canneries (mainly in Asia) or delivered directly by the seiners to a cannery in the Philippines or American Samoa. A growing amount of purse seine tuna is processed in PNG.

Three tuna processing plants are currently in operation and four are under progress. Each of the three operating facilities is supported by a cold storage. One of the facilities is currently processing mackerel, but is now being fitted with additional production lines to process tuna (Kumoru 2009).

Most of the coastal commercial catch destined for domestic consumption is utilized in urban or peri-urban areas, close to the base of operations of the fishers. Much commercial seafood demand in PNG is from commercial or institutional buyers such as fast-food outlets, restaurants and hotels. However, small-scale fishermen and fish merchants have difficulty responding to the needs of these buyers due to problems of quality, product volume, product form and consistency of supply. Most institutional and commercial buyers prefer to purchase from larger fishing companies who can assure regular supplies of the desired product quality and form.

The major export commodities from coastal commercial fisheries are: (source: Diffey 2005)[202]

– Frozen lobster tails and barramundi fillets to Australia (air-freighted on chartered aircraft from Daru via the Torres Islands)
– Canned fish (using imported mackerel) to the Solomon Islands
– Fresh (chilled) fish to the USA
– Frozen snapper fillets, mud-crabs, lobster tails and Spanish mackerel by sea-freight to Australia
– Live food fish, crabs and lobsters to Australia and SE Asia
– Processed and un-processed shells and shell-meat, primarily to SE Asia and Australia
– Fish meal to SE Asia

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.

4.2 Fish markets

The major markets for PNG's important offshore fisheries are located overseas. The main market for the fresh longline tuna is Japan. Purse seine tuna is exported to markets in Europe.

Domestic fish markets are found in the urban areas of the country. PNG has about 20 coastal cities and towns that have more than 5 000 people and most of these places have fish markets, although some are quite rudimentary.

[202] Source: Diffey, S. (2005). Market and Market Linkages Study. Rural Coastal Fisheries Development Project, National Fisheries Authority, Government of Papua New Guinea, and the European Union.

PNG, like many other Pacific Island countries, has had major involvement with rural fish collection and marketing schemes. The box below reviews some of the lessons learned from PNG's large collection/ marketing attempt.

Box: PNG'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 Programme, the biggest publicly funded fisheries development activity ever undertaken in PNG. The programme, 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 PNG;
- 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 PNG, there was a lack of commercial focus and accountability. Indeed, making a profit was seldom stated as an objective of any of the stations.

Today of the 22 original fisheries stations, 13 are now lying idle, 4 are barely operating, and the remainder have been converted to other uses.

Source: Preston (2001)[203]

5. FISHERY SECTOR PERFORMANCE

5.1 Economic role of fisheries in the national economy

A recent study by the Asian Development Bank attempted to quantify the fishery-related benefits received by Papua New Guinea. The study gave the available information on the contribution of fishing/ fisheries to GDP, exports, government revenue, and employment. The results can be summarized as:

- Official estimates show that fishing in 2006 was responsible for 2.7 percent of the GDP of PNG. A recalculation using a different methodology shows it was about 15 percent greater in 2006.

[203] Preston, G. (2001). A Review of the PNG Fisheries Sector. Gillett, Preston and Associates for the Asian Development Bank.

- Exports of fishery products are about 10 percent of all export in 2007.
- Access fees paid by foreign fishing vessels represent 0.62 percent of all government revenue.
- Formal jobs directly related to the tuna fisheries represent about 1.2 percent of the total number of formal jobs in the country. The tuna industry employs about 3.3 percent of all formally employed women.

From the above it can bee seen that fisheries make a relatively important contribution to GDP, exports, and employment.

5.2 Demand

The per capita consumption of fish in PNG, based on the 2007 FAO Food Balance Sheet, is 17.7 kg. Various other studies have made estimates ranging between 18.2 and 24.9 kg. Considering PNG's population, 21.5 kg of fish consumption per capita translates into a 2010 demand for 145 375 tonnes of fish.

Factors influencing the future demand for fish are migration from inland to coastal areas, increase in the price of fish, relative cost of fish substitutes, the amount the success of government-sponsored marketing schemes, and changes in dietary preferences.

5.3 Supply

The government has several strategies to increase the national fish supply. These involve supporting the marketing of fishery products in urban areas from rural parts of the country, deploying offshore fish aggregation devices, promoting aquaculture, and introducing non-native species into rivers.

Major factors affecting the local supply of fish are the costs of small-scale commercial fishing, transport links to the outer islands, and the offloading of fish by the offshore fleet.

5.4 Trade

FAO estimated the total export of fish and fishery products in 2007 as USD138.7 millions including USD97 millions of tuna products. A study by the Asian Development Bank (Gillett 2009) indicated that a crude estimate of the value of the fishery exports in 2007 could be obtained by adding the value of tuna products (US$88 million), to the value of other fish, lobster, shell, and shrimp (about US$13 million, for a total export value of US$101 million which is about 10 percent of all exports from the country).

5.5 Food security

Fish is an important element of food security in PNG. The FAO Food Balance Sheets show that in 2007 fish contributed an average of 7.5 percent of all protein to the diet and 13.9 percent of animal protein.

Animal protein substitutes for fish consist mainly of various types of meat, much of which are extremely fatty and have negative health implications.

5.6 Employment

The number of people employed in small-scale commercial fishing in PNG 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)[204] using several sources summarizes the current state of knowledge: "In 1989 UNDP estimated that PNG had about 2 000 coastal village communities with a population 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 fishermen. These

[204] Diffey, S. (2005). Market and Market Linkages Study. Rural Coastal Fisheries Development Project, National Fisheries Authority, Government of Papua New Guinea, and the European Union.

data are confirmed by the 1990 population census where NSO estimated 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".

Quantifying the number of people engaged in aquaculture in PNG remains elusive. There is general consensus that many people in the country are involved in the small-scale culture of fish, but the various studies give different results. SPC (2008)[205] mentions an "estimated 10 to 15 000 fish farmers in Papua New Guinea". An Australian-sponsored study on the status of freshwater fish farming in PNG during 2001-2006 (Smith 2007)[206] estimated the number of farms in 2001 in each of the 19 provinces of PNG to be 5 418. On the degree of involvement of people in the these farms, the report also quotes Mufuape (2000)[207] who states that there were "approximately 5 000 families in the highlands who each had one or two fish ponds that grew 50 fish to 500 g."

The tuna industry provides many of the formal fishing jobs in the country. Gillett (2009) tracked the number employed in that industry over a seven-year period:

Locals employed in the PNG tuna industry

	2002	2006	2008
Local jobs on vessels	460	110	440
Local jobs inshore facilities	2 707	4 000	8 550
Total	**3 167**	**4 110**	**8 990**

Considering the "monetary employment" of 774 000 in PNG in 2008, these 8 990 jobs represent about 1.2 percent of the salaried jobs in the country.

5.7 Rural development

Rural fisheries development projects have included trials and promotion of various designs of fishing boats and fishing gear and methods. Various initiatives have been taken to introduce or adapt exotic fishing techniques or technology to the PNG situation, and to expose local fishermen to these innovations with the aim of improving the productivity, economic efficiency, safety or comfort of fishing operations. Success of these efforts has been mixed. Constraints include high investment costs and general high opportunity costs. In addition, Preston (2001) states that despite their initial curiosity about innovative ideas, fishermen are by nature conservative and prefer to stay with tried and familiar methods wherever possible and within a society as traditional as PNG's, this conservatism might be expected to be even stronger than in some other countries.

The constraints to coastal fishery development mainly relate to the absence of a fish handling, distribution and marketing infrastructure. 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 such an infrastructure. Future commercialization of coastal fisheries will depend largely on the development of facilities such as longline bases or fish canneries to service the needs of the industrial tuna fishery, whose production levels can justify the high cost of such plants. If such infrastructure is put in place it should also be able to absorb production from commercial coastal fisheries.

[205] SPC (2008). Status Report: Nearshore and Reef Fisheries and Aquaculture. Officials Forum Fisheries Committee, Sixty-Seventh Meeting, 12-16 May 2008, Secretariat of the Pacific Community, Noumea.

[206] Smith, P. (2007). Aquaculture in Papua New Guinea: status of freshwater fish farming. ACIAR Monograph No. 125, 124 p.

[207] Mufuape K., Simon M. and Chiaka K. (2000). Inland fish farming in PNG. Papua New Guinea Food and Nutrition 2000 Conference, 26-30 June 2000. University of Technology.

6. FISHERY SECTOR DEVELOPMENT

6.1 Constraints and opportunities

Some of the major constraints in the fisheries sector are:

- To some degree, the tuna processing in PNG is leveraged by PNG'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.
- 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 greatest 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 opportunities in the fisheries sector include:

- Development of the Pacific Maritime Industrial Zone in Madang. This involves tuna canneries, tuna loining plants and in vessel servicing in a scheme that requires foreign vessels operating in PNG 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 PNG.
- 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.

6.2 Government and private sector policies and development strategies

The most up-to-date source of government policies and development strategies in the fisheries sector are to be found in the National Fisheries Authority Corporate Plan 2008-2012. Some of the important points are:

- The 1995 Domestication Policy encourages the full participation of PNG citizens and PNG-based companies in the development of commercial fisheries. The policy aspires to have citizens actively participate in all aspects of fishing, from harvesting to post-harvesting, to downstream processing to value-adding.
- The government has a "development framework" in fisheries which promotes:
  - Preferential – but not necessarily protected – access for national operators dependent on increasing participation by nationals;
  - Actively consulting with industry to consider their 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 to plan and manage their businesses well;
  - Provision of a range of practical training programmes to provide skilled labour for the industry through the National Fisheries College; and
  - Increasing restrictions on direct foreign employment where skilled nationals are available.

The Fishing Industry Association of PNG is involved in fisheries policies and development strategies. Although these polices/strategies are rarely formalized, the Association is an important force in these areas through its representation on the Board of the National Fisheries Authority.

6.3 Research

The Fisheries Act mandates the National Fisheries Authority as follows: "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 the NFA) is charged with (a) accessing research expertise, (b) approving, arranging or facilitating research required for the effective development and management of marine resources and fisheries, and (c) undertake collaborative projects and research with national and international stakeholders to address regional management requirements.

The results of many of the previous research programmes in the country are given in the Aquatic Resources Bibliography of Papua New Guinea[208] and the Papua New Guinea Fishery Profiles.[209] Past research has mostly been carried out by NFA, its processor agency (the Department of Fisheries and Marine Resources), the University of PNG, the Secretariat of the Pacific Community, the Forum Fisheries Agency, FAO, and agencies based in Australia, Japan, New Zealand, and the USA.

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 funding donors.

One of the latest developments in PNG fisheries research is the Nago Island Mariculture and Research Station (Box).

Box: 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 new 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)[210]

6.4 Education

The most important institution in PNG for education related to fisheries is the National Fisheries College. The College provides training in:

- Commercial fisheries, including course for skippers and deckhands
- Post-harvest aspects of fisheries
- Fishery observation
- Business aspects of fisheries

[208] Kailola, P. (2003). Aquatic Resources Bibliography of Papua New Guinea. National Fisheries Authority and the Secretariat of the Pacific Community.

[209] Kailola, P. (1995). Papua New Guinea Fishery Profiles. Forum Fisheries Agency, Honiara.

[210] Ponia, B. (2009). Aquaculture updates from Papua New Guinea (March 2009). Aquaculture Portal, Secretariat of the Pacific Community, Noumea. Available at: www.spc.int/aquaculture/index

The National Fisheries College is a branch of NFA. It is located in Kavieng in the north of the country, but some of the courses are given in other areas of PNG. The National Fisheries College is incorporated into a new NFA entity, the Institute of Sustainable Marine Resources.

In 2006 a PNG fisheries training needs assessment was carried out. The results[211] were used to modify the various courses offered by the National Fisheries College. A major conclusion of that assessment was that in order to better address training needs across the sector, (a) it will be necessary for training providers and industry to make better use of partnership type arrangements and develop the capacity of provincial-level institutions; and (b) there needs to be greater commitment in industry to staff professional development and to localization programmes.

There are a number of other institutions in PNG which offer training relevant to the fisheries sector:

- the PNG Marine School, in Madang, provides more advanced and officer-level vocational training for the 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 PNG 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 Secretariat of the Pacific Community in New Caledonia and by the Forum Fisheries Agency 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.

6.5 Foreign aid

According to the National Fisheries Authority Corporate Plan 2008-2012, the Government of PNG is a party to numerous development and investment related international arrangements, agreements and treaties, both bilateral and multilateral. For NFA, key development partners in recent years have included:

- Asian Development Bank
- European Union
- Australia
- Japanese International Corporation Agency
- German Technical Assistance
- Chinese Government

Important aid-funded projects have provided: fisheries infrastructure, training in fish sanitary procedures, aquaculture development, and fish marketing.

7. FISHERY SECTOR INSTITUTIONS

The Fisheries Act provides 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 in 2001 to manage PNG's fisheries resources under the Fisheries Management Act (1998) and was completely reorganized and re-staffed and strengthened. Staff numbers dropped by two thirds.

[211] Blanc, M.G. Carnie, and H. Walton (2006). Training Needs Assessment. Secretariat of the Pacific Community for the National Fisheries Authority.

NFA is governed by a board of 10 people, consisting of representatives of government, the fishing industry, resource owners and NGOs. The National Executive Council appoints the chair of the board. It is supposed to meet at least once every three months.

Access fees from foreign fleets currently form the bulk of the revenues received and managed by the National Fisheries Authority. 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 the National Fisheries Authority 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; and
- 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 sub-regional organizations in accordance with this Act.

NFA has been structured into several business groups, each under the leadership of an Executive Manager reporting directly to the NFA Managing Director. These groups are:

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)

The other main body involved in PNG 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 PNG. 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 the FIA sits on the National Fisheries Board, as well as on the Governing Council of the National Fisheries College.

8. GENERAL 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 PNG's fishery resources, whether these be inland, coastal or offshore. Although the Act recognises 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 consists of nine parts:

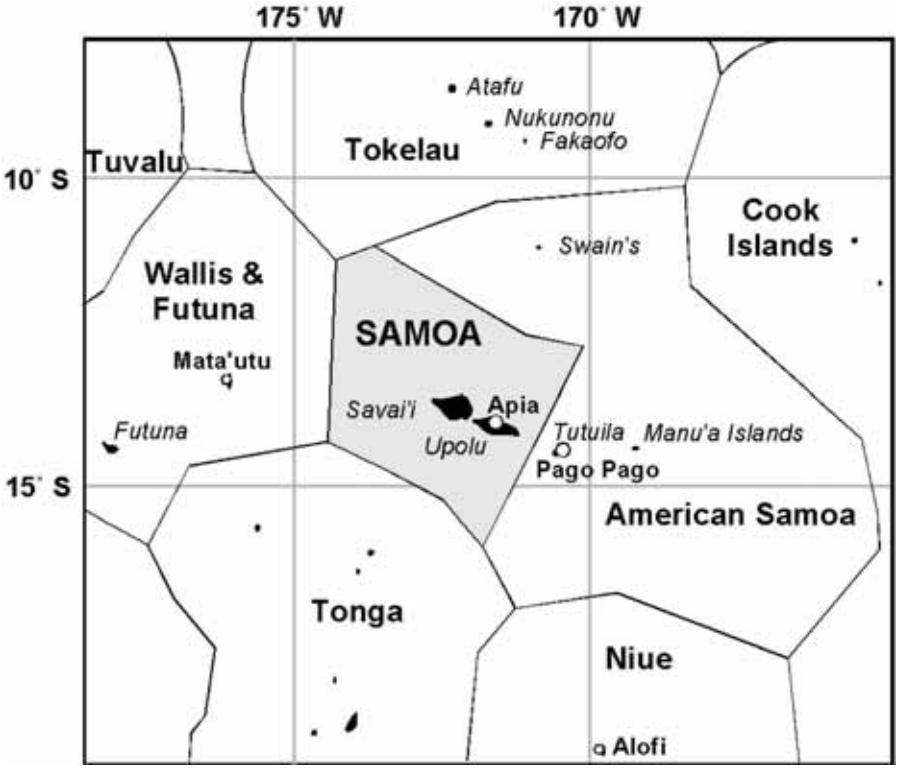
Part i	Preliminaries
Part ii	Institutional arrangements
Part iii	Fisheries management, conservation and development
Part iv	Licences
Part v	Enforcement and observer programme
Part vi	Jurisdiction, procedure, offences, penalties and liability
Part vii	Administrative proceedings
Part viii	Evidence
Part ix	Miscellaneous

With respect to the details of the Act:

- The provisions of the Act on the functions of the NFA are given in Section 7 above
- The provisions of the Act on the content of fisheries management plans and on the objectives of fisheries management in PNG are given in Section 3.2.5 above

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 the 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.

SAMOA



1. GENERAL GEOGRAPHIC AND ECONOMIC DATA

Area	2 935 km^2
Water area	129 000 km^2
Shelf area	[no continental shelf]
Length of continental coastline	447 km
Population (July 2007)	179 478
GDP at purchaser's value (2007)	523.8 million USD[212]
GDP per head (2007)	2 919 USD
Agricultural GDP (2007)	32.3 million USD[213]
Fisheries GDP (2007)	28.5 million USD[214]

2. FISHERIES DATA

2005	Production	Imports	Exports	Total supply	Per caput supply
	tonnes liveweight				kg/year
Fish for direct human consumption[215]	4 501	4 776	1 744	9 292[216]	50.5
Fish for animal feed and other purposes	–	–	–	–	

[212] 2007 average exchange rate: US$1 – ST$2.62; GDP source: Samoa Source: Bureau of Statistics, unpublished data; GDP at current market price.

[213] The contribution to GDP of agriculture and forestry; In the official statistics, "agriculture" does not include fisheries.

[214] Official fishing contribution to GDP; From Gillett (2009). The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories. Pacific Studies Series, Asian Development Bank, Manila.

[215] Data from FAO food balance sheet of fish and fishery products (in live weight).

[216] Modified to reflect actual supply.

Estimated employment (2003)	
(i) Primary sector (including aquaculture)	11 700[217]
(ii) Secondary sector	[not known]
Gross value of fisheries output (2007)	42.9 million USD[218]
Trade (2007)	
Value of fisheries imports	[unknown]
Value of fisheries exports	7.6 million USD[219]

3. FISHERY SECTOR STRUCTURE

3.1 Overall fishery sector

Fish and fishing is important to Samoa, both economically and socially. In 2007 over half of all exports of the country consisted of fishery products. About a quarter of all households receive some income from fishing. Fish (fresh, frozen and canned) are an important feature of the Samoan diet, and on average households consume fish most days of the week.

The country's fisheries can be placed into six categories. These categories and the associated production in 2007 are:

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based[220]	Fresh-water	Aqua-culture
Volume of production (metric tonnes)	4 129	4 495	3 755	25	10	10
Value of production (USD)	19 557 592	14 903 842	8 362 836	49 300	33 206	33 206

Source: Gillett (2009)

No discussion of the fisheries sector in Samoa would be complete without a discussion of the "alia" catamaran fishing craft. 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 the alia. The box describes the large change in the alia fleet in the past decade.

Main trends and important issues in the fisheries sector

The main trends in the fisheries sector include:

- After a disastrous safety record in the 1990s, sea accidents on alia longliners decreased markedly in the early 2000s.
- Since the mid-1990s, participation in the village fisheries management programme has steadily increased.
- There has been a decline in albacore abundance in the Samoa zone, likely due to a combination of several factors.
- The contribution of fisheries and agriculture to the Samoan GDP have remained about equal during the present decade.

[217] From Mulipola, A. 2003. Fisher Creel Census 2003 Report. Fisheries Division, Ministry of Agriculture, Apia, Samoa. Figure includes subsistence and small-scale commercial fishers.

[218] From Gillett (2009); includes the six fishery production categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally-based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing, and (6) aquaculture.

[219] Gillett (2009).

[220] This is the catch in the Samoa zone by vessels based outside the country.

Box: The rise and fall of the Samoan alia fishery

The offshore fishery in Samoa commenced in the late 1970's, when alias were first constructed for deepwater bottom fishing and trolling around fish aggregation devices (FADs). An alia is a catamaran style-vessel of around 9.0 metres in length, originally constructed from plywood, but nowadays constructed from aluminium, and is powered by a 40 h.p. outboard motor. Trial vertical and horizontal longlining primarily targeting albacore commenced in the early 1990s, with many alias being converted or purpose-built for longlining during the mid-1990s. Commercial longline fishing vessels (over 12.5 m) entered the fishery in the late 1990's. In 1994, Samoa's longline fleet was comprised of 25 alias, increasing to around 200 vessels in 1999, the majority of which were alias. 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 2002/03. Localised 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.

Source: Hamilton (2007)[221]

Some of the major issues in the fisheries sector are:

- The longline fishery is highly dependent on selling the albacore to the tuna canneries in American Samoa, but the continuation of operations at those canneries is uncertain, due to competition with canneries in low-wage countries.
- The participation of small alia longliners in the tuna longline fishery is being challenged by economic viability and competition with larger longliners.
- The tuna longline fishery in Samoa is constrained by a small EEZ, space in the Apia harbour, and high cost of air freight to fresh tuna markets.
- The fishery production from the characteristically small village fishing areas is likely to be approaching the sustainable limit.
- Although there has been considerable enthusiasm for aquaculture in Samoa in the past, the present production is tiny.
- Difficulties arise in the partitioning of the attention of available Fisheries Division staff between domestic and international aspects of fisheries management.

3.2 Marine sub-sector

The marine fisheries have two very distinct components, offshore and coastal:

- Offshore fisheries consist almost exclusively of tuna longlining, from small "alia" catamarans and from much larger mono-hull vessels.
- Coastal fishing, mainly on the reef and inside lagoons, is carried out for subsistence purposes and for sale in local markets.

3.2.1 Marine catch profile

In recent years catches by the Samoa-based offshore fleet have ranged from about 1 700 to 3 700 tonnes (tuna plus bycatch).

Catches by the Samoa-based offshore fleet

	2003	2004	2005	2006	2007
Total catch (mt)	2 916	1 982	1 681	2 713	3 755
Catch value (USD)	6 443 816	5 996 125	4 636 511	7 895 875	8 377 705

Source: Gillett (2009)

[221] Hamilton, A. 2007. The Samoa Alia Fishery. Development of Tuna Fisheries in the Pacific ACP Countries (DEVFISH) Project, Forum Fisheries Agency, Honiara.

Estimates of the coastal marine catch are more open to speculation. Two recent surveys (one of creel fisheries; one from a household income and expenditure survey) indicate that about 4 500 tonnes is taken annually by the coastal commercial fisheries and an amount slightly less by the coastal subsistence fisheries.

3.2.2 Marine 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 a few of the 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 along the roads.

3.2.3 Marine fishing production means

Virtually all offshore production is by longlining – either by alia catamarans or, in recent years mostly larger mono-hull vessels. The number of vessels operating in recent years and the number of hooks set is given in the table:

Yearly period	Number of LL vessels	Total fishing effort (No. hooks)
2002-2003	24	7 492 729
2003-2004	17	5 262 957
2004-2005	32	4 595 439
2005-2006	54	3 799 366
2006-2007	60	5 686 408
2007-2008	60	6 103 754

Source: Annual reports of the Fisheries Division

The bulk of Samoa's tuna catch being taken by 14 large longliners of 12.5-20.5 metres or more in length. A number of steps have been taken by the Samoan Government to try to preserve and revitalize the Alia catamaran fleet (mostly vessels less that 11 metres) through fishery management, fiscal measures and development assistance (Hamilton 2007).

Most of the alia craft go on short trips of one to two days in duration. The larger mono-hull vessels stay out much longer, with trip limitation being set by the ability to carry ice – often about two weeks.

Coastal fishing (both subsistence and commercial) employs a wide variety of production means. Fishing is undertaken by villagers operating in shallow lagoon waters adjacent to their lands. Fishing is for both subsistence and commercial purposes, with a significant overlap between the two. Fishing occurs from canoes or other small vessels, or on foot, and may involve the use of spears, nets, or hook and line, or, in the case of sessile invertebrates, simple hand-gleaning. Spearfishing is especially common, with most divers using mask/fins/snorkel and a sling-type spear. Night spearing is also common in some villages, using underwater torches. Trolling, using open motorized craft outside the reef is common, but the viability is affected by fuel costs and the presence/absence of anchored fish aggregating devices.

3.2.4 Main resources

The main target species captured in the offshore fishery are albacore (about 80 percent of the total catch), yellowfin (8 percent), and bigeye (3 percent). The other species taken include (in descending order) wahoo, dolphinfish, skipjack, striped marlin, blue marlin, and various species of oceanic sharks.

An FAO study[222] carried out in Samoa in the 1990s 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, rabbit fish), octopus, giant clams, bêche-de-mer, turbo, and crab. A study in 2006 identified the major species caught by spearfishing:

Common species in the spearfishing catch[223]

Samoan name	English name	Scientific name
Alogo	Lined surgeonfish	*Acanthurus lineatus*
Pone	Striated surgeonfish	*Ctenochaetus striatus*
Fuga	Five-banded parrotfish	*Scarus ghobban*
Saesae	Unicornfish	*Naso* spp.
Laea	Parrotfish	*Scarus* spp.
Ume	Long-nosed Unicornfish	*Naso unicornis*

3.2.5 Management applied to main fisheries

Samoa is a member of the Western and Central Pacific Fisheries Commission that 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.

Management objectives

The objectives of fisheries management in Samoa appear in the legislation only in very broad terms. The Fisheries Act states that the Director of the Department of Agriculture, Forests and Fisheries may "propose management and development measures designed to obtain the maximum benefits from the fishery resources for the people of Samoa, both present and future".

Fisheries management objectives must therefore be obtained or inferred from other sources. The Ministry of Agriculture and Fisheries Corporate Plan (2005-2007) has the goal of "Growing a Healthy and Wealthy Samoa". The broad objectives of management interventions in the fisheries sector are suggested in the mission statement of the Fisheries Division: "Promoting the optimum and ecologically sustainable use of the country's fishery resources and the development of suitable alternatives to harvesting depleted resources in order to maximize benefits to Samoa".

For the offshore fishery, the Samoa Tuna Management and Development Plan 2005-2009 gives two major overall management goals: (1) To ensure the sustainability of harvesting of tuna resources throughout their range, and (2) To maximize the long-term economic and social benefits accruing to the people of Samoa from the utilization of its tuna resources. The Plan establishes the specific objectives of:

- Continuing to strengthen the exercise of sovereign rights of Samoans over tuna;
- Increasing the economic gains received by Samoa through exercising its rights over tuna;
- Ensuring effective participation by Samoa in regional tuna management activities, and
- Continuing recognition of the cultural values in tuna policy and planning, particularly the importance of the contribution of tuna to food security, protection of the interests of small-scale fishers, and respecting various local by-laws and conservation measures.

For the coastal fisheries, fisheries management occurs on a geographic basis within village fishing areas. Many villages have their own management scheme and objectives. Because there are about 230 coastal

[222] Zann, L., 1992. The Inshore Resources of Upolu, Western Samoa. Field Report number 2, FAO/UNDP Project SAM/89/002, Apia, Western Samoa.

[223] Source: Gillett, R. and W. Moy (2006). Spearfishing in the Pacific Islands: Current Status and Management Issues. FAO Fishcode Review No.19, ISSN: 1728-4392, Food and Agriculture Organization of the United Nations, 72 pages.

villages in Samoa, the number of management schemes and associated objectives is quite large. Typical objective for village-level management in Samoa are given in King (2001):[224] "to protect the marine environment in order to increase the number of fish and shellfish available for present and future generations".

Measures and institutional arrangements

The management measures and institutional arrangements for the offshore fisheries are detailed in the Samoa Tuna Management and Development Plan 2005-2009. The main measure used to achieve the stated objectives in the plan is licence limitation. Restrictions are currently placed on longline vessel license numbers by size class, as follows:

Category	License Limit (number of licenses) 2005-2009
Class A: *Less than and equal to 11 m*	No limit
Class B: *Over 11 m and up to 12.5 m*	15
Class C: *Over 12.5 m and up to 15 m*	15
Class D: *Over 15 m and up to 20.5 m*	12
Class E: *Equal to or greater than 20.5 m*	5

Licence limitation is applied by the Fisheries Division and enforced by several government departments.

A large number of management measures are formulated and applied at the village level. A report on the status of village fishery management[225] gives the management tools in use at the village level. Figures in the right-hand column indicate the percentage of all villages using the particular action or regulation.

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 (e.g. smashing coral).	80%
Organizing collections of crown-of-thorns starfish.	80%
Enforce (national) mesh size limits on nets.	75%
Banning the dumping of rubbish in lagoon waters.	71%
Banning the commercial collection of sea cucumbers (Holothuroidea).	41%
Banning the capture of fish less than a minimum size.	41%
Banning removal of mangroves (in villages with mangroves).	27%
Restricting the use of 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 overseas aquarium trade.	<10%
Banning the coral-damaging collection of edible anemones (Actinaria).	<10%
Protecting areas where palolo worms, *Eunice* sp., are traditionally gathered.	<10%
Offering prayers for the safe-keeping of the marine environment.	<10%

[224] King, M., K. Passfield, and E. Ropeti (2001). Village Fisheries Management Plan: Samoa's community-based management strategy. Samoa Fisheries Project, Fisheries Division.

[225] King, M. and U. Fa'asili (1998). Community-Based Management of Subsistence Fisheries in Samoa. Fisheries Division, Ministry of Agriculture, Forests, Fisheries and Meteorology, Apia, Samoa.

3.2.6 Fishing communities

The concept of "fishermen 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, the Apia urban area. Nearly all households in coastal villages are involved in coastal fishing activities – mainly subsistence but often selling the surplus.

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 mt per year. The main freshwater fishery species are tilapia (there are occasionally roadside sales near lakes), eels, and freshwater shrimps.

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 food from the resource to the village.

3.4 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 sports fishing (mainly offshore trolling) and occasionally there are sports fishing competitions. Some of the hotels offer fishing as an activity for their guests.

3.5 Aquaculture sub-sector

A review of aquaculture in Samoa[226] states that the culturing of aquatic animals was not a traditional practice in Samoa. However, a traditional form of giant clam ranching was practiced on village reefs or in lagoon where a community placed giant clams in a fenced off area for special occasion or reserves for seafood supply in bad weather. The idea of initiating aquaculture in Samoa dates to 1954 when the Secretariat of the Pacific Community investigated the possibility of establishing fish ponds near Apia. However, significant aquaculture activities did not occur until the 1980s when several trials pertaining to farming tilapia, freshwater and marine prawns, oyster, eucheuma seaweed, green mussels and giant clams were investigated. Aquaculture activities have been initiated in Samoa to:

- Alleviate pressure on over-exploited inshore reef and lagoon fishery resources;
- Create an additional/alternative source of food and income;
- Increase fishery production.

Aquaculture development efforts in Samoa have historically been directed at providing alternative sources of fishery products, mainly through the introduction of exotic species. Trials have included:

- Mussels: Philippine green mussel *Perna viridis;*
- Tilapia: *Oreochromis mossambicus* and *O. niloticus;*
- Carp: *Carassius auratus;*
- Oysters: Pacific oyster *Crassostrea gigas;*
- Trochus: *Trochus niloticus*
- Giant clams: *Tridacna gigas* and *T. derasa;*
- Freshwater prawn: *Macrobrachium rosenbergii;*
- Marine prawn: *Penaeus monodon;*
- Seaweeds: eucheuma *Kappaphycus alvarezii* and *Eucheuma denticulatum.*

[226] Mulipola, A. (1998). Samoa Aquaculture, Profile. Fisheries Division, Ministry of Agriculture, Forests, Fisheries and Meteorology, Apia.

Another review of aquaculture in Samoa in 2001[227] states that aquaculture in Samoa can be broadly divided into two types:

- Village-level aquaculture. This mainly involves Nile tilapia aquaculture in local waterways, and the provision of giant clams to participating villages.
- Commercial aquaculture. This has not developed in Samoa, despite previous attempts using a range of species.

As the village giant clam nurseries are oriented to enhancing the wild stock, aquaculture harvesting is largely limited to tilapia. According to officials of the Ministry of Agriculture and Fisheries, the tilapia ponds are mostly quite small with poor productivity.

The total annual harvest of cultured tilapia (which is largely the entire aquaculture production) is unknown, but likely to be about 10 mt per year. This equated to less that 1/10 of one percent of the fisheries production of Samoa.

Little information is available on any management of aquaculture activities in Samoa. Management is likely to be limited to measures to prevent poaching prior to a scheduled harvesting.

4. POST-HARVEST USE

The catch from the offshore fisheries is mainly for the export market, about 75 percent of the total catch is sent abroad. 80 percent of these exports are frozen tuna destined for the tuna cannery in neighbouring American Samoa. The remaining exports are mainly fresh chilled fish and mainly for markets in the United States. The catch from offshore fisheries that is not exported is sold locally, mostly in the Apia fish market.

Production from coastal commercial fishing is surveyed by the Fisheries Division. Most of the catch is sold at the Apia fish market, Fugalei agro-produce market, on the Apia-Faleolo roadside, and the Salelologa market. Whole finfish accounted for 64 percent of the total volume of fishery items traded. Invertebrates and processed items accounted for 24 percent and 11 percent, respectively of the total volume.

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 faasoso fish is exported. Fisheries Division records show about 1.5 tonnes of pelagic fish and 10.0 tonnes of other fish was exported as faasoso in the 2007/08 financial year.

The small amount of inland and aquaculture production is mainly for subsistence purposes, but some roadside sales of tilapia occur.

5. FISHERY SECTOR PERFORMANCE

5.1 Economic role of fisheries in the national economy

A recent study by the Asian Development Bank attempted to quantify the fishery-related benefits received by Samoa in various categories. The study gave the available information (focused on 2007) on the contribution of fishing/fisheries to GDP, exports, government revenue, and employment. The results can be summarized as:

- Official estimates show that fishing in 2007 was responsible for 5.4 percent of Samoa's GDP. A recalculation shows it to be 6.2 percent.

[227] Rimmer, M., L. Bel, M. Lober, and A.Trevor (2001). Evaluation of the Potential for Aquaculture in Samoa. Samoa Fisheries Project, Fisheries Division, Ministry of Agriculture, Forests, Fisheries & Meteorology.

- Exports of fishery products are about 55.3 percent of all exports.
- Access fees paid by foreign fishing vessels represent 0.15 percent of all government revenue.
- With respect to employment, 41.7 percent of households in Samoa have at least one fisher.

From the above it can bee seen that fisheries make a relatively important contribution to GDP, exports and employment.

5.2 Demand

The per capita consumption of fish in Samoa, based on the 2005 FAO food balance sheet, is 50.5 kg. Various other studies have made estimates ranging between 46.3 and 73 kg. Considering Samoa's population, 50.5 kg of fish consumption per capita translates into a 2010 demand for 9 086 tonnes of fish.

Factors influencing the future demand for fish are a rising population, an increase in the price of fish, relative cost of fish substitutes, and the level overseas cash remittances.

5.3 Supply

The government has several strategies to increase the national fish supply. The main mechanism is the promotion of village level management of traditional fishing areas to stabilize fisheries production. The government also encourages aquaculture and offshore fishing.

5.4. Trade

The Samoa Bureau of Statistics tracks the country's exports, including the export of fishery products:

Fish and total exports of Samoa

	2002	2003	2004	2005	2006	2007
Fish exports (USD millions)	8 615	5 253	4 864	4 258	5 558	7 634
Percentage fish exports of all exports	62.7%	35.6%	40.8%	35.7%	53.8%	55.3%

Exchange rates ST$ to the USD: 2002 – 3.37; 2003 – 3.00; 2004 – 2.78; 2005 – 2.72; 2006 – 2.78; 2007 – 2.62

According to Fisheries Division staff, since 1997 export bans on several types of fishery products (coral, aquarium fish, and bêche-de-mer) have resulted in almost all commercial fishery exports in recent years being tuna products.

5.5 Food security

Fish, both local and imported, is an important element of food security in Samoa. A survey in 2006/07 showed that the average frequency of consumption of fresh finfish was 2.8 times per week, and that for invertebrates was 0.8 times per week. The average frequency of consumption of imported canned fish was 4.5 times per week. In 2002 the Samoa Household Income and Expenditure Survey revealed that 9.3 percent of weekly household expenditure is for fish.

The food supply in Samoa suffers from frequent cyclones. After especially severe cyclones, fish (both imported and local) is critically important. This is because the local fish supply is less affected by cyclones than agriculture supplies, and because imported canned fish is an important component of post-cyclone relief efforts.

5.6 Employment

Fisheries employment in Samoa has two distinct components: formal jobs in the offshore fisheries and less formal participation in the coastal fisheries:

– An Asia Development Bank study[228] estimated that in 2008, 295 jobs were associated with offshore fishing (on vessels and inshore facilities). This represents about 1.3 percent of the formal employment in the country.
– As for employment in small-scale fishing, a survey[229] conducted in 2007 to assess the socio-economic status of rural villages, found that 41.7 percent of households have at least one fisher.

5.7 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 to 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. In addition, the major issue in population movement is not a migration to the urban area, but rather a migration to overseas countries, especially New Zealand.

6. FISHERY SECTOR DEVELOPMENT

6.1 Constraints and opportunities

Some of the major constraints of the fisheries sector in Samoa are:

– The small-size and limited productivity of the village fishing areas.
– The small area of Samoa's exclusive economic zone – 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.
– A large dependence on a cannery in a neighbouring country, which has an uncertain future.
– The lack of inexpensive air transport to markets for fresh chilled tuna.
– Crowded conditions in Apia harbour.
– With increasing exploitation of albacore, an increasingly noticeable seasonality of the resource.

The opportunities in the fisheries sector include:

– Value-adding to the fishery products, for both domestic consumption and for export.
– Cooperation with neighbouring countries to enable greater exploitation of the offshore resources outside of the Samoa EEZ.
– Greater use of fish aggregating devices to promote offshore fishing by small-scale fishers.
– Greater linkages to the expanding tourism industry.

6.2 Government and private sector policies and development strategies

The fisheries policies of Samoa can be inferred from a variety of documents. The general policy thrust is given by the mission statement of the Fisheries Division:

> "Promotes the optimum and ecologically sustainable use of the country's fishery resources and the development of suitable alternatives to harvesting depleted resources in order to maximize benefits to Samoa".

[228] Gillett (2009).

[229] Mulipola, A., A. Taua, O.Tuaopepe, and S.Valencia (2007). Samoa Fisheries Socio-Economic Report 2006-2007. Fisheries Division Ministry of Agriculture and Fisheries, Apia, Samoa.

The main government policy in the offshore fisheries is to work within the framework of the Commercial Fisheries Management Advisory Committee to address issues affecting the management and further development of the offshore fisheries in Samoa.

For the coastal fisheries, the main policy is the empowerment of villages to actively engage in the management and development of their coastal fishing areas. This is done primarily through establishment, reviewing, and strengthening of village fisheries management plans, fish reserves and creation of by-laws.

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 expanding but rather surviving during a period of poor albacore fishing – as has been the case for the last few years.

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 Samoa Fisheries Bibliography[230] and the research carried out on the main fishery resources in Samoa is summarized in the Western Samoa Fisheries Resources Profiles.[231]

More recent research projects by the Fisheries Division are given in the annual reports. They include:

- Fish and shellfish poisoning project: Macro algae species of *Sargassum* sp. and *Halimeda* sp. which are considered hosts to the poisonous dinoflagellate *Gambierdiscus toxicus* were collected for sampling.
- Monitoring of fish spawning aggregations: This project investigates sites and times of breeding of inshore fish species. This involves collection, measurement and analysis of gonads from twelve selected species.
- Giant clams: This is a study to identify the status of the recruitment of giant clams in the Savaia and Tafagamanu coastal area.
- Evaluation of community-base fish reserves: Seven villages have been selected, consulted and trained on the simplified monitoring and reporting methodologies of regular Fisheries research. Assessment exercises have been conducted by village members trained by Fisheries staff.
- Feed trials for tilapia feed: Different combinations of local ingredient were formulated and tested using three ponds at the tilapia hatchery.

There is also an active tuna research programme which collects catch and effort data from the locally-based longliners. This information is analyzed by the Fisheries Division and by the Oceanic Fisheries Programme of the Secretariat of the Pacific Community in New Caledonia.

6.4 Education

Education related to fisheries in Samoa 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.
- Training courses are frequently organized by the following regional organizations: the Secretariat of the Pacific Community in New Caledonia and the Forum Fisheries Agency in the Solomon Islands.

[230] Gillett, R.D. and D. Sua (1987). Western Samoa Fisheries Bibliography. Document 87/6, FAO/UNDP Regional Fishery Support Programme, Suva, 90 pages.

[231] Bell, L. (1995). Western Samoa Fisheries Resources Profiles. Report 95/18, Forum Fisheries Agency, Honiara.

– 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 New Zealand, Australia, and Hawaii.

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 being more focused on the fisheries stakeholders was a major achievement. The project was concluded in 2003, but the positive impact of that work is still very evident today.

Bilateral programmes of technical cooperation, collaboration and assistance have been provided by the governments of Australia, China, Japan and the European Union. Multilateral donors include UNDP and FAO. Samoa also enjoys technical assistance or the channeling of multilateral donor assistance from various regional agencies including, FFA, SPC, and SOPAC.[232]

7. FISHERY SECTOR INSTITUTIONS

Responsibility for fisheries and marine resource matters is vested in the Fisheries Division of the Ministry of Agriculture and Fisheries. The Division is headed by Assistant Chief Executive Officer. It is headquartered in Apia, and employs about 35 staff.

According to its latest annual report (2007/08), the substantive work of the Fisheries Division is organized into six services:

– Inshore Fisheries Services
– Offshore Fisheries Services
– Aquaculture Services
– Community Fisheries Advisory Services
– Regulations and Enforcement Services
– Fish Market Services

The Commercial Fisheries Management Advisory Committee (CF-MAC) is the official body that represents the offshore fishing industry. The Committee is comprised of representatives from the private sector and relevant government departments: 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, Ministry of Agriculture, Forests, Fisheries and Meteorology, Fisheries Division, Ministry of Transport, Port Authority and the Department of Trade, Commerce and Industry.

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 the various local stakeholders in fisheries.

Some of the important internet links related to fisheries in Samoa are:

– www.maf.gov.ws – The website of the Ministry of Agriculture and Fisheries
– www.spc.int/Coastfish/Countries/Samoa – Information on Samoa fisheries, links to other sites concerning Samoa and its fisheries, and some SPC reports on Samoa fisheries

[232] Pacific Islands Applied Geoscience Commission.

- www.paclii.org/cgi-paclii – Text of Samoa fishery legislation
- http://moana.library.usp.ac.fj – Institutional repository for published and unpublished documents produced by Fisheries Division of the Ministry of Agriculture and Fisheries, Samoa

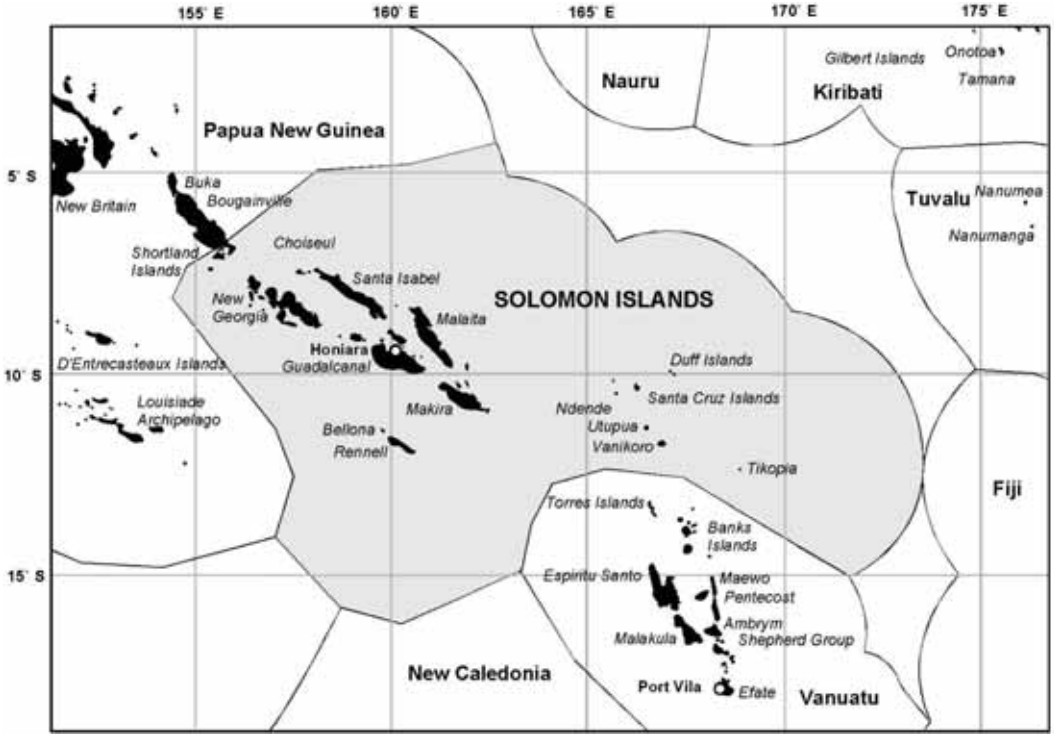
8. GENERAL LEGAL FRAMEWORK

The main legislative instrument relating to fisheries in Samoa is the Fisheries Act of 1988 – prepared with assistance from FAO and the Forum Fisheries Agency. The Act has been amended several times, including in 1999 and 2002.

The Fisheries Act controls the operation of both domestic and foreign fishing vessels. The stated purposes of the Act include the conservation, management and development of marine resources, the promotion of marine scientific research and the protection and preservation of the marine environment. An important provision of the Act is that the Director responsible for fisheries "may, in consultation with fishermen, industry and village representatives, prepare and promulgate by-laws not inconsistent with this Act for the conservation and management of fisheries". Using this provision, many villages now have by-laws to assist in managing their fishing grounds. Samoa's Constitution has important implications for fisheries. Under Article 104 of Constitution, all land lying below the line of high water is vested in the State and therefore legally all Samoans have equal access to coastal resources. In practical terms, the village by-laws apply equally to village residents and outsiders and no Samoans can be differentially excluded from fishery areas.

Other legislation relevant to fisheries includes the Territorial Sea Act of 1971, and the Exclusive Economic Zone Act of 1988.

SOLOMON ISLANDS



1. GENERAL GEOGRAPHIC AND ECONOMIC DATA

Area	28 370 km^2
Water area	1 340 000 km^2
Shelf area	[no continental shelf]
Length of continental coastline	4 270 km (length of the coast of islands)
Population (2007)*	498 000
GDP at purchaser's value (2006)	459.6 million USD[233]
GDP per head (2006)	937 USD
Agricultural GDP (2006)	160.0 million USD[234]
Fisheries GDP (2006)	27.4 million USD[235]

*UN Population Division

2. FISHERIES DATA[236]

2007	Production	Imports	Exports	Total supply	Per caput supply
	tonnes liveweight				kg/year
Fish for direct human consumption[237]	31 272	2 744	17 282	16 734	33.6
Fish for animal feed and other purposes	120[238]	–	120	–	

[233] 2006 average exchange rate: USD1 – Solomon $7.65; GDP source: Statistical Office (2008). Gross Domestic product (GDP) by Economic Activity – Current and Constant Price Values. Ministry of Finance, Honiara.
[234] This is the contribution to GDP of agriculture, forestry and fisheries; Source: Statistical Office (2008).
[235] Fishing contribution to GDP; From Gillett (2009). The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories. Pacific Studies Series, Asian Development Bank, Manila.
[236] Corrected to reflect actual supply.
[237] Data from FAO food balance sheet of fish and fishery products.
[238] This is the pet food production of the tuna cannery in 2007, as given in MFMR (2008). Statistics and Information. Special Edition for 30th Independence Anniversary.

Estimated employment (2004)	
(i) Primary sector (including aquaculture)	5 114[239]
(ii) Secondary sector	(post-harvest fisheries employment included in above figure)
Gross value of fisheries output (2007)	202 million USD[240]
Trade (2007)	
Value of fisheries imports	2.4 million USD
Value of fisheries exports	22 million USD

3. FISHERY SECTOR STRUCTURE

3.1 Overall fishery sector

The fisheries situation of the country is characterized by the large importance of both subsistence fisheries and offshore industrial fisheries. Because 90 percent of the Solomon Islands population is living in remote rural areas, subsistence fishing activities are 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 license fee for foreign vessels to fish in the Solomon Islands' EEZ is a substantial source of revenue for the government.

The country's fisheries can be placed into six categories. These categories and the associated production in 2007 are estimated as:

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based[241]	Fresh-water	Aquaculture	
						Tonnes	Pieces[242]
Volume of production (metric tonnes or pieces[243])	3 250	15 000	23 619	98 023	2 000	165	8 202
Value of production (USD)	3 307 190	10 980 392	32 662 077	153 548 868	1 464 052	40 654	

Source: Gillett (2009)

No discussion of the fisheries sector in the Solomon Islands would be complete without some mention of the rise and fall of the Solomon Taiyo fishing company. The box below gives a summary of that company. The Japanese partner pulled out in 2000, during a period known as the "ethnic tensions", and shortly thereafter the company restructured itself as Soltai Fishing and Processing Ltd. It has struggled to survive to the present.

The main trends and important issues in the fisheries sector

The main trends in the sector include:

– An expansion of the purse seine tuna fishery and a decline in the longline and pole-and-line tuna fisheries – all for different reasons.

[239] This figure is for "formal jobs" in the fishing and fish processing sub-sectors; From IMF (2005). Solomon Islands: Selected Issues and Statistical Appendix. IMF Country Report No. 05/364, International Monetary Fund.

[240] From Gillett (2009); includes the six fishery production categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally-based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing, and (6) aquaculture.

[241] This is the catch taken by the foreign fleet within the Solomon Islands EEZ. In FAO statistics of capture fisheries production, this catch is accounted under the catch of the nation(s) under which the vessel(s) is (are) flagged.

[242] Pearls and coral are commonly measured in pieces, rather than kg.

[243] The production of the most important aquaculture products, post-larvae and corals, are measured in pieces (individual pearls) rather than in weight.

Solomon Taiyo fishing company[244]

Before the ethnic tensions, Solomon Islands had the most vibrant domestic tuna fisheries 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.

- Over-exploitation and decline of production in the coastal commercial export fisheries.
- Subsistence fisheries being affected by a rising population.
- A tremendous deterioration of the quality of governance in the fisheries sector during the period of ethnic tension – and subsequent efforts by the government and donors to strengthen fisheries institutions.

Some of the major issues in the fisheries sector are:

- There is considerable difficulty in reconciling the economic and political importance of the cannery and pole-and-line fishing to the nation with the fact that those operations require large inputs of government and donor funds.
- There is a need to strengthen the Fisheries Department in a way that is (a) appropriate for the management required for the nation's fisheries, (b) acceptable to fishery stakeholders and existing staff, and (c) within the budget likely to be available in the future.
- Although coastal fishery resources are crucially important for nutrition in the Solomon Islands, the rising population and stagnant levels of production from these resources suggest that the per capita consumption of fish will fall.
- The demand for fish in the Honiara urban area cannot be met from local coastal areas. The need to make more fish available in Honiara must be balanced with the fact that past attempts to establish the necessary operational and transportation infrastructure in the outer islands have been expensive and have had many failures.

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 both locally-based and foreign tuna vessels: pole-and-line, longline, and purse seine.
- Coastal fishing is primarily carried out for subsistence purposes, but there are some sales for local markets, and exports of high-vale products. There is also an industrial-scale coastal fishery for baitfish that are used in offshore tuna fishing.

3.2.1 Marine catch profile

The annual catch taken by locally-based offshore fisheries has ranged in recent years between about 17 000 and 29 000 metric tonnes. Purse seining is dominating taking more than 80-90 percent of the catch, with pole-and-line fishing and longlining supplying the balance. About 90 percent of the catch

[244] Source: Barclay, K. (2008). Fisheries and Aquaculture. *In*: Solomon Islands Diagnostic Trade Integration Study (DTIS). Ministry of Foreign Affairs and External Trade.

is tuna, with various species of bycatch making up 10 percent. The foreign-based offshore fleets catch much more than local vessels. Recent estimates[245] indicate that about 98 000 tonnes of mostly tuna were taken by foreign vessels in 2007. This equates to three times the offshore catch by local vessels.

Estimates of catches of the coastal fisheries vary widely. The Asian Development Bank recently examined a large number of Solomon Islands fisheries studies on coastal commercial fishing, selectively used the information, and made catch estimates:

- Local sales for domestic consumption: about 1 500 tonnes worth about 1.5 million USD annually to the fishers for the years 2005 to 2007. This includes mainly reef and lagoon finfish, but also some edible invertebrates.
- Baitfish: about 800 tonnes worth 100 000 USD annually to the recipient communities for 2005 to 2007.
- Exports: about 950 tonnes worth 1.6 million USD annually to the fishers for 2005 and 2007; about 750 tonnes worth 1.3 USD million for 2006. This includes bêche-de-mer, coral, trochus, shark fins, aquarium fish, and lobster. The total value of the coastal commercial production is greatly affected by the value of the bêche-de-mer harvest – which is subject to periodic country-wide harvest bans (as was the case in 2006).

Estimates of coastal subsistence fisheries production involve much guesswork. Many of the estimates used at present are derived from dietary surveys in the 1980s. If those early estimates are extrapolated on the basis of population and constant per capita fish consumption, the result is a coastal subsistence production of about 15 000 tonnes in 2007.

3.2.2 Marine landing sites

Landing sites for the offshore fishery are diverse. All landings by the local pole-and-line vessel 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 (during the period 2004-2006, 279 such transshipments occurred), or deliver to a foreign port. When locally-based longliners operate, the catches are unloaded in Honiara for overseas air freighting.

Landings from the coastal commercial fishery are made mostly at population centres. The small-scale commercial fisheries are mainly 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.

3.2.3 Marine fishing production means

The composition of local offshore fleet has changed considerably in recent years. The number of pole-line vessels is dropping due to the deterioration of an ageing fleet. The number of longliners is dropping in response to difficult business conditions in the country and sashimi market conditions. The number of purse seine vessels is increasing due to good catches and good conditions in the canned tuna market. The Yearbook of Western and Central Pacific Fishery Commission showed the number of domestic offshore fleet as:

[245] FFA (2008) and SPC (unpublished information), for the Forum Fisheries Agency and the Secretariat of the Pacific Community, respectively.

	2000	2002	2004	2006	2008	2009
Longline	14	11	8			
Purse seine	18	12	10	11	3	
Pole and line	5	2	3	4	4	7

A study by the Forum Fisheries Agency[246] tracked the recent evolution of the offshore fleets:

- The local pole-and-line vessels range in length from 24 to 36 metres. They are operated by the government fishing company and characteristically fish inshore for baitfish at night with lights and fish for tuna offshore (mainly close to the six main islands) with the bait using fishing poles with barbless hooks.
- Two of the local purse seiners (the older ones) are 57 metres in length. Information is not readily available on the newer/larger vessels. Four seiners are operated by a single private sector company. They fish both inside (often on fish aggregating devices) and outside the Solomon Islands' EEZ. The length of the fishing trips depends on fishing success and area of operation, but can range from a few days to a few weeks. Trips characteristically finish with fish delivery to the company base at Noro.
- All local longline vessels (mostly 20 to 35 metres in length) were based at Honiara. Vessels used ice for fish preservation and carried out fishing trips of one to two weeks, mainly inside the Solomon Islands' EEZ. Fish were air freighted, mainly to sashimi markets in Japan. During the ethnic tensions in Honiara in the early 2000s several companies found it impossible to continue operations. One company that did continue experienced severe difficulties, including that associated with fish marketing and subsequently suspended operations in 2005.

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 hand lining, trolling, spearing (spear guns; weighted spears), netting, and hand collection. Mainly small outboard-powered vessels are used, but some commercial fishing (i.e. bêche-de-mer) takes place from non-powered canoes, or does not use a vessel (i.e. spear fishing 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 liftnet, with the baitfish maintained alive in bait wells.

Commercial fishing for finfish, due to their perishable nature, is largely confined to urban areas and locations with direct transport links to urban areas. Many export products (e.g. bêche-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 transportation limitations 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 to the present.

In the Solomon Islands there is a large variety of subsistence fishing techniques. Fishing is largely from non-powered canoes or from the shore by swimming. The main types of fishing are 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 specialization of activity by gender. The traditional fishing lore of the country (i.e. knowledge and practices) is extremely diverse and varies considerably between islands and ethnic groups.

[246] Gillett, R. (2008). A Study of Tuna Industry Development Aspirations of FFA Member Countries. Forum Fisheries Agency, Honiara, 70 pages.

3.2.4 Main resources

In 2007 catch taken from the EEZ waters of the Solomon Islands was about 121 600 tonnes. The catch composition was about 24 percent yellowfin, 62 percent skipjack, 4 percent bigeye, 4 percent albacore, and 6 percent of other species. 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.

The coastal fisheries catch a large variety of finfish and invertebrate species. A study by the Forum Fisheries Agency[247] 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 bêche-de-mer, trochus, green snail, and 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.

3.2.5 Management applied to main marine fisheries

The Solomon Islands is a member of the Western and Central Pacific Fisheries Commission that 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.

The management of marine fisheries in the Solomon Islands can be placed in three categories: the offshore fisheries, commercial export fisheries, and subsistence fisheries. The offshore/export fisheries are actively managed by the government through the Fisheries Department, whereas subsistence fishing in traditional management areas is mainly undertaken by village-level authorities.

Formal management plans only exist for three fisheries. These are the offshore fisheries, live reef food fishery, and the bêche-de-mer fishery.

Management objectives

The Fisheries Act 1998 states that the objective of fisheries management and development in Solomon Islands shall be to ensure the long-term conservation and the sustainable utilization of the fishery resources of Solomon Islands for the benefit of the people of Solomon Islands.

The management objectives for the offshore fisheries is covered in the "Solomon Islands National Tuna Management and Development Plan" which came into force in June 1999. The plan (three volumes and 196 pages) gives the following objectives:

- to ensure that the tuna resources of the Solomon Islands are not exploited beyond their optimal sustainable yields; and
- within the limit set by this conservation objective, to harvest the resource in such a way that maximises the economic and social benefits received by the people of the Solomon Islands.

The management objectives for the coastal commercial fisheries are focussed on resource sustainability (or prevention of resource exhaustion) for the export species. Some management interventions (e.g. high taxes on the export of raw trochus) have the objective of encouraging the development of a local processing industry. The management objectives for the subsistence fisheries are much less formal, but usually involve some aspect of protecting village food supplies.

Management measures and institutional arrangements

The current tuna management plan specifies that the management measures for the industrial fishery consist of a limit on the number of licences and restrictions on access by certain vessels to some areas.

[247] Richards, A., L. Bell, and J. Bell (1994). Inshore Fisheries Resources of Solomon Islands. Report 94/01, Forum Fisheries Agency, Honiara.

In the decade that the plan was in force, problems were experienced with implementing these measures, especially those related to restricting licences during the period of ethnic tensions. The licensing procedures have since been tightened, and further strengthening is anticipated in a new tuna management plan presently being formulated.

The institutional arrangements for tuna fishery management, as prescribed by the current tuna management plan are:

Minister Responsible for Fisheries
- accountable for the sustainable use of fisheries resources
- retains all powers but works within agreed constraints
- prescribes tuna fishery regulations

Fisheries Advisory Council
- advises Minister on management & research
- administers Fisheries Management & Development Fund

Tuna Management Committee
- operational authority for implementing the Management Plan
- strategic direction

Director of Fisheries
- legal authority for implementing the Management & Development Plan (under s7(1))
- acts on advice from the Tuna Management Committee

The management arrangements for the coastal commercial export fisheries consist mainly of temporary and long-term bans, mostly enforced at the point of export. The 2006 national closure of the bêche-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 Fisheries Department 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 the management of coastal commercial fisheries that occur in their areas. The residents of Ontong Java atoll, for example, have alternating annual closures for bêche-de-mer fishing and for trochus fishing.

Most of the areas where coastal subsistence fishing is undertaken are covered by traditional management arrangements. A recent study found that nearly 85 percent 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, making management decisions after considering the views of their resident stakeholders. 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 restriction include periodic harvesting bans in specific areas and bans on gear types. In recent years some of the areas have an external management partner, such as the local branch of an international NGO.

Solomon Islands is a member of the South Pacific Commission (SPC), the Pacific Islands Forum Fisheries Agency (FFA) the South Pacific Regional Environmental Programme (SPREP), and the Food and Agriculture Organization of the United Nations (FAO).

Solomon Islands is also party to a number of treaties and arrangements relating to the management of regional fisheries, including:

- the Harmonized Minimum Terms and Conditions for Foreign Fishing Vessel Access;
- the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America;

- the Wellington Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific;
- the Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region;
- the Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Concern;
- the Palau Arrangement for the Management of the Western Pacific Purse Seine Fishery; and
- the FSM Arrangement for Regional Fisheries Access.

Solomon Islands is a party to the United Nations Convention on the Law of the Sea (UNCLOS), the Agreement for the Implementation of the Provisions of the United Nations Convention of the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean.

3.2.6 Fishermen communities

The concept of "fishermen 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 villages in the Solomon Islands that are rural and coastal are "fishing communities". One village, called "Honiara Fishing Village" carries out much of the commercial fishing for sale in Honiara, but the village is based on resettlement from another area in the Solomon Islands (Residents are originally from the Lau Lagoon of Malaita island), rather than on fishing.

Many of the people that work on the industrial fishing vessels live in Noro close to the cannery where those vessels are based. Other fishers are widely dispersed and do not live in distinct communities.

3.3 Inland sub-sector

The many large islands in the country result in 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 an annual inland fishery production to be about 2 000 tonnes per year, valued at about 1.5 million USD. Although some of the catch may be sold, 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 with very small-scale gear. This consists of baited lines, spears, variety of traditional woven traps, hollow poles, snares and knives.

Information is scarce on the resources that support the inland fisheries – no comprehensive survey has been carried out. Anecdotal information and survey reports focussed on single islands suggest that flagtails, gobies, eels, and freshwater shrimps are important native species. Tilapia, an introduced species, appears to be important, especially in small ponds and lakes.

The management applied to inland fisheries in the Solomon Islands is poorly documented. In general, it could be considered similar to that for the coastal subsistence fisheries – in which management 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.

3.4 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 activity to their overseas guests and some local expatriates in Honiara occasionally carry out some fishing on the weekends. This mainly involves trolling for coastal pelagic fish, such as Spanish mackerel, barracuda, and tunas.

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

3.5 Aquaculture sub-sector

The current aquaculture activities in the Solomon Islands are limited and based on three types of products:

- The coral culture involves Acropora and soft corals.
- Post larval capture and culture is based on postlarval lobsters, shrimp and fish, with that of coral shrimp (*Stenopus* spp.) and especially spiny lobsters (*Panulirus* spp.) showing the most promise.
- Seaweed culture utilizes the species *Kappaphycus alvarezii.*

A New Zealand-sponsored project recently summarized the aquaculture situation in the Solomons Islands:[248]

> There has been a wide range of species cultured within the Solomon Islands, including giant clams, penaeid shrimps, freshwater prawns, pearl oysters, seaweed, sea cucumbers, hard and soft corals, milkfish, sponges and the capture/culture of postlarval 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.

The most significant attempt to promote aquaculture in the Solomon Islands was the Coastal Aquaculture Centre, which was a joint project between the Government of the Solomon Islands and the International Centre for Living Aquatic Resource Management (ICLARM; now the WorldFish Center) and 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 giant clam sashimi markets in Taiwan and Hong Kong. The Centre also initiated a black-lipped pearl oyster collection programme with a view to investigating pearl culture, experimental culture of bêche-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 tension.

The latest attempt to quantify the volume and value of aquaculture production in the country was undertaken by the Asian Development Bank (ADB). Using a variety of source documents, ADB determined:

[248] Source: Lindsay, S. (2007). Aquaculture Sector Assessment, Solomon Islands. Lincoln International Pty Ltd., Marine Resource Organizational Strengthening Project Solomon Islands.

Recent annual volumes and values of aquaculture

	2005		2006		2007		2008	
	Volume	Value (USD)	Volume	Value (USD)	Volume	Value (USD)	Volume	Value (USD)
Post larval capture/culture	1 400 pcs	1 200	1 200 pcs	1 000	n.a.	n.a.	n.a.	n.a.
Coral	1 800 pcs	1 900	7 000 pcs	7 400	n.a.	n.a.	n.a.	n.a.
Giant tiger prawn	n.a.	n.a.	n.a.	n.a.	1 t	14 000	1 t	14 000
Seaweed	326 t	87 000	169 t	33 000	108 t	21 000	144 t	58 000

Note: Values are producer prices

Source: Gillett (2009) for post larval culture and coral, FAO for the rest

Most of the current aquaculture production is supported by donors with an interest in rural development. Accordingly, many of the aquaculture operations are 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 by mariculture initiatives such as coral culture in Marau Sound, the Nggela Islands and Langalanga Lagoon in Malaita.

Other than efforts to promote its development, there is no active management of the aquaculture sub-sector in the Solomon Islands.

4. POST-HARVEST USE

4.1 Fish utilization

In general offshore fishing is export oriented. The local purse seiners supply the cannery in the Solomon Islands, but most of the catch is exported unprocessed to overseas canneries. Catches taken by foreign-based purse seining is exported to overseas canneries. Longlining (presently all foreign-based) is oriented to producing sashimi for Asia and North America.

Coastal commercial fishing produces mainly fresh products (finfish, invertebrates) for urban consumption and non-perishable products (bêche-de-mer, trochus) for export. Some perishable fishery products (e.g. lobster tails) are sporadically exported, while aquarium items are exported much more regularly.

The subsistence fisheries (both coastal and inland), as the name implies 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 of the 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.

4.2 Fish markets

Fish canned in the Solomon Islands is exported to Japan, Europe and regional markets (e.g. Fiji). Currently, the Solomon Islands has duty-free access for its canned tuna into the EU market. The non-processed tuna that is exported has as its final market (after processing in mainly Southeast Asia or American Samoa) mostly the United States and Europe, with small amounts going to a large number of countries.

The main domestic market for fish is in Honiara, but other markets exist in the towns of Gizo, Buala, Tulagi, Auki, Kirakira, and Lata.

Bêche-de-mer is exported to China, with smaller amounts going to Southeast Asian countries. The markets for trochus shell are the processing plants in Europe and Asia, with the processed buttons going to fashion clothes for consumers in Europe, North American and Japan. Lobster tails are primarily for Australia and the aquarium products for North America.

5. FISHERY SECTOR PERFORMANCE

5.1 Economic role of fisheries in the national economy

A recent study by the Asian Development Bank attempted to quantify the fishery-related benefits received by Solomon Islands. The study gave the available information on the contribution of fishing/ fisheries to GDP, exports, government revenue, and employment. The results can be summarized as:

- Official estimates show that fishing in 2006 was responsible for 6.0 percent of the GDP of the Solomon Islands. A recalculation using a different methodology shows it was 6.8 percent in 2007.
- Exports of fishery products are about 12.0 percent of all exports (13 percent in official report).
- Access fees paid by foreign fishing vessels represent 4.4 percent of all government revenue.
- Formal jobs directly related to fisheries represent about 12.1 percent of the total number of formal jobs in the Solomon Islands.

From the above it can bee seen that fisheries make a relatively important contribution to GDP, exports, government revenue, and employment.

5.2 Demand

The per capita consumption of fish in the Solomon Islands, based on the 2007 FAO Food Balance Sheet, is 33.6 kg. Various other studies have made estimates ranging between 27.5 and 40.0 kg. Considering the Solomon Islands' population, 35 kg of fish consumption per capita translates into a 2010 demand for 18 750 tonnes of fish.

Factors influencing the future demand for fish are a rising population, increases in price of fish (over-exploitation of inshore areas, gradual devaluation of the local currency, fuel cost increases), and relative cost of fish substitutes.

5.3 Supply

The government has several strategies to increase the national fish supply. These involve supporting the marketing of fishery products in Honiara from remote parts of the country and promoting the use of offshore tuna resources by encouraging (a) small-scale fishers, and (b) increase domestic utilization of industrial tuna catches.

Major factors affecting the local supply of fish are overfishing, siltation, destructive fishing, transport links to the outer islands, and the offloading of fish by the offshore fleet.

5.4 Trade

Exports of fishery products in 2007 were S$168.6 million (USD22 million) and represented about 13 percent of all exports of the Solomon Islands. The vast majority of the exports were tuna products. The major non-tuna commodities were bêche-de-mer, trochus, items for the aquarium trade, seaweed, and shark fins.

5.5 Food security

Fish is an important element of food security in the Solomon Islands. The FAO Food Balance Sheets show that in 2007 fish contributed an average of 22 percent of all protein to the diet and 76 percent of animal protein. In rural areas of the country the contributions are even higher.

Animal protein substitutes for fish consist mainly of various types of livestock and imported canned meat. Food imports are now relatively expensive in the local currency due to deterioration of the economy during the previous decade.

5.6 Employment

The most recent estimate of the formal employment in the Solomon Islands, including the fisheries component, was carried out by the International Monetary Fund in 2005.[249]

Formal employment in the Solomon Island

	2001	2002	2003	2004
Formal fishing jobs	5 179	5 030	5 015	5 114
Total formal jobs	42 631	41 067	41 723	42 297
Fishing jobs as % of all formal jobs	12.1%	12.2%	12.0%	12.1%

An important component of fisheries employment in the Solomon Islands are those jobs related to offshore fishing. A study by the Forum Fisheries Agency[250] tracked the number of Solomon Island citizens employed in the country's offshore fishing industry (both onboard and in processing plants) over a seven-year period:

Locals employed in the Solomon Islands tuna industry

	2002	2006	2008
Local jobs on vessels	464	66	107
Local jobs inshore facilities	422	330	827
Total	**886**	**396**	**934**

5.7 Rural development

An assessment by UNDP[251] earlier in the decade indicated that most future employment opportunities lie in the informal rural sector. Fisheries development in rural areas has a major role in providing such employment.

One of the major mechanisms for rural fisheries development has been the fisheries centres. About 25 of these facilities were established in rural areas and were intended to serve as market outlets for fish caught by rural fishermen. 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 problem (especially during the ethnic tension), about two-thirds of the centres continue to function – and are vital in the government's attempts to develop rural fishery resources.

6. FISHERY SECTOR DEVELOPMENT

6.1 Constraints and opportunities

Some of the major constraints of the fisheries sector are:

- Many of the inshore fishery resources, especially those close to the urban markets, are fully or over-exploited.
- Small-scale fishers cannot economically access the relatively abundant offshore fishery resources.

[249] IMF (2005). Solomon Islands: Selected Issues and Statistical Appendix. IMF Country Report No. 05/364, International Monetary Fund.

[250] Gillett, R. (2008). A Study of Tuna Industry Development Aspirations of FFA Member Countries. Forum Fisheries Agency, Honiara, 70 pages.

[251] UNDP (2002). Solomon Islands Human Development Report. United Nations Development Programme.

- Although the government-owned cannery and tuna fleet is vitally important for the national economy and for the welfare of the people employed, those operations are unprofitable. The government cannot afford the financial injections required to keep them operating, but for political and social reasons it cannot afford to shut them down.
- There are considerable difficulties associated with marketing fishery products from the remote producing areas to the urban areas where the marketing opportunities are high.

There was a large decline in the quality of governance of the fisheries sector during the period of ethnic tension.

The opportunities in the fisheries sector include:

- Upgrading the cannery to meet EU fish sanitary requirements
- 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 the Fisheries Department by enhancing staff capability and re-orientation of the Department to current needs

6.2 Government and private sector policies and development strategies

The Government's 2008 "National Unity and Rural Advancement Government Policy" gives the current official development strategy in the fisheries sector:

- Increased opportunities for rural fishers to improve their standard of living by establishing onshore fish processing facilities and the introduction of pump-boats.
- Establishment of a dolphin assessment and monitoring programme.
- Increased potential value of fisheries and marine products by setting up two tuna loin processing plants in the country.
- Strengthen Soltai fishing and processing company to ensure its long-term survival and economic viability.
- Improve Solomon Islands earnings through the realization of the international value of the resource and effective licensing procedures.
- Management plans and appropriate legislations are in place for the main stocks.
- Monitoring systems are in place that provide accurate and timely information on commercial and sustainable fisheries for all stakeholders including regional agencies.
- Enhanced organizational capacity, systems and skills to support the ministry to meet its commitments.
- marine products by small-scale fishermen or fishing communities so as to allow them to actively participate in inshore fisheries activities.

The private sector policies are much less formal. Recent action by the major industrial fishing company suggest their position is that they are comfortable with the size of the domestic tuna fishing fleet and that any significant expansion in vessel numbers should be accompanied by increased fishing outside the EEZ of the Solomon Islands. The tuna processing company feels that access by small-scale fishers to tuna resources is essential. Coastal commercial fishers do not have an articulated policy.

6.3 Research

The older fishery research in the Solomon Islands has been compiled into one volume by a project undertaken by the Forum Fisheries Agency.[252] Most of the recent fisheries research carried out in the Solomon Islands ha been undertaken through cooperation with overseas partners. The fishery-related research subjects and partners include:

- Aquaculture – with the WorldFish Center and NGOs
- Tuna – with the Oceanic Fisheries Programme of the Secretariat of the Pacific Community (SPC)
- Reef fish and invertebrates – with the Coastal Fisheries Programme of the Secretariat of the Pacific Community
- Corals – with the Foundation of the Peoples of the South Pacific International and the Secretariat of the Pacific Regional Environment Programme (SPREP)
- Spear fishing – with the Food and Agriculture Organization of the United Nations (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 (TNC)

6.4 Education/Training

Education/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.
- Practical aspects of fisheries and certification of vessel officers is undertaken at the Solomon Islands College of Higher Education.
- Training courses, workshops and attachments are frequently organized by the regional organizations: the Secretariat of the Pacific Community in New Caledonia and by the Forum Fisheries Agency 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. Coded of Conduct for Responsible Fisheries, IUU fishing, Coastal fisheries management, Ecosystem approach to coastal fisheries management, Fishery statistics, annual roundtable meeting on WTO agreements, etc.) are also conducted by the 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.

6.5 Foreign aid

Important donors in the fisheries sector (and major initiatives) are the European Union (rural fisheries enterprises, seaweed culture, wharf at Noro), Overseas Fishery Cooperation Foundation (renovation of fisheries centres, a loan for cannery construction), Japan International Cooperation Agency (fisheries wharf, cold storage and social facilities), and the Nature Conservancy (fisheries centre, live reef fish management plan).

[252] Skewes, T. (1990). Marine Resource Profiles: The Solomon Islands. Report 90/61. Forum Fisheries Agency, Honiara.

A recent study[253] summarises the activities of the main donors active in the fisheries sector:

- Japan has been a long term donor, for the rural fisheries centres, and for projects supportive of the domestically owned and run pole-and-line fishery, most recently for two new vessels for Soltai Fishing and Processing in 2005-2006. Japanese fisheries aid also comes through organizations like the Overseas Fisheries Cooperation Foundation. This organization supports Japan-based technical training for a range of fisheries related personnel in the public and private sector, and also has funded two technical advisors in canning and engineering to work in the government-owned Soltai Fishing and Processing in recent years.
- New Zealand is currently a major player in fisheries aid with its Solomon Islands Marine Resources Organizational Strengthening project focusing on the Ministry of Fisheries and Marine Resources since 2006.
- The EU funded long-term Rural Fisheries Development Project in the 1990s and 2000s, and has provided its assistance to two projects, one on seaweed production and another on pearl farming.
- Taiwan through its funding of the Rural Constituencies Development Fund provides its assistance in rural fisheries development. It also has injected funds into specific fisheries activities over the years. For example, it provided several million dollars to enable Soltai Fishing and Processing to reopen operations after having lain dormant for a year.
- FAO assisted in formulating a National Plan of Action to prevent, deter and eliminate illegal, unreported and unregulated fishing (IUU fishing) in Solomon Islands in 2009-2010.

7. FISHERY SECTOR INSTITUTIONS

Under the Fisheries Act 1998 the administration of fisheries is under the Minister for Fisheries and Marine Resources (MFMR). Until 2006, the government fisheries authority was a department under the Ministry of Natural Resources. In 2006, the Ministry of Fisheries and Marine Resources was created. The MFMR has five divisions. These are Research, Aquaculture, Licensing and Enforcement, Extension, and Statistics plus an administration unit. The latest annual report of the MFMR states that there are 65 established posts (of which 26 were vacant) and four non-established posts.

The MFMR is now being strengthened by the New Zealand-funded Solomon Islands Marine Resources Organizational Strengthening Programme in its transition from the current organizational arrangements to new arrangements. The MFMR Corporate plan 2008-2011 states that the Programme will assist in several areas, including (a) agreeing on the new direction of the Ministry (reflected in strategic plan), (b) agreeing on and implementing an appropriate organizational structure able to provide strategic direction, (c) securing budget and other resources, and (d) building sound institutional capacity within the MFMR (financial, administration, IT, technical, policy). In general, the MFMR has elected to shift its focus away from attempting to be a full service provider to a role that enables it to more productively use the skills and resources available to it.

With respect to fishery stakeholder institutions, there is no grouping that represents the interests of small-scale fishers in the country. For the offshore fisheries, the two individuals that head the tuna processing company and the tuna fishing company often meet informally to discuss issues of mutual interest. Although the Fisheries Act 1998 established a "Fisheries Advisory Council" consisting of stakeholders, that group has not met in several years.

Some of the important internet links related to fisheries institutions in the Solomon Islands are:

- www.spc.int/Coastfish/Countries/solomons/solomons.htm – Information on Solomon Islands fisheries, linking to other sites and some SPC reports on Solomon Islands.

[253] Barclay, K. (2008). Fisheries and Aquaculture. *In*: Solomon Islands Diagnostic Trade Integration Study (DTIS). Ministry of Foreign Affairs and External Trade.

- www.paclii.org/cgi-paclii – Text of Solomon Island fishery legislation.
- www.sprep.org/att/IRC/eCOPIES/Countries/Solomon_Islands/9.pdf – information on the fishery resources of the Solomon Islands.

8. GENERAL LEGAL FRAMEWORK

The legal framework for fisheries development and management in the Solomon Islands was established by the Fisheries Act 1998. Major features of the Act are:

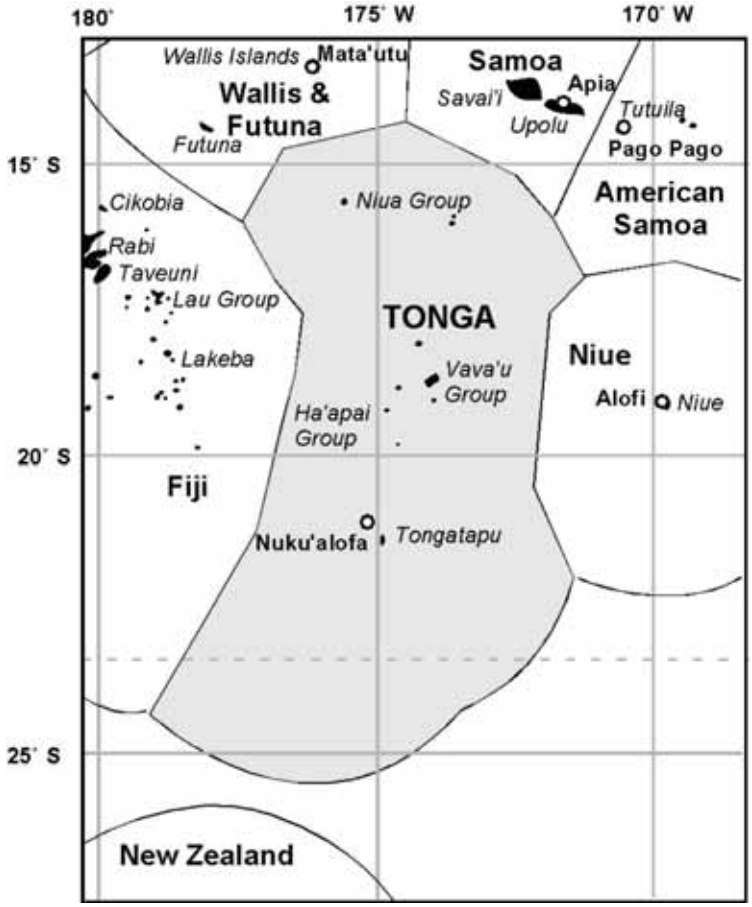
- Establishment of a Fisheries Advisory Council
- Establishment of a Fisheries Management and Development Fund which receives funding from foreign fishing vessel access fees
- Requirement for a national Fisheries Management and Development Plan
- Establishment of the principle that provinces are responsible for the management of reef, inshore and freshwater fisheries
- Requirement for licences for commercial fishing vessels
- Requirement for licences and access fees for foreign fishing vessels
- Prohibition of fishing using explosives
- Requirement for written permission for aquaculture activity and for the export of live fish
- Requirement for a licence and record keeping by fish processing establishments

The most important subsidiary legislation is the Fisheries (Local Fishing Vessels) Regulations, which specify the obligations of a master of a licensed fishing vessel, including a ban on fishing within five hundred metres of low water mark, within one nautical mile of any village or fish without permission in writing. The Fisheries (Foreign Fishing Vessels) Regulations prescribe the terms and conditions for foreign fishing vessels fishing in Solomon Islands waters. The Fisheries (Prohibition of Importation of Live Fish) Regulations prohibit the importation of live fish into Solomon Islands without authorization from the Director of Fisheries. A number of proposed regulations have been submitted by MFMR to the Attorney General's Office in recent year but have not yet been approved.

Other fisheries-relevant legislation includes:

- Delimitation of Marine Waters Act (1978) and subsequent amendments
- Declaration of the Archipelagos of the Solomon Islands (20 August 1979)
- Declaration of Archipelagic Baseline (20 August 1979)
- Fisheries (Foreign Fishing Vessels) Regulations 1981
- Fisheries (United States of America) (Treaty) Act (1988)

TONGA



1. GENERAL GEOGRAPHIC AND ECONOMIC DATA

Area	747 km^2
Water area	700 000 km^2
Shelf area	[no continental shelf]
Length of continental coastline	419 km (length of the coast of islands)
Population (2007)*	103 000
GDP at purchaser's value (2005/06 financial year)	243 993 000 USD[254]
GDP per head (2006)	2 397 USD**
Agricultural GDP (2006)	51 872 000 USD[255]
Fisheries GDP (2006)	10.0 million USD[256]**

* UN Population Division

** Tonga National account statistics: www.spc.int/prism/country/to/stats

[254] Tonga National account statistics: www.spc.int/prism/country/to/stats

[255] Tonga National account statistics: www.spc.int/prism/country/to/stats

[256] This is the official fishing contribution to GDP – which includes (a) local market component, (b) non-market component, and (c) export component; A recalculation shows the total fishing contribution to be USDD12.0 million: Gillett (2009). The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories. Pacific Studies Series, Asian Development Bank, Manila.

2. FISHERIES DATA

2007	Production	Imports	Exports	Total supply	Per caput supply
	tonnes liveweight				kg/year
Fish for direct human consumption[257]	2 549	2 380	1 321	3 608	35.0
Fish for animal feed and other purposes	0	–	0	–	

Estimated employment (2003)	
(i) Primary sector (including aquaculture)	1 050[258]
(ii) Secondary sector	Unavailable
Gross value of fisheries output (2007)	20.6 million USD[259]
Trade (2007)	
Value of fisheries imports	USD2 390 000
Value of fisheries exports	USD2.8 million

3. FISHERY SECTOR STRUCTURE

3.1 Overall fishery sector

The geography of Tonga exerts a large influence on fishing in the country. Tonga is made up of some 150 islands (of which about 36 are inhabited), as well as many smaller islets and reefs. The islands, whose collective land area is about 747 sq km, 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, especially mullet, have been reduced to a small fraction of their earlier abundance, and inshore invertebrates such as bêche-de-mer, lobsters and giant clams have undergone severe declines, some quite recently. 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. These mostly started in the 1970s and included outer-islands fish collection schemes, promotion of offshore tuna fishing and deep-slope demersal fish fishing, and attempts to develop aquaculture.

With respect to the current situation, Tonga's fisheries can be placed into six categories. These categories and the associated production in 2007 are estimated as:

[257] Data from FAO food balance sheet of fish and fishery products.

[258] The results of a 2003 survey of employment in the country show that there were a total of 34,561 people employed in Tonga, of which 1,050 were employed in the category of "fishing". Employment in an industry is defined as working at least one hour during the week in the industry. Source: TSD (2004). Report on the Tonga Labour Force Survey 2003. Tonga Statistics Department, Nuku'alofa.

[259] Tonga National account statistics: www.spc.int/prism/country/to/stats

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based[260]	Fresh-water	Aquaculture	
						Tonnes	Pieces[261]
Volume of production (metric tonnes or pieces)	3 700	2 800	1 119	0	1	–	12 334
Value of production (USD)	11 287 129	6 182 178	3 081 498	0	1 980	18 317	

Source: Gillett (2009)

The main trends and important issues in the fisheries sector

The main trends in the sector include:

- Increasing exploitation of the coastal resources, especially those close to urban markets.
- Growing recognition that (a) for effective coastal fisheries resource management to occur, coastal communities need to be more involved in the management process; and (b) for this to occur, some form of preferential access to adjacent resources by those communities is required.
- Decreasing number of locally-based longline vessels and associated employment in the present decade.
- A gradual increase in the present decade of stakeholder input into the government fisheries agency.
- Greater use of fisheries management plans to manage the major fisheries in the country.
- A continuing dominance of Tonga as the leading exporter of deep-slope demersal fish in the Pacific Islands.

Some of the major issues in the fisheries sector are:

- In recent years there has been a perception on the part of the fishing industry of high rates of taxation and high charges for government services.
- A large investment in aquaculture development activities has yielded disappointing results.
- The regional/global move to ecosystem-approach to fisheries management, however desirable, is clashing with the realities of fisheries management in Tonga.
- Although there is a large desire on the part of the government for development of a domestic tuna industry, there are considerable difficulties of operating such an industry from a high cost location such as Tonga.
- It is important to attain an appropriate balance between regional/international aspects of fisheries and domestic aspects of fisheries.

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 longline vessels.
- 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: bêche-de-mer, aquarium fish, and deepwater demersal fish.

[260] This is the catch taken by foreign fleet within the Tonga EEZ. In FAO statistics of capture fisheries production, this catch is accounted under the catch of the nation(s) under which the vessel(s) is (are) flagged.

[261] Pearls and giant clams are commonly measured in pieces, rather than kg.

3.2.1 Marine catch profile

The Tongan longline fleet has reported the following catch of tuna and tuna like species (albacore, bigeye, yellowfin, blue marlin, black marlin, striped marlin and swordfish) to the Western and Central Pacific Tuna Commission (WCPFC) are:

Catches by the Tonga longline fleet (tuna and tuna-like species)

	2004	2005	2006	2007	2008	2009
Total catch volume (tonnes)	433	677	829	941	649	312

Estimates of the volumes and values of the catches of the four main commercial species of tuna in Tonga have been made also by the Forum Fisheries Agency,[262] using data sourced from the Oceanic Fisheries Programme of the Secretariat of the Pacific Community. By adding in volumes and values of bycatch, estimates of total catches can be made.

Catches by the Tonga-based longline fleet (tuna plus bycatch)

	2002	2003	2004	2005	2006	2007
Total catch volume (tonnes)	2 174	1 262	504	818	988	1 119
Total catch value (USD)	4 241 452	2 884 456	1 473 014	2 617 727	2 938 100	3 364 662

Estimates of catches from the coastal fisheries vary widely. Indications are that in the first part of the new millennium annual catches were of the order of 3 000 tonnes. In 2008 the Asian Development Bank examined a large number of studies on coastal fishing in Tonga, and made catch estimates by extrapolating earlier estimates on the basis of population and fish prices changes as per the Tonga Statistics Department (2007).[263] Accordingly, the study determined that a crude estimate of the recent annual production from Tonga's coastal commercial fisheries is 3 700 tonnes (of which about 700 tonnes was exported), worth about USD11.3 million to the producer (of which about USD2.4 million were for products that were exported). Similarly, the study estimated that the production from coastal subsistence fisheries in Tonga in 2007 was about 2 800 tonnes, worth USD6.2 million.

3.2.2 Marine landing sites

The offshore fishing vessels 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.

Deep-slope bottom fishing vessels deliver their catch to Nuku'alofa, and to a smaller 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 Neiafu in Vava'u, and to Lifuka 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.

3.2.3 Marine fishing production means

All offshore tuna catches in the Tonga EEZ are made by locally-based longliners. These vessels range in size from 18 to 39 metres in length. The WCPFC yearbook of 2009 gave information on the recent evolution of this fleet: 35 longliners in 2002, 22 in 2004, 14 in 2006, 9 in 2008 and 7 in 2009. Fishing trips

[262] FFA (2008). The Value of WCPFC Tuna Fisheries. Unpublished report, Forum Fisheries Agency, Honiara.
[263] TSD (2007). Key Statistics. Tonga Statistics Department, Nuku'alofa.

are usually 5 to 10 days in length for the smaller longliners which use ice to preserve the catch. The larger vessels can stay out for nearly a month and freeze the catch.

Tonga is the leading producer of deep-slope demersal fish in the Pacific Islands region. This fishery has its origins in the exploratory fishing carried out in the 1970s by the FAO and the South Pacific Commission, which was followed up by a comprehensive fisheries development programme by the government and the United Nations Development Programme. A report done for the Worldwide Fund for Nature[264] contains a description of current deep-slope bottom fishing in Tonga (Box).

Deep-slope bottom fishing in Tonga

A typical fishing trip starts when the fishing crew loads ice, food, and fuel onto the vessel – which range from 9 to 15 metres. 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 metres 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.

In September 2009 there were 13 active deepwater bottom fishing vessels (three of which were based in Vava'u). This does not include three vessels that have recently departed the deepwater bottom fishery and commenced fishing for bêche-de-mer. The 13 vessel fleet does include 3 vessels that supply only the local market. The original deepwater bottom fishing fleet in the 1980s ranged in size from 21 to 32 feet.[265] The average vessel length increased from 8.5 metres in 1994 to 10.6 metres in 2002. The current management plan for the fishery states "The total length of vessels licensed for snapper and grouper fisheries must not be more than 15 m".

Other types of coastal commercial fishing use a wide variety of gears. A recent survey[266] of fish arriving in Tongatapu from Vava'u and Ha'apai showed that almost half of the fish that arrived was caught by diving, 34 percent from handlining, and around 10 percent from droplining. The rest was caught using various other methods, including netting and gleaning. These results could be considered as indicative of the types of small-scale commercial fishing in the country.

Spear fishing is very important in Tonga. An FAO survey[267] in 2006 provides some information on this fishery. The use of underwater torches for night spear fishing appears to have originated in the 1960s. Halapua (1982)[268] indicates that spear fishing in Tongatapu (both day and night) was well-established in the 1970s with 57 full-time divers. He also states that most Tongatapu divers at that time had Ha'apai origins. A bêche-de-mer boom in Tonga (roughly mid-1980s to mid-1990s) and its associated diving with

[264] Gillett, R. (2008). Coastal Fisheries in the Pacific Islands Region: Candidates for Marine Stewardship Council Certification. Worldwide Fund for Nature, Suva.

[265] Wilson, M. (2007). The Tongan DW Line Fishery 2007. An Assessment of the Need for Fisheries Management. Tonga Fisheries Project.

[266] Lautaha, T. and Cohen, P. (2004). Sampling of Coolers Arriving on Ferries. Ministry of Fisheries, Tonga, unpublished manuscript.

[267] Gillett, R. and W. Moy (2006). Spearfishing in the Pacific Islands: Current Status and Management Issues. FAO FishCode Review No.19, ISSN: 1728-4392, Food and Agriculture Organization of the United Nations, 72 pages.

[268] Halapua, S. (1982), Fishermen of Tonga – their means of survival. Institute of Pacific Studies and the Institute of Marine Resources. University of the South Pacific, Suva.

hookah[269] and scuba apparently increased the skills and interest of individuals in this gear, while a bêche-de-mer ban in the mid-1990s created a pool of unemployed divers. There are several types of spear fishing in Tonga: predominantly subsistence, small-scale commercial, recreational, and operations that involve many divers on a large vessel. The gear used for spear fishing in the country is not very sophisticated. Fins, masks, 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 spear fishing vessels (mostly 6 to 8 metres in length) are all outboard-powered and most are made of wood and have a small cabin.

The subsistence fishing techniques are similar to those for small-scale commercial fishing: diving, handlining, and netting. Gleaning by women is especially common. A study of women's fishing activities in Tonga[270] showed that the major activities of Tongan women in harvesting marine resources have traditionally been reef gleaning for shellfish, holothurians and echinoderms.

3.2.4 Main resources

The WCPFC yearbook showed that albacore dominates, accounting for 34 to 56 percent of the total tuna and tuna-like species longline catch, followed by yellowfin at 24 to 45 percent and bigeye at 8 to 27 percent. An Asian Development Bank report,[271] based on its review of the catch composition of the locally based longline fleet in the period 2003 to 2007. Indicated that the amount of bycatch is about 26 to 32 percent of total catch. Dolphinfish and moonfish accounted for more than 50 percent of this bycatch.

In the deepwater bottom fishery, the major resources are numerous species of snappers, groupers, and other demersal fish. Bell (1994)[272] states that the most important deep-slope species landed in Tonga include *Aphareus rutilans* (rusty jobfish – *palu polosi*), *Aprion virescens* (green jobfish – *utu*), Carangidae (trevallies and jacks – *lupo*), *Etelis carbunculus* (short-tailed red snapper – *palu malau*), *E. coruscans* (longtail snapper – *palu tavake*), *Epinephelus morrhua* (comet grouper – *ngatala*), *E. septemfasciatus* (convict grouper – *mohuafi*), *Pristipomoides filamentosus* (crimson jobfish – *palu hina*), *P. flavipinnis* (golden eye jobfish – *palu sio'ata*), *P. argyrogrammicus* (Ornate jobfish), *Lethrinus chrysostomus* (sweetlip emperor – *manga*), and *Gymnocranius radiosus.*

With respect to coastal commercial fishing, the Ministry of Fisheries' Inshore Fisheries Statistics programme lists 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-breams (Lethrinidae), Seaperches (Lutjanidae), Goatfishes (Mullidae), Sweetlips (Plectorhynchidae), Parrotfishes (Scaridae), Rabbitfishes (Siganidae), Half-peak parrotfishes (Sparisomidae), Sea-pikes (Sphyraenidae), Drummerfishes (Kyphosidae), Rock-cods (Epinephelidae), Silver-biddy (Gerridae), Trigerfishes (Balistidae), Bullseyes (Priacanthidae), and Majors (Abudefdufidae).

Quantitative information on the species composition in the Tongatapu spearfishing catch is given in Vaikona *et al.* (1997):[273]

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[269] 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.

[270] Walton, H. (1998). Supporting women in fisheries. Tonga Fisheries Sector Review, Volume 2. Food and Agriculture Organization of the United Nations (Rome) and Australian Agency for International Development (Canberra).

[271] Halafihi, T. and U. Fa'anunu (2008). Tonga Tuna Fishery Annual Report to SC4 Papua New Guinea, 22nd August 2008. Working Paper 29, Western and Central Pacific Fisheries Commission, Scientific Committee, Fourth Regular Session, Port Moresby, Papua New Guinea.

[272] Bell, L. (1994). Fishery Resource Profiles – Kingdom of Tonga. Report 94/5, Forum Fisheries Agency, Honiara.

[273] Vaikona, L., V. Kava, and U. Fa'anunu (1997). Inshore Fisheries Statistics Annual Report 1996. Ministry of Fisheries, Kingdom of Tonga.

The five major species caught by diving

	Tongan name	English name	Scientific name	Percentage in catch category
Night diving	Hohomo	Parrotfish	*Scarus* spp.	19%
	‘Ume	Unicornfish	*Naso unicornis*	17%
	Maiava	Rabbitfish	*Siganus argenteus*	17%
	Olomea	Parrotfish	*Scarus* spp.	10%
	Pone	Surgeonfish	*Acanthurus* spp.	7%
	Others			30%
				100%
Day diving	Pone	Surgeonfish	*Acanthurus* spp.	38%
	Hohomo	Parrotfish	*Scarus* spp.	13%
	Feke	Octopus		9%
	Ngatala	Grouper	*Epinephelus* spp.	8%
	Ta’a	Squirrelfish	*Ostichthys* spp.	5%
	Others			26%
				100%

In a World Bank study, residents of six coastal communities in Tonga were asked to name the three subsistence fishery resources of most importance to them. Seven resources were most often cited: finfish, octopus, lobster, bêche-de-mer, turbo, giant clams, seaweed, and Anadara.

3.2.5 Management applied to main marine fisheries

Tonga is a member of the Western and Central Pacific Fisheries Commission that 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.

The management of the offshore fishery, deep-slope bottom fishery, aquarium fish, and bêche-de-mer is undertaken through the framework of formal management plans. The management of other coastal fisheries is less formalized; the management framework consists of the Fisheries Act, various regulations, and the policies of the ministry responsible for fisheries.

A major feature of resource management in Tonga is the open access nature of Tonga’s inshore fisheries. Basically, all Tongans can fish anytime/anywhere, with few restrictions on participation. Petelo *et al.* (1995)[274] summarizes the situation (Box).

Management objectives

The current Tonga National Tuna Management and Development Plan was enacted in 2002 by the Minister responsible for fisheries. The stated objectives of the conservation, management and development of the tuna fishery are to: (a) ensure that the utilization of Tonga’s national tuna resource is compatible with the sustainable harvesting of the tuna stocks throughout their range; (b) maximize economic benefits to Tonga from the utilization of its tuna resources, including harvesting and processing; and (c) contribute to the food security of Tongan subjects and, through the sustainable utilization of the tuna stocks.

[274] Petelo, A, S. Matoto, and R. Gillett (1995). The Case for Community-Based Fisheries Management in Tonga. Background Paper 61, Workshop on the Management of Pacific Island Inshore Fisheries, South Pacific Commission, Noumea.

Open access in Tonga's inshore fisheries

Tonga's sea areas were defined by Royal Proclamation in 1887 to be all islands, rocks, reefs, foreshores and water lying between 15 and 23.5 degrees south latitude and between 173 and 177 degrees west longitude. In other words, Tonga was defined as being all that inside a boxed area and that all geographic features are owned by the King. The Land Act of 1927 further reinforced this ownership. With respect to fishing, this has resulted in two consequences: (1) all Tongans have equal fishing access to all Tongan waters and (2) any traditional claim of local control or management authority over fishing areas was abolished. Although Tonga is the only Pacific Island country not to have been colonized, it is the only country in the region to have done away entirely with any traditional fisheries management which may have existed. It should be noted that in the Tongan context this is not incongruous: the King is the maker of traditions in Tonga.

The open access nature of fisheries in Tonga is in some respects compatible with the sharing nature of Tongan society. Nobody would refuse to give food to a hungry person and to discourage somebody from fishing in an area regardless of the purpose or how close to a village was. This system may have worked reasonably well in the era of subsistence fisheries, but it has fairly recently collided with commercial realities and the carrying capacity of inshore resources. A recent survey team visited 11 villages in Ha'apai to discuss development issues (land, marine, health, environment, etc.). In many of the villages the priority concern was the fact that Tongans from anywhere, especially commercial operators from Tongatapu, could harvest the food resources adjacent to villages thereby affecting the food security situation. One frequent comment from villagers in Ha'apai is that, even if a community conserves and manages its adjacent marine resources, it may be a useless exercise as outsiders can, and have, moved in to over-harvest.

Source: Petelo *et al.* (1995)[275]

The current Snapper and Grouper Fisheries Management Plan was endorsed by cabinet in 2007. The Plan gives the following objectives:

- Objective 1: To ensure that utilization of the deep bottom fish resources are for long-term conservation and sustainable benefit;
- Objective 2: To maximize economic welfare to Tonga from utilization of its deep bottom fish resources including harvesting, processing and exporting;
- Objective 3: To contribute to the food security and livelihoods of Tongan subjects through sustainable utilization and employment.

Other management objectives are given in the bêche-de-mer management plan and the aquarium fisheries management plan.

The objectives for the management of the other coastal fisheries are not consolidated in a single document. In general, the objectives are required to conform to the Fisheries Management Act 2002. That law requires that measures promote the objective of optimum utilization and to achieve economic growth, human resource development, employment creation and sound ecological balance. In practice, the purposes of many management measures for coastal fisheries are to prevent resource collapse, deter destructive fishing, and to mitigate threats to the flow of food from coastal fisheries.

Management measures and institutional arrangements

Various management measures are used for the different fishery categories:

- The current tuna management plan establishes a total allowable catch/harvest target per annum for the longline fishery and a limit on the number of vessels participating in the fishery.

[275] Petelo, A, S. Matoto, and R. Gillett (1995). The Case for Community-Based Fisheries Management in Tonga. Background Paper 61, Workshop on the Management of Pacific Island Inshore Fisheries, South Pacific Commission, Noumea.

– The Snapper and Grouper Fisheries Management Plan places maximum limit of 20 hooks per line, a maximum size of 15 metres on vessel length, and a ban on the use of electric reels.

A more diverse array of measures is used in the management of coastal fisheries. These include total bans on certain types of fishing (e.g. use of explosives, poisons), temporary bans (e.g. a 10-year ban on bêche-de-mer fishing), size restrictions for certain species (e.g. lobster), and export restrictions (e.g. controls on giant clam exports). Most management measures are related to fishing input, while output controls have in recent years only been placed on export-oriented fisheries.

The Fisheries Division is responsible for formulating management measures and (after approval by the minister responsible for fisheries) implementing the measures. Until the late 1990s there was little consultation with fishery stakeholders on the need for, and form of, management measures. In the previous decade the concept of consultation with stakeholders has been embedded in legislation and management plans (see Box).

Box: Institutionalization of stakeholder input in the management of the snapper fishery[276]

Consistent with the Section 7(4) of the Fisheries Management Act 2002, a Snapper Fishery Management Committee (SFMC) is established under this Plan. The Committee shall be primarily responsible for the implementation and review of the fishery plan or otherwise monitor the performance of the fishery subject of the fishery plan or perform such other duties and responsibilities as are given it under the fishery plan consistent with this Act. The main functions of the SFMC will be to:

- Advise the Minister and Secretary for Fisheries through the requirements of the FMA 2002 and on the effective management and administration of the Snapper Fisheries;
- Provide a forum for discussion of issues and strategies that require the input of all stakeholders, industry, other government ministries and the Ministry;
- Implement, monitor and review the management plan;
- Provide recommendations and advice to the Head of Ministry of Fisheries relating to the snapper & grouper fisheries operations on a regular basis for management and operational purposes; and
- Ensure transparent decision making in regard to the snapper & grouper fishery.

The SFMC will have representation from all major stakeholders and should include the following representatives:

- Fisheries Management representative from the Ministry of Fisheries;
- Compliance representative from the Ministry of Fisheries;
- Representatives from such other government ministries/departments as selected by the Head of the Ministry of Fisheries;
- Representatives from the Vava'u snapper & grouper fisheries licence holders;
- A representative from the Tongan Fish Exports Association;
- Three representatives of the licensed snapper fishers (at present they do not have any association); and
- ad hoc advisors and members as determined by the Committee Chair.

The open access nature of inshore fishing areas in Tonga creates special problems for fisheries management (see Box on open access above). The net effect of open access and associated lack of community control is that the conditions do not encourage a long-term relationship with the resource. The first-come-first-served regime now prevailing is an incentive to harvest as much as possible, as fast as possible. A pilot project is underway in which selected communities are given some degree of

[276] The deepwater bottomfish fishery is often in Tonga referred to as the "snapper" fishery – despite the fact that fish other than snapper are targeted.

management control in their inshore fishing areas. In Section 13 of the Fisheries Management Act 2002, the Minister may declare any area of the fisheries waters and corresponding subjacent area to be a "Special Management Area" (SMA). Additionally, Section 14 of the Act states that the Minister may designate any local community in Tonga to be a coastal community for the purposes of community based fisheries management. These provisions in the Act are the cornerstones of community based initiatives and sustainable development. In 2006 the three pilot communities in Ha'apai were selected for this programme: 'O'ua, Felemea and Ha'afeva. Those communities formulate a management plan and have a legal foundation for implementing the plan. Subsequently, three other communities have applied and been selected to join the programme. There is the intention of expanding the programme to other parts of Tonga.

Institutions

The main institutions involved with fisheries management are the Fisheries Division (formerly, the Ministry of Fisheries) and the Fisheries Advisory Committee. The Fisheries 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 this Act or as provided in a fisheries management agreement.

In practice, the major fisheries (tuna, deepwater bottomfish, bêche-de-mer, aquarium fish) have management plans that establish committees that are 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."

Other institutions that are important in the management of fisheries are the Fishing Industry Association of Tonga (represents the larger fishing companies), and the Tonga National Fishing Association (represents mainly the smaller fishing operations). For enforcement of management measures the important institutions are the Tonga Police and the Tonga Defense Services.

3.2.6 Fishermen communities

The concept of "fishermen 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".

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 tilapia in small lakes in the three northern island groups of the country.

3.4 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 11 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".

The Fisheries Division has plans to formulate a management plan for sport fishing activities.

3.5 Aquaculture sub-sector

Aquaculture research has been carried out in Tonga for almost 50 years, mostly by the Fisheries Division, with extensive support from a wide range of foreign aid donors. The research carried out has been mostly biological in nature and has covered a wide range of aquaculture candidate species including finfish (tilapia, mullet, mollies, milkfish), molluscs (edible oysters, pearl oysters, mussels, giant clams, green snail, trochus) and algae (Eucheuma and, recently, angel-hair seaweeds). Little economic development has resulted from this work, although there are some promising avenues.

An FAO report explores some of the reasons for the lack of development of aquaculture in Tonga (Box).

Some lessons in aquaculture development

There appear to be two lessons to be learned from aquaculture development in Tonga:

- Although basic biological and technical work is an essential beginning to any aquaculture research and development project, economic studies are also needed at an early stage in order to identify and focus resources on the research lines that have a real potential to generate development, and to avoid those most likely to lead into dead ends. Economic work – meaning market studies, examinations of comparable projects elsewhere, and financial modeling of alternative production scenarios – should proceed in parallel with technical and biological work rather than following it, as has often been the case in Tonga. Failure to carry out economic feasibility studies at an early stage may be one of the reasons why non-viable research avenues have not been identified and discontinued at an early stage, and therefore why so much long-term aquaculture research work in Tonga has failed to lead to any economic development.

Another problem in translating research work into economic development appears to be that even where research may have identified commercial potential there has generally not been a parallel set of extension activities to promote commercial or economic development. At a higher level, there does not appear to be any kind of planning or provision for such extension activities within the aquaculture programmes that have so far taken place. Although research activities may be planned several years in advance, it has been assumed that development will flow on naturally once research has overcome technical problems. In practice, however, the Ministry's aquaculture work has sometimes become locked in the research phase due to the absence of any specific plans or mechanisms for building on research results.

Source: Preston (1998)[277]

Recent annual reports of the government fisheries agency and discussion with its staff give information on aquaculture production:

- Fisheries Division (2008)[278] states that in 2007 "aquaculture development in recent years has been relatively slow and limited to stock enhancement largely at community level with little significant commercial production…..At the end of the year about 12 134 clams equivalent of T$33 297 were sold."
- Fisheries Department (2007)[279] states that in 2006 "Aquaculture production for the year was largely carried out by the Ministry of Fisheries. Main projects included enhancement of giant clams, trochus and green snails. Research trials were aimed at reviving and enhancing over-exploited resources."

[277] Preston, G. (1998). Cost and benefits of aquaculture research and development in Tonga. FAO/AusAID Fisheries Sector Review, Food and Agriculture Organization of the United Nations, Rome.

[278] Fisheries Division (2008). Annual Report for the Year 2007. Fisheries Division, Ministry of Agriculture & Food, Forests and Fisheries, Nuku'alofa.

[279] Fisheries Department (2007). Annual Report for the Year 2006. Fisheries Department, Ministry of Agriculture & Food, Forests and Fisheries, Nuku'alofa.

– Aquaculture staff of the Fisheries Division[280] indicate that mabe pearls are being produced by three or four people in Vava'u. About 200 pearls are produced each year, with an average value of T$20.

Aquaculture production in Tonga in 2007 is estimated to be about 12 000 pieces,[281] worth about USD18 000. The fisheries authority only recorded 0.8 tonnes of production of three giant clam species from the entire aquaculture sub-sector for 2008.

A new aquaculture initiative in Tonga may get around some of the past difficulties in aquaculture development in Tonga. A project with funding from the Australian Centre for International Agriculture Research is a partnership between the Tongan Fisheries Division, the Secretariat of the Pacific Community, and a commercial aquariumfish company. The project is culturing "live-rock" and corals for the aquarium trade. The unique aspect is that, by having a partner with substantial commercial experience in the aquarium trade, the work will focus on what industry wants – to ensure that the efforts are not wasted.[282]

4. POST-HARVEST USE

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 USA. Much of the albacore is sent to canneries in American Samoa, although an increasing amount is sold domestically due to high fish prices. The bycatch from the offshore fisheries is consumed locally.

In the coastal fisheries:

- For deepwater bottom fishing about 2/3 of the catch is exported, with the remainder mostly for restaurants in Tongatapu. All deepwater bottom fish exports currently go to Hawaii.
- The bêche-de-mer is shipped to China.
- The aquarium fish and associated coral products are shipped to the USA.
- 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 the export of seafood for relatives overseas.

Aquaculture production of giant clams is for the aquarium trade in the USA. The cultured pearls are mainly for the tourists that visit Tonga.

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, several smaller ones, and significant roadside sales. Some fishing companies distribute fish to the restaurant trade.

Currently there is only one exporter of deepwater demersal fish and that company ships exclusively to one buyer in Honolulu, Hawaii. For many decades albacore was shipped to the two canneries in American Samoa, but in 2008, one of those canneries ceased operation. Aquarium fish are handled by agents in the USA affiliated with the local Tongan harvestor/exporter. Although it is known that the destination for Tongan bêche-de-mer is China, the marketing arrangements are mostly unknown.

[280] P. Ngaluafe, personal communication, September 2008.

[281] mostly giant clams and some pearls.

[282] FIAT (2009). Fish Tales – a monthly publication of FIAT. Fishing Industry Association of Tonga, Nuku'alofa.

5. FISHERY SECTOR PERFORMANCE

5.1 Economic role of fisheries in the national economy

A recent study by the Asian Development Bank attempted to quantify the fishery-related benefits received by Tonga. The study gave the available information on the contribution of fishing/fisheries to GDP, exports, government revenue, and employment. The results can be summarized as:

- Official estimates show that fishing in 2008/09 was responsible for 4.1 percent of the GDP of Tonga.
- Exports of fishery products are about 36 percent of all export in 2007.
- Access fees paid by foreign fishing vessels represent 0.2 percent of all government revenue.
- Formal jobs directly related to fisheries represent about 3 percent of the total number of formal jobs in the country.
- According to Agricultural census in 2001, 33 percent of household was engaged in fishing at that time.

From the above it can bee seen that fisheries make a relatively important contribution to GDP, exports, and employment.

5.2 Demand

The per capita consumption of fish in Tonga, based on the 2007 FAO Food Balance Sheet, is 35.0 kg. Various other studies have made estimates ranging between 25 and 58 kg. Considering Tonga's population, 35 kg of fish consumption per capita translates into a 2010 demand for 3 627 tonnes of fish.

Factors influencing the future demand for fish are emigration, increase in the price of fish (over-exploitation of inshore areas, gradual devaluation of the local currency, fuel cost increases), relative cost of fish substitutes, and changes in dietary preferences.

5.3 Supply

The government has several strategies to increase the national fish supply. These involve supporting the marketing of fishery products in Tongatapu from other parts of the country, deploying offshore fish aggregation devices, promoting aquaculture, and discouraging the use of destructive fishing techniques.

Major factors affecting the local supply of fish are overfishing, destructive fishing, transport links to the outer islands, and the offloading of fish by the offshore fleet.

5.4 Trade

Exports of fishery products in 2007 were USD2.8 million and represented about 36 percent of all exports of the country. The major exports by value were tuna (29 percent), live rock[283] (21 percent), soft coral (12 percent), deepwater demersal fish (11 percent), and aquarium fish (10 percent).

5.5 Food security

Fish is an important element of food security in Tonga. The FAO Food Balance Sheets show that in 2007 fish contributed an average of 13.5 percent of all protein to the diet and 23.4 percent of animal protein. In rural areas of the country the contributions are much higher.

Animal protein substitutes for fish consist mainly of various types of imported meat, much of which are extremely fatty and have negative health implications.

[283] 'Live rock' is a piece of dead coral rock encrusted with coraline algae and other organisms.

5.6 Employment

TSD (2004)[284] gives the results of a 2003 survey of employment in the country. In 2003 there were a total of 34 561 people employed in Tonga, of which 1 050 were employed in the category of "fishing". Fishing employment therefore represented 3 percent of the employment in the country during that period. Of those employed in fishing, 180 (17 percent) were females.

Tonga Fisheries Project (2005)[285] gives the results of the Tongan Seafood Socio Economic Survey. It estimated the number of people engaged in fishing activities: Tongatapu, 6 470; Ha'apai, 2 053; Vava'u, 4 375. The survey gave the percentage of self-employed that are fishers: Tongatapu, 5 percent; Ha'apai, 18 percent; Vava'u, 7 percent. The survey also found that of the households surveyed, about 64 percent at Tongatapu fished for their own supply of seafood and gifts to others. The corresponding figures for Vava'u and Ha'apai were 80 percent and 82 percent, respectively.

An important component of fisheries employment in Tonga are those jobs related to offshore fishing. A study by the Forum Fisheries Agency[286] tracked the number of Tongan citizens employed in the country's offshore fishing industry (both onboard and in processing plants) over a seven-year period:

Employment in the tuna fisheries of Tonga

	2002	2006	2008
Local jobs on vessels	161	75	45
Local jobs inshore facilities	85	35	35
Total	**246**	**110**	**80**

5.7 Rural development

The Fisheries Division maintains offices and staff in several locations outside of the main urban area of Nuku'alofa: Vava'u, Ha'apai, 'Eua, and Niuatoputapu. One of the major objectives of these outposts is to promote fisheries development. This is carried out through a variety of ways, including market facilitation, advice on fisheries management, deployment of offshore fish aggregation devices, and provision of ice-making equipment.

6. FISHERY SECTOR DEVELOPMENT

6.1 Constraints and opportunities

Some of the major constraints of the fisheries sector are:

- Many of the inshore fishery resources, especially those close to the urban markets, are fully or over-exploited.
- The open-access nature of Tonga's inshore fisheries 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 cannot economically access the relatively abundant offshore fishery resources.
- There are considerable difficulties associated with marketing fishery products from the remote areas where abundance is greatest to the urban areas where the marketing opportunities are greatest.

[284] TSD (2004). Report on the Tonga Labour Force Survey 2003. Tonga Statistics Department, Nuku'alofa.

[285] Tonga Fisheries Project (2005). Tongan Seafood Socio Economic Survey. Tonga Fisheries Project.

[286] Gillett, R. (2008). A Study of Tuna Industry Development Aspirations of FFA Member Countries. Forum Fisheries Agency, Honiara, 70 pages.

- Aquaculture is, to some degree, stuck in the phase of the Fisheries Division growing organisms in tanks.
- There is some degree of miscommunication between the Fisheries Division and fishery stakeholders.

The opportunities in the fisheries sector include:

- Expansion of the Special Management Area concept (communities acquiring management control over adjacent inshore fisheries) to other island communities in Tonga.
- Making the transition from the Fisheries Division raising organisms in tanks to the creation of a viable aquaculture industry.
- Increasing the effectiveness of the Fisheries Division by creating incentives to promote private sector development.
- Enhancement of the input of private sector associations into the functioning of the Fisheries Division.

6.2 Government and private sector policies and development strategies

The clearest articulation of the government's policies and development strategies in fisheries is found in the goals of the Fisheries Division Strategic Plan 2007-2011. Those are:

- Goal 1: Improve fisheries investments through 15 percent fleet development for longline fisheries and promotion of sub-regional access agreements.
- Goal 2: Strengthen and develop aquaculture through promotion of commercial farming for export and supporting coastal community development through stock enhancement.
- Goal 3: Increase employment opportunities equivalent to at least 10 percent of current level of employment, through training and development of fisheries skills in the fisheries industry.
- Goal 4: Improve fisheries information and catch data on resource status through strengthening of existing data management framework and reporting process.
- Goal 5: Strengthen existing, and explore new, fisheries markets.
- Goal 6: Increase production by 15 percent through opening of closed fisheries, research new fisheries, and scientific monitoring of existing fisheries in order to better target fishing effort.
- Goal 7: Improve fisheries governance through increased participation of fisheries stakeholders in fisheries management and in the decision making process.
- Goal 8: Continue to support Community Based Management capacity building, enforcement capability, and expansion of Special Management Areas for sustainable food supply.
- Goal 9: Promote the creation of integrated programmes and income generating opportunities for coastal communities.
- Goal 10: Continue to strengthen the integrated approach to coastal fisheries management and development through close working partnerships and coordination with relevant agencies.
- Goal 11: Match national fisheries management and development with ongoing regional and international fisheries development.
- Goal 12: Continue strengthening fisheries compliance through capacity building.
- Goal 13: Continue strengthening organizational capacity and capability.

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 expanding but rather surviving during a period of poor profitability – as has been the case for the last few years. In deepwater bottom fishing, the sole remaining large fishing/exporting company has a policy of diversification: not "putting

all the eggs in the bottom fish basket", but extending out into retail sales (including meat/wine) and into tuna longlining. In the bêche-de-mer fisheries, most private sector participants have the attitude of harvesting as much as possible before the fishery closes (last time it closed for 10 years).

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 the Tonga Fisheries Bibliography.[287] The results of many of the research projects are summarized by resource in the Tonga Fisheries Profiles.[288] Research projects in the 1990s are summarized in the FAO/AusAID Tonga Fisheries Sector Review.[289] 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 the commercial operators
- Suggestions for improving fisheries research in Tonga

Current fisheries research in Tonga by the Fisheries Division includes that related to tuna, giant clams, and deepwater demersal fish. Major issues in fisheries research are translating research needs into research activities, analysis of data collected by research projects, and funding for research.

6.4 Education

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 on small boat safety and for the certification of vessel officers.
- Training courses, workshops and attachments are frequently organized by the regional organizations: the Secretariat of the Pacific Community in New Caledonia and by the Forum Fisheries Agency 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.

6.5 Foreign aid

The latest Fisheries Division annual report indicates that donor funding is responsible for about 12 percent of the expenditure of the Fisheries Division. "Overseas Donor Funding (In-kind)" is responsible for an additional 32 percent.

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[287] Gillett, R. (1994). Tonga fisheries bibliography: 1st Revised Edition. Pacific Islands Marine Resource Information System, University of the South Pacific, and Technical Cooperation Programme, Food and Agriculture Organization of the United Nations, 115 pages.
[288] Bell, L. (1994). Fishery Resource Profiles – Kingdom of Tonga. Report 94/5, Forum Fisheries Agency, Honiara.
[289] Gillett, R., P. Cusack, W. Pintz, G. Preston, B. Kuemlangan, C. Lightfoot, H. Walton, and D. James (1998). Tonga Fisheries Sector Review, Volume I: Main Report of the Consultants. Food and Agriculture Organization of the United Nations and Australian Agency for International Development, 132 pages.

The largest donor initiative in Tonga's fisheries sector in recent years 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.

Japan has been the major donor supporting aquaculture in Tonga. The Japanese International Cooperation Agency (JICA) funded the construction of the Tongan Mariculture Centre in 1978, and its refurbishment in 1991 after damage by a major cyclone in 1982. JICA has also provided aquaculture experts, training, materials and operating support to Tonga through in-kind technical assistance programmes.

Current donors include the USA (Peace Corps volunteer), the European Union (fish market renovation), Australia (aquaculture), and Japan (fish aggregation devices).

7. FISHERY SECTOR INSTITUTIONS

The main government fisheries institution is the Fisheries Division. In the early 1990s the Fisheries Division was elevated to a Ministry of Fisheries, and then in 2006 the Ministry was downgraded to a division within the Ministry of Agriculture and Food, Forests and Fisheries.

The current Fisheries Division budget is about T$1.2 million (USD600 000). There are about 60 established positions. Most of the staff are based at the Fisheries Division complex in Sopu to the west of Nuku'alofa. Additional staffs are located in Vava'u, Ha'apai, 'Eua, and Niuatoputapu.

Currently, the Fisheries Division has two main sections, Corporate Services and Technical. The various entities under these two sections are:

Corporate services:

- Finance/Budget
- Administration
- Information technology
- Asset management
- Outer islands

Technical:

- Monitoring, control and surveillance
- Research
  - Offshore
  - Inshore
  - Aquaculture
- Management
  - Industry
  - Policy

Other institutions that are important to fisheries in Tonga are the Fishing Industry Association of Tonga (represents the larger fishing companies), and the Tonga National Fishing Association (represents mainly the smaller fishing operations). Attempts are currently being made to establish an umbrella association that would represent both associations as the main interface between fishers and the government.

Some of the important internet links related to fisheries in Tonga are:

- www.tongafish.gov.to – the website of the Tonga Fisheries Division; contains information on legislation, management plans, applications for licences, publications, contact details for key fisheries officials

- www.spc.int/coastfish/Countries/Tonga - Information on Tonga fisheries, links to other sites
- www.pmo.gov.to/index.php/Department-of-Fisheries-Special-Management-Area.html – a description of the Special Management Areas
- www.tonganfishers.org – the website of the Fishing Industry Association of Tonga (FIAT)

8. GENERAL 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:

- 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.

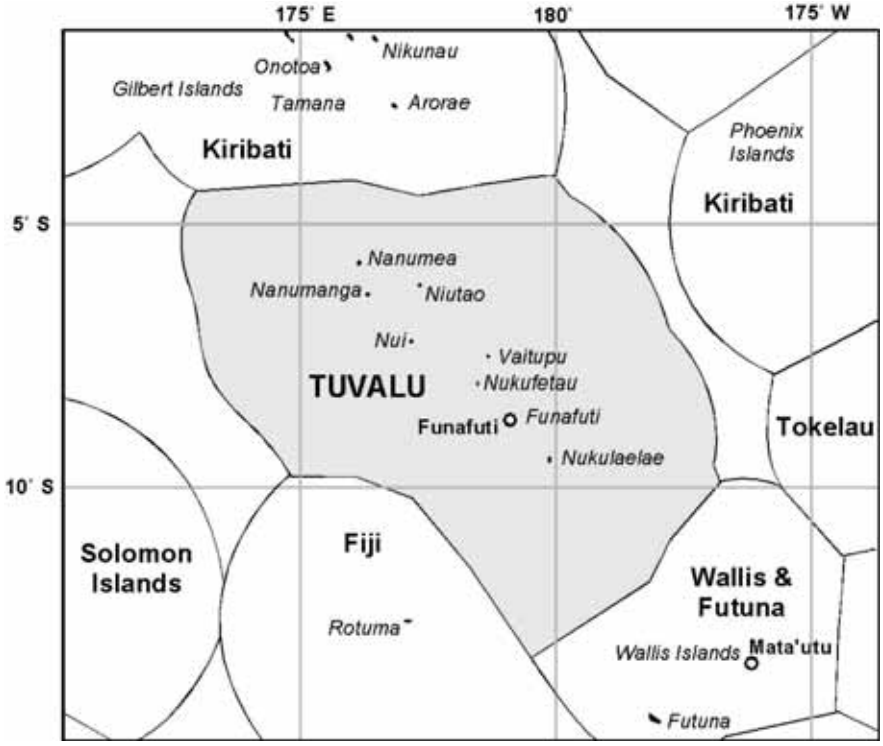
Main features of the Aquaculture Management Act 2003[290] are:

- 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 areaincluding 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.

[290] 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" after the words in one section.

- 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 authorisation 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 otherauthorisation issued in accordance with this Act; within aquaculture areas; and in accordance with this Act and any regulations or orders made under this Act.
- 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 authorisation 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 authorisation of the Secretary.

TUVALU



1. GENERAL GEOGRAPHIC AND ECONOMIC DATA

Area	26 sq km	GDP at purchaser's value (2002)	20 129 000 USD[291]
Water area	900 000 sq km		
Shelf area	[no shelf]	GDP per head (2002)	2 103 USD
Length of coastline	590 km	Agricultural GDP (2002)	3 342 000 USD[292]
Population (2007)	10 000	Fisheries GDP (2002)	1 625 000 USD[293]

2. FISHERIES DATA

2007	Production	Imports	Exports	Total supply	Per caput supply
	tonnes liveweight				kg/year
Fish for direct human consumption[294]	461	52	100	413	41.3
Fish for animal feed and other purposes	1 740	–	–	–	–

[291] As of January 2010, the latest year for which GDP estimates are available is 2002. In 2002 the average exchange rate was 1.00 USD = 1.83 Australian dollars.

[292] This is the official contribution of agriculture, forestry, and fishing to GDP. Source: Tuvalu Central Statistics Division.

[293] This is the official contribution of fishing to GDP. A re-calculation by the Asian Development Bank indicates that in 2002 the fishing contribution was 25 percent greater; source: Gillett, R. (2009). The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories. Pacific Studies Series, Asian Development Bank, World Bank, Forum Fisheries Agency, Secretariat of the Pacific Community, and Australian Agency for International Development, 500 pages.

[294] Data from FAO food balance sheet of fish and fishery products.

Estimated employment (2002)	
(i) Primary sector (including aquaculture)	About 4 000 people[295]
(ii) Secondary sector	[unknown]
Gross value of fisheries output (2007)	43 773 582 USD[296]
Trade (2007)	
Value of fisheries imports	103 000 USD
Value of fisheries exports	305 000 USD

3. FISHERY SECTOR STRUCTURE

3.1 Overall fishery sector

Tuvalu is a group of islands lying in the south-central Pacific north of Fiji. 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 air service from Fiji and only Funafuti has a useable 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 sq km limits the prospects for agriculture or other forms of terrestrially based development. The country places much hope for future economic growth on the fishery resources contained within its large EEZ area, which covers 900 000 sq km.

Subsistence activities dominate Tuvalu's domestic fisheries sector. A wide variety of techniques are used throughout the group to collect fish, crabs and other invertebrates which are consumed, shared or informally bartered. Fisheries centres have been established on several outer islands with the intention of providing fishers there with income earning opportunities. On the main island, Funafuti, artisanal fishing is limited to a small fleet of 4-5 m outboard powered skiffs which mostly fish by trolling for tuna, and by line fishing for reef fish.

Domestic fishing in Tuvalu is quite small compared to the activities of foreign fleets in Tuvalu waters. The tuna catches of the foreign fleets are very large and the money generated from access fees is a critically important source of government revenue.

With respect to the current situation, fisheries in the waters of Tuvalu can be placed into six categories. These categories and the associated production in 2007 are estimated as:

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based[297]	Fresh-water	Aqua-culture
Volume of production (tonnes)	226	989	0	35 541	0	0
Value of production (USD)	616 526	2 232 686	0	40 924 370	0	0

Source: Gillett (2009)

[295] The 2002 Population and Housing Census of Tuvalu showed that 42 percent of the population of 9 554 people participated in some form of fishing.

[296] From Gillett (2009); includes the six fishery production categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally-based offshore fishing, (4) foreign-based offshore fishing, (5) freshwater fishing, and (6) aquaculture.

[297] This is the catch taken by foreign flag vessels in the Tuvalu EEZ. In FAO statistics of capture fisheries production, this catch is accounted under the catch of the nation(s) under which the vessel(s) is (are) flagged.

The main trends and important issues in the fisheries sector

The main trends in the sector include:

- Increasing coastal fishing pressure on the main island of Funafuti due to an expanding population.
- Continuing variability of the volume and value of the foreign tuna catch in the Tuvalu EEZ.
- Falling offshore licensing revenue in real terms.
- Increasing costs of domestic motorized fishing, primarily due to escalation in fuel prices.
- Decreasing enthusiasm by donors to promote activities that could increase reef and lagoon fishing effort.

Some of the major issues in the fisheries sector are:

- Although Tuvalu is located in one of the most favourable tuna fishing areas in the world, the exports of tuna from the country have remained zero over many years.
- Despite the importance of access agreements to the Government, fishing operations are mostly not well monitored.
- 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 frequently perceived by the general public as being contradictory to the Fisheries Department's development efforts.
- The regional/global move to ecosystem-approach to fisheries management, however desirable, is clashing with the realities of fisheries management in Tuvalu.
- Safety at sea and the loss of lives of fishers while trolling offshore is a major issue.
- The desirability for development of a domestic tuna industry, must be reconciled with the difficulties and expense from 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).

Box: Constraints to fishing industry development in Tuvalu

Gillett and Reid (2005):[298]

- 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 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):[299]

- 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,

[298] Gillett, R. and C. Reid (2005). A Business Plan for the National Fishing Corporation of Tuvalu. Gillett, Preston and Associates, for the Forum Fisheries Agency, 30 pages.

[299] FFA (2004). Domestic Tuna Industry Development in the Pacific Islands: The Current Situation and Considerations for Future Development Assistance. Forum Fisheries Agency, Honiara, 198 pages

high costs of doing business, limited domestic market for by-catch 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):[300]

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.

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 foreign-based vessels. These are mainly purse seiners and longliners, and to a much lesser extent, pole-and-line vessels. There is no locally-based vessels operating in offshore fishing.
- Coastal fishing is primarily carried out for subsistence purposes, and to a lesser extent, for sales in local markets. The only export-oriented fishing activities are those for bêche-de-mer (amounts are small and sporadic) and for shells for handicrafts.

Virtually none of the fish caught by foreign vessels within Tuvalu's EEZ are brought ashore, although the licensing of foreign vessels is a crucially important source of government revenue. Over the five-year period 2003 to 2007 access fees have averaged 13.3 percent of the government's total revenue. With respect to coastal fishing, Vunisea (2004)[301] describes the situation: "Because fishing is closely knit into the everyday lives of people, there exists a rich history of fishing, fishing lore and practices which need to be acknowledged and taken into account in any work relating to coastal fisheries development or management."

No discussion of fisheries in Tuvalu would be complete without mention of the National Fishing Corporation of Tuvalu. NAFICOT was established by legislation in 1982 as a mechanism to allow Tuvalu to benefit from the commercial exploitation of its marine resources. In the early years of NAFICOT the main role of the company was to provide the management structure for a donated Japanese pole-and-line tuna vessel, Te Tautai, which was delivered in March 1982. Important events affecting NAFICOT are given in the box.

[300] Chapman, L. (2004). Nearshore Domestic Fisheries Development in Pacific Island Countries and Territories. Secretariat of the Pacific Community, Noumea.

[301] Vunisea, A. (2004). Preliminary assessment of coastal fisheries management needs in Tuvalu. Secretariat of the Pacific Community, Noumea.

Box: A chronology of important events affecting NAFICOT

- 1982: The National Fishing Corporation of Tuvalu was established by the NAFICOT Act.
- 1984-1986: A fisheries resource assessment sponsored by Japan was carried out using the NAFICOT vessel Te Tautai.
- 1986: NAFICOT became a government enterprise under the Ministry of Natural Resources.
- 1986: Te Tautai moved to the Solomon Islands to operate.
- 1987: The Teone fish market, constructed/equipped with British/Australian funding, was acquired by NAFICOT.
- 1987:United Kingdom funding was provided for the construction of a new fish market, which was constructed beside the slipway. As part of this project, Australian aid was provided in the form of equipment for the market.
- 1988: NAFICOT's pole-and-line vessel had a peak annual catch of 1 091 mt.
- 1989: Te Tautai was chartered for three years by the SPC, to undertake a regional tagging programme. The charter fee paid for the vessel (around AUD 4.0 million) allowed NAFICOT to put some of these funds into reserve.
- 1989: The Government of Japan donated six, 9.0 m diesel-powered fishing boats.
- 1991: Commencement of a new USAID-funded survey project for deepwater snappers.
- 1992: The CFC (Community Fishery Centre) was established at Vaitupu. CFCs on other islands followed.
- 1993: At the completion of the SPC charter, F/V Te Tautai sat idle until it was transferred to the Marine Department (Ministry of Works and Communication) in September.
- 1994: Study of NAFICOT undertaken by the Commonwealth Secretariat.
- 1994-1997: A Japanese project (COFIDAS) assisted NAFICOT to investigate the feasibility of fishing and marketing for deep bottomfish around Funafuti. In addition, a Japanese engineer and a Japanese adviser were stationed in Funafuti to get the NAFICOT freezers operational and to install a new ice maker.
- 1997: ADB produces a Tuvalu economic report with a section on NAFICOT.
- 1997: NAFICOT's pole-and-line vessel sank in Funafuti lagoon.
- 2001: SPC produces a national tuna fisheries assessment for Tuvalu.
- 2001: Work began on a draft Tuvaluan National Tuna Development and Management Plan.
- 2001: SPC produces document titled: "Development Options and Constraints Including Training Needs and Infrastructure Requirements within the Tuna Fishing Industry and Support Services in Tuvalu"
- 2002: Four person Tuvalu delegation travels to Korea to inspect vessels.
- 2002: National Tuna Development and Management Plan is produced.
- 2004: FAO undertakes institutional review of the NAFICOT and the Fisheries Department.
- 2004: In April NAFICOT accepts two second-hand vessels offered by the Korean Government as aid assistance to Pacific Island countries.
- 2004: In May and June a SPC Fisheries Development Officer conducted an initial assessment of the two ex-Korean vessels and a workshop on processing and handling of sashimi grade tuna.
- 2004: In November the ex-Korean vessels take first fishing trips in Tuvalu.
- 2004: NAFICOT formulates "Outline of the Proposed Business Plan for the Operation of Two Commercial Fishing Vessels"
- 2004: NAFICOT signs agreement with Fiji Fish to market fish from the newly-acquired fishing vessels.
- 2005: In April an FFA mission visits Tuvalu to formulate a business plan for NAFICOT and recommends disposal of the longliners.
- 2007: The Tuvalu Government puts the longliners up for sale.

Source: Gillett and Reid (2005); SPC = Secretariat of the Pacific Community, USAID = United States Agency for International Development

3.2.1 Marine catch profile

Estimates of the volumes and values of the catches of the four main commercial species of tuna (Bigeye, yellowfin, skipjack and albacore) taken by foreign vessels within the Tuvalu EEZ have been made by the Forum Fisheries Agency,[302] using data sourced from the Oceanic Fisheries Programme of the Secretariat of the Pacific Community. By adding in volumes and values of non-tuna species catch, estimates of total catches can be made.

Estimating tuna catches in Tuvalu waters by foreign-based fleets

Tuna catch	2002	2003	2004	2005	2006	2007
Volume foreign fleet catch in Tuvalu waters (mt)	28 332	3 499	19 282	14 572	14 873	33 848
Volume foreign fleet total catch in Tuvalu waters (mt)	29 749	3 674	20 246	15 300	15 616	35 541
Value foreign fleet tuna catch at destination market (USD million)	26.6	4.1	23.3	23.2	15.2	48.2
Value foreign fleet catch in Tuvalu waters adjusted for transship (USD million)	22.6	3.5	19.8	19.7	12.9	40.9

Estimates of catches from Tuvalu's coastal fisheries vary widely. In 2008 the Asian Development Bank examined a large number of studies on coastal fishing in the country, and made catch estimates:

- The annual coastal commercial production in the mid-2000s was estimated to be 226 mt, worth USD616 526
- The annual coastal subsistence fisheries production in Tuvalu in the mid-2000s was estimated to be 989 tonnes, worth USD2 232 686

3.2.2 Marine landing sites

The catch taken by foreign fleet operating within the Tuvalu EEZ is either delivered by the catching vessels to foreign ports or transshipped in ports in neighbouring Pacific Island country to processing facilities, mainly in Asia. Only a very small amount of transshipping occurs in Tuvalu.

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.

3.2.3 Marine fishing production means

The catch in the offshore areas is made entirely by foreign industrial fishing vessels. The table below gives the fleet composition for recent years. Tupulaga (2008)[303] states "the purse seine fleet alone contributed 98 percent to the total reported catch".

Most commercial fishers on Funafuti use a variety of fishing techniques. The decision of which specific technique to use (spear fishing, bottom fishing, netting, trolling) depends on a number of factors, including market conditions, weather, and the phase of the moon. Gillett and Moy (2006)[304] give information on spearfishing in Tuvalu:

[302] FFA (2008). The Value of WCPFC Tuna Fisheries. Unpublished report, Forum Fisheries Agency, Honiara.

[303] Tupulaga, P. (2008). Tuvalu Part 1 Report 2008. Submission to the 4th Regular Meeting, Scientific Committee (WCPFC) , Port Moresby, Papua New Guinea.

[304] Gillett, R. and W. Moy (2006). Spearfishing in the Pacific Islands: Current Status and Management Issues. FAO Fishcode Review No.19, ISSN: 1728-4392, Food and Agriculture Organization of the United Nations, 72 pages.

Foreign Fishing Vessels licensed to operate in the Tuvalu EEZ

	Types and numbers of licensed vessels	Countries participating
2005	93 longliners, 7 pole/line vessels 140 purse seiners	FSM, Fiji, Japan, Korea, New Zealand, Papua New Guinea, Taiwan and USA
2006	34 longliners 3 pole/line vessels 52 purse seiners	Japan, Korea, Netherlands Antilles, New Zealand, Taiwan and USA
2007	81 longliners 3 pole/line vessels 57 purse seiners	Japan, Korea, New Zealand, Taiwan and USA
2008	42 longliners 3 pole/line vessels 126 purse seiners	Japan, Korea, New Zealand, Spain, Taiwan and USA

Source: Fisheries Department, unpublished data

Spear fishing is done during the day and at night in both the lagoon and on the ocean side of the nine islands in the country. Fairly simple gear is used by fishers in the eight outer islands (mainly for subsistence but some fish is sold), as well as on Funafuti (some for subsistence but most fish is sold). Although modern spearguns are occasionally used, most fishers use sling-type spears in which the rubber is not fixed to the spear shaft. These spears are mainly constructed by the divers themselves. The spear tips (some single, some triple) are sharpened before each spearfishing session. Very young divers sometimes make their small spears from old umbrella frames. Scuba gear is not used, but one set of hookah gear, leftover from bêche-de-mer fishing in the mid-1990s, has been employed for spearfishing.

A study by the Forum Fisheries Agency indicates that 10 to 20 small outboard-powered boats on Funafuti fish commercially, mainly coastal trolling for tuna. Another 10 commercial boats fish occasionally troll. Alternatively, the head of the Funafuti Fishermen's Association indicated that there are about 10 boats which could be considered full-time commercial tuna boats.

With respect to subsistence fishing, Vunisea (2004) states that most people are engaged in fishing almost daily to meet subsistence 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.

3.2.4 Main resources

Tupulaga (2008) gives the composition of the catches taken by the offshore foreign fleets for recent years:

- Purse seine: About 94 percent skipjack, 5 percent yellowfin, and 1 percent bigeye and other
- Longline: About 47 percent yellowfin, 28 percent bigeye, 9 percent albacore, and 16 percent other
- Pole-and-line: About 99.5 percent pole-and-line, and 0.5 percent yellowfin

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).[305] Common species in the Tuvalu spearfishing catch are given in the table.

[305] Wilson, M. (1995). Tuvalu Fisheries Resources Profiles. FFA Report 95, Forum Fisheries Agency, Honiara.

Common species in the Tuvalu spearfishing catch

Tuvalu name	English name	Scientific name	Comment
Ume	Long-nosed unicornfish	*Naso unicornis*	Very important in catch
Maninilakau	Orangespine unicornfish	*Naso lituratus*	Very important in catch
Pokapoka	Unicornfish	*Naso* sp.	A black unicornfish
Ponelolo	Lined surgeonfish	*Acanthurus lineatus*	
Kapalagi	Surgeonfish	*Acanthurus* sp.	
Ulafi	Parrotfish	*Scaridae*	
Laea	Parrotfish	*Scaridae*	
Maiava	Rabbitfish	*Siganus* sp.	Very important in catch
Malau	Soldierfish	*Myripristis* sp.	

Source: Gillett and Moy (2006)

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.

3.2.5 Management applied to main marine fisheries

Tuvalu is a member of the Western and Central Pacific Fisheries Commission that 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.

In Tuvalu national government interventions in the fisheries sector are largely limited to action in support of obtaining government revenue from the foreign offshore fisheries and to small-scale inshore fisheries development. A report of the Forum Fisheries Agency[306] states "Apart from conditions relating to the licensing of foreign fishing vessels, there is very little regulation of fisheries in Tuvalu. In earlier times there were well developed systems of traditional resource management but many of these appear to have broken down."

Johannes (2000)[307] provides some information on fisheries management at the island level. 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". Johannes provides a description of actions by the various island councils that could be considered fisheries management measures. As an example, the situation at Nukulaelae Atoll:

- According to Nukulaelae's Control of Faapuku and Kaumu Bye-law of l984, fishing with nets or spear for faapuku (identified by several fishers as *Epinephelus macrospilos*) and kaumu (apparently a small spotted grouper) is prohibited June through August.
- The 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 northern and southern halves of the atoll are closed to collecting of seabirds, their eggs, land-crabs, and coconut crabs.

[306] FFA (1999). FFA Regional Compendium of Fisheries Legislation Western Pacific Edition. Forum Fisheries Agency, Honiara.

[307] Johannes, R. (2000). Findings During A Trip To Introduce To Tuvalu Methods Of Obtaining And Storing Local Marine Environmental And Fishing Knowledge. Departments of Fisheries and Natural Resources and Environment, Funafuti.

Finekaso (2004)[308] states that one of the most important marine resource conservation measures in Tuvalu is the "Li'iga" system whereby there is 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 UNDP and the South Pacific Regional Environmental Programme, Tuvalu established its first marine protected area within 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).

Tuvalu's National Master Plan for Fisheries Development 2008-2011[309] states that nearly all island communities stated that they would like help with assessment of fisheries resources and developing management measures. In many countries, this is the main function of the Fisheries Department, but in Tuvalu most of the effort and funding has been diverted to other "development" efforts, and the only real management initiative has been the setting up of marine protected areas on each island.

With the paucity of conventional fisheries management measures that support established objectives, it may be informative to discuss a tuna management regime (Box) that was formulated and agreed to in principle, but for which formal adoption did not occur. – due to some relatively minor editorial requirements, the departure of the head of the Fisheries Department and the death of his successor.

Box: The status of the Tuvalu Tuna Development and Management Plan

According to the text of the "National Tuna Development and Management Plan 2002-2006", the "Plan describes what the Government of Tuvalu intends to do over the next five years, from 2002 to 2006 to develop and manage tuna resources so to increase their contribution to the long term economic and social welfare of the people of Tuvalu."

The Plan has two major overall objectives:

- To maximize the long term economic and social benefits for the people of Tuvalu from the development of tuna resources
- To ensure the sustainability of harvesting of tuna resources.

The development objectives given in the plan are:

- Increase the participation of private sector interests in tuna fishing through the provision of infrastructure needed to foster development, such as a anchorage for fishing vessels, and land availability for constructing support services, like processing and/or storage facilities.
- Work with other government departments in overcoming the logistical problems of transporting products, especially fresh fish, at a cost effective price both internally, and to export markets from Tuvalu.
- Promote value-adding to tuna catches in Tuvalu, to maximize local employment, and produce a low weight, high value product to minimize freight costs to export market.
- Establish an effective extension service to introduce alternative small-scale and medium-scale harvesting techniques to Tuvalu when the main infrastructure constraints are overcome and fish can be exported easily.
- 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 Tuvalu.

[308] Finekaso, S. (2004). Traditional Marine Ethnobiodiversity and its Application to Inshore Marine Resources Management in Tuvalu. Masters of Arts thesis, University of the South Pacific, Suva.

[309] MNR (2008). National Master Plan for Fisheries Development 2008-2011. Ministry of Natural Resources, Government of Tuvalu.

The tuna management objectives are given as:

- Continuing to strengthen the exercise of sovereign rights by Tuvalu over tuna
- Increasing the economic gains received by Tuvalu from the exercise of its rights over tuna
- Ensuring effective participation by Tuvalu in regional tuna management activities
- Reflecting customary values in tuna policy and planning, including recognition of the importance of the contribution of tuna to food security, protection of the interests of small-scale tuna fishers, respect for local bylaws and bycatch management.

The tuna management strategy is given as:

- Revising the legal framework: a new marine resources act to be presented to parliament.
- Revising the licensing system, including updating the licensing requirements for foreign vessels, introducing licensing requirements for larger-scale Tuvalu fishing vessels, and applying limits to catches.
- Increasing Tuvaluan involvement with foreign fishing operations.
- Strengthening tuna management capacities.

Although it was anticipated that the plan would be approved in late 2001 and implementation would begin in early 2002, this has not occurred. According to the Permanent Secretary of the Ministry of Natural Resources and Lands, the Plan was submitted to the Development Coordination Committee (DCC) in early 2003. The DDC endorsed the Plan but required some minor editorial changes before submitting it to Cabinet. This has yet to occur.

Management objectives

The Marine Resource 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.

Due to the few national fisheries management measures currently in place, it is not possible to draw conclusions on national fisheries management objectives.

Gillett and Moy (2007) analyze local fisheries management measures in Tuvalu dealing specifically with spearfishing and conclude: "Several of the islands' restrictions on spear fishing 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 spear/line conflict – old men, who mostly fish with lines, disapproving of spear fishing, mostly done by much younger males."

Management measures, institutions, and institutional arrangements

As indicated above, there are few national fisheries management measures that support established objectives. Examples on measures on Nukulaelae Atoll are given above, along with the proposed arrangements for the management of the offshore fisheries.

The Fisheries Department of Ministry of Natural Resources and Lands is the government entity charged with fisheries management at the national level. More information on the Department is given in Section 7 below. Island councils are empowered under the Local Government Act to regulate local fishing activities.

3.2.6 Fishermen communities

The concept of "fishermen communities" has limited applicability to Tuvalu. Most households in the country are involved in coastal fishing activities. SPC (2005)[310] presents the main findings of demographic, socio-economic, household and housing information collected in the 2002 Population and Housing

[310] SPC (2005). Tuvalu 2002: Population and Housing Census. Volume 1. Analytical report, Secretariat of the Pacific Community, Noumea, New Caledonia.

Census of Tuvalu. With respect to fishing employment, the report indicates that 67 percent of all households in Tuvalu were involved in fishing activities".

It could therefore be stated that all villages in Tuvalu are "fishing communities".

3.3 Inland sub-sector

There are no inland fisheries in Tuvalu.

3.4 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.

There is no active management specifically for the recreational sub-sector.

3.5 Aquaculture sub-sector

Uwate (1984)[311] lists the 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.

Tuvalu's National Master Plan for Fisheries Development 2008-2011 states that the Fisheries Department and island communities have undertaken a number of projects and culture trials, but "none of these have resulted in a single working aquaculture project in Tuvalu…there are no functional aquaculture activities".

4. POST-HARVEST USE

4.1 Fish utilization

All of the fish captured by the offshore foreign fleets in Tuvalu EEZ 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).

The coastal commercial catch is mainly 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 domestic use of the household that made the catch – but some are giving away to relatives and friends.

The export of fishery products from Tuvalu is very small: sporadic exports of bêche-de-mer (e.g in 2007, 4 202 USD of bêche-de-mer was sent to China) and some shell handicrafts (mainly given departing Tuvaluans). In the 1990s some exports of tuna jerky were sent to Fiji, but this did not continue for very long after the sponsoring project was completed.

4.2 Fish markets

Fish are 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 fishermen making the catch.

In the outer islands the intention was that "community fishery centres" would have an important role in fish marketing. The centres have not been entirely successful (Box).

[311] Uwate, K. (1984). A review of Aquaculture Activities in the Pacific Islands Region. East-West Centre, Honolulu.

Box: 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 (CFCs), 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 none of these projects was financially viable, the Government proceeded with the construction of further Centres of the Australian design in Nanumanga, 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.

The current situation of the CFCs in Tuvalu can best be described as 'run down'. Although Centres in Vaitupu, Nanumea and to a lesser extent Nanumanga are still actively buying and selling fish on a daily basis, others are barely operating. All Centres have broken down equipment and other maintenance needs. Each Centre received subsidy from the Government in 2008.

On the other hand the CFCs are viewed as providing a valuable service by the communities of each island, and a decision to close them down would be very unpopular. It is also true that they provide one of the few sources of paid employment and opportunities to earn income on most islands. A review of the CFCs was carried out in 2004, and most islands have endorsed the recommendations.

Source: National Master Plan for Fisheries Development 2008-2011

5. FISHERY SECTOR PERFORMANCE

5.1 Economic role of fisheries in the national economy

A recent study by the Asian Development Bank attempted to quantify the fishery-related benefits received by Tuvalu. The study gave the available information on the contribution of fishing/fisheries to GDP, exports, government revenue, and employment. The results can be summarized as:

- Official estimates show that fishing in 2002 was responsible for 8.2 percent of the GDP of Tuvalu. A recalculation using a different methodology shows it was 25 percent greater.
- Exports of fishery products form most of the exports of Tuvalu, but the total amount of all exports is quite small.
- Access fees paid by foreign fishing vessels in recent years represent 13.3 percent of all government revenue.
- Employment in fisheries (both formal and informal) is quite important; 67 percent of all households in Tuvalu are involved in fishing activities.

From the above it can bee seen that in Tuvalu fisheries make a relatively important contribution to GDP, government revenue, and employment.

5.2 Demand

The per capita consumption of fish in Tuvalu, based on the 2007 FAO Food Balance Sheet, is 41.3 kg. Various other studies have made estimates ranging between 85 and 146 kg. Considering Tuvalu's population, 100 kg of fish consumption per capita translates into a 2010 demand for 979 tonnes of fish.

Factors influencing the future demand for fish are migration from the outer islands (where fish consumption is highest) to Funafuti, population change, increase in the price of fish (mainly due to fuel cost increases), relative cost of fish substitutes, overseas cash remittances (enables greater consumption of fish substitutes) and changes in dietary preferences.

5.3 Supply

The government has several strategies to increase the national fish supply. These involve supporting the communities fisheries centres (Box in Section 4.2) and encouraging shipments of fish from the outer islands, having the Fisheries Department focus on small-scale fisheries development, and promotion of aquaculture.

Major factors affecting the local supply of fish are overfishing in Funafuti, transport links to the outer islands, and the cost of commercial fishing from Funafuti.

5.4 Trade

The published export statistics of Tuvalu are not very detailed – they are only disaggregated to the level of "Consignment", "Other", or "Sold". Staff of the Central Statistics Division Customs Department indicate that virtually all of the "Sold" category consists of marine products such as bêche-de-mer. Staff of the Customs Department indicate that the only significant exports in recent years are bêche-de-mer and aluminium scraps (crushed cans), with the latter actually being a re-export.

The fishery exports of Tuvalu in 2007 was estimated as USD305 thousands, including USD4 202 of bêche-de-mer (CSD 2008).[312]

5.5 Food security

Fish is an extremely important element of food security in Tuvalu. The FAO Food Balance Sheets show that in 2007 fish contributed an average of 22.3 percent of all protein to the diet and 38.0 percent of animal protein. In the outer islands the contributions are much higher.

Animal protein substitutes for fish consist mainly of various types of imported meat, much of which are extremely fatty and have negative health implications.

5.6 Employment

SPC (2005) presents the main findings of demographic, socio-economic, household and housing information collected in the 2002 Population and Housing Census of Tuvalu. With respect to fishing employment, the report states:

- 67 percent of all households in Tuvalu were involved in fishing activities, although mainly for their own consumption.
- The highest percentage of households participating in fishing was on Nanumea (95 percent) and the lowest was on Funafuti (52 percent).
- Commercial fishing was slightly more common in the outer Islands than in Funafuti (10 percent and 8 percent respectively).

[312] CSD (2008). Biannual Statistical Report. Central Statistics Division, Ministry of Finance and Economic Planning. Government of Tuvalu.

- Of those households that engaged in fishing, most fished only on the reef, especially in Funafuti (Figure 29). However, a large minority (42.5 percent) of all households fished both inside and outside the reef. Just over 6 percent of all households fished only outside the reef.
- Of the 528 people whose main economic activity was fishing, 68 (12.9 percent) were females.

5.7 Rural development

In the fisheries sector the major rural development efforts of the government have been the community fisheries centres (Box in Section 4.2). 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.

6. FISHERY SECTOR DEVELOPMENT

6.1 Constraints and opportunities

Some of the major constraints of the fisheries sector are:

- Many of the inshore fishery resources, especially those close to the Funafuti urban markets, are fully or over-exploited.
- Small-scale fishers experience difficulty in economically harvesting the relatively abundant offshore tuna resources; chasing tuna schools with outboard-powered skiffs is relatively inefficient, especially in an era of high fuel costs.
- There are considerable difficulties associated with economically marketing fishery products from the outer islands where abundance is greatest to the Funafuti urban area where the marketing opportunities are greatest. The community fishery centres are likely to require subsidies in perpetuity.
- The Box in Section 3.1 details the multitude of constraints on establishing an industrial fishery in Tuvalu. 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 by-catch and other factors, all work against the establishment of a domestic fishing industry like those of many Pacific Island countries.

The opportunities in the fisheries sector include:

- Improvements in the process of negotiating foreign fishing vessels access to the Tuvalu EEZ.
- Encouraging the industrial fishing vessels to offload fish on Funafuti.

  Tuvalu's National Master Plan for Fisheries Development 2008-2011 lists additional opportunities:
  - Invite expressions of interest from fishing companies in a partnership to develop tuna longlining and deepwater bottom fishing 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 FAD deployment programme, for Funafuti and islands without lagoon fishery resources
  - Develop some simple regulations to conserve the most threatened fisheries resources
  - Develop and approve a tuna management plan
  - Establish a giant clam hatchery
  - Develop a shell handicraft project to supply shell cutting and polishing equipment to each island's CFC for the production of new types of shell handicraft
  - Request a donor an institutional strengthening project
  - Establish a Fisheries Advisory Council
  - Support the Tuvalu Fishermen's Association

Another opportunity that is presently being developed is a joint-venture with a Taiwan Province of China firm to own and operate a tuna purse seine vessel. The Tuvalu-Chingfu joint venture provides the opportunity for Tuvalu to participate in the purse seine fishery – in exchange for granting the seiner assured access to the fishing grounds of Tuvalu and neighbouring countries.

The perceptions of the various island communities in Tuvalu as to development possibilities were obtained as part of the process in the formation of the National Master Plan for Fisheries Development 2008-2011. These are given in the table below.

Table: Areas of development interest from community consultation

Description of area of interest	NUK	FUN	NKF	VTP	NUI	NTO	NGA	NMA
Marketing								
New products and markets	×	×	×	×	×	×	×	×
Processing waste for animal feed		×			×	×	×	
Improved transport to Funafuti	×						×	×
CFCs								
Upgrade of storage/freezers	×		×	×	×	×	×	×
Infrastructure – jetty, market	×	×	×					
Provision of equipment	×	×	×	×	×	×	×	×
Staff training	×		×	×	×			×
Improved management			×			×		
Resource management								
Resource assessment and surveys	×		×					×
Advice on management measures	×	×	×	×	×	×		
Help with Conservation Areas	×	×					×	
Fish Aggregation Devices								
Deployment of FADs		×	×	×	×	×	×	
Safety at sea								
Sea safety supplies (flares etc.)		×		×		×	×	×
Training in OBM maintenance			×	×	×	×	×	
Rescue vessel				×			×	
Fishing technology								
Supply of fishing gear for resale	×	×	×	×	×	×	×	×
Other supplies – spares, petrol			×					×
Training in fishing gear/methods		×		×	×			
Launch for offshore fishing				×			×	×
Aquaculture								
Hatchery based (clams, pearl)	×	×		×	×	×		×
Fish pond (mainly milkfish)	×	×	×	×	×	×		×
Other – seaweed, transplantation		×			×	×	×	
Women in fisheries								
Shell handicraft making		×	×	×	×	×	×	×
Other (training, boat)							×	×
Fisheries infrastructure								
Fishing boat harbour						×	×	
New reef passage							×	
Navigation lights for passage				×	×	×	×	
Other								
Monitoring/reporting of FFVs						×	×	
Traditional fishing methods							×	
Jobs on foreign fishing vessels							×	

Notes: NUK = Nukulaelae; FUN = Funafuti; NKF = Nukufetau; VTP = Vaitupu; NUI = Nui; NTO = Nuitao; NGA = Nanumanga; NMA = Nanumea

An important aspect of fisheries development opportunities in Tuvalu concerns the resilience of the atoll environment to fishing pressure. The ability of atolls, with characteristically clear water and relatively small inflow of nutrients, to support substantial fisheries production over the long-term is thought to be relatively low compared to areas adjacent to much larger land masses. It has become apparent, across the Pacific, that atolls and other small islands are unable in the long-term to support substantial export fisheries relying only on inshore fishery resources and that attempts to do so have resulted in lower fish available for local consumption.

6.2 Government and private sector policies and development strategies

The most recent articulation of the government's policies and strategies in the fisheries sector are found in the National Master Plan for Fisheries Development 2008-2011. These are:

Key Policy Objectives:

- Improve management of fisheries resources – inshore and EEZ;
- Eliminate subsidies to CFCs through efficiency gains, privatization or closure;
- NAFICOT is made commercially viable.

Priorities and Strategies:

- Review operations of CFCs to reduce subsidies through efficiency gains, privatization or closure;
- Develop and adhere to a fully costed business and management plan for the operation of NAFICOT's longline venture so that no subsidy is required;
- Increase revenue from fish licensing;
- Formulate and implement a clear, coherent and integrated fisheries sector development programme.

The private sector in Tuvalu is very small and its policies are not formalized. The fishers association in Funafuti is vocal on obtaining government support for lower fuel costs and for safety gear on the local troll vessels.

6.3 Research

Many fisheries research projects have been carried out in Tuvalu. The older research is listed in the document "Tokelau and Tuvalu: an atoll fisheries bibliography".[313] The results of many of the research projects are summarized by resource in the "Tuvalu Fisheries Resources Profiles".[314]

Fisheries research in Tuvalu in the past few decades has included coverage of tuna, tuna baitfish, ciguatera, giant clams, trochus, fish nomenclature, marine ethno-biodiversity, aquaculture potential, specimen shells, bêche-de-mer, pearl oysters, deepwater bottomfish, seabirds, traditional fishing, and turtles.

Research is not mentioned in Tuvalu's National Master Plan for Fisheries Development 2008-2011, but the Plan proposes a new structure for the Fisheries Department that includes a Principal Fisheries Officer for fisheries research.

6.4 Education

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.

[313] Gillett, R. (1988). Tokelau and Tuvalu: an atoll fisheries bibliography. Document 88/4, FAO/UNDP South Pacific Regional Fisheries Development Programme, Suva, Fiji, 72 pages.

[314] Wilson, M. (1995). Tuvalu fisheries Resources Profiles. Report 95, Forum Fisheries Agency, Honiara.

- Training courses, workshops and attachments are frequently organized by the regional organizations: the Secretariat of the Pacific Community in New Caledonia and by the Forum Fisheries Agency 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 by bilateral donors.

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 and ADB. Assistance has flowed from UN agencies, including FAO, UNDP, ESCAP, and UNCDF. The regional organizations serving Pacific Island countries, including the Forum Fisheries Agency, the South Pacific Commission, the South Pacific Regional Environment Programme, the Forum Secretariat, and the South Pacific Applied Geoscience Commission have also been active in supporting Tuvalu's fisheries sector.

Projects have variously 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 bottom fish, aquaculture), the provision of fishing vessels, and assistance with projects involving marketing, training, and statistics.

One of the themes of the Tuvalu's National Master Plan for Fisheries Development 2008-2011 is Developing greater self-reliance:

> "Although Tuvalu has had political independence for 29 years, the country has developed an increasing economic dependence on overseas aid. While the flow of aid funds has undoubtedly improved the infrastructure – particularly on Funafuti – and increased the material prosperity of most Tuvaluans, it has also created a culture of dependency. Almost every planned activity in the Fisheries Department now seems to require donor assistance and funding. This is not healthy, and it may not be sustainable."

7. FISHERY SECTOR INSTITUTIONS

The main government fisheries institution is the Fisheries Department of the Ministry of Natural Resources and Lands.

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, and who in turn reports to Cabinet.

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 can be thought of as being partitioned into four sections. These are:

- Inshore Fisheries Management and Aquaculture
- Licensing, MCS and reporting on commercial tuna fishing and access arrangements
- Vessel operations, support to CFCs, Maintenance of assets
- Support Staff

According to Tuvalu's National Master Plan for Fisheries Development 2008-2011, the Fisheries Department has adequate numbers of staff, many of whom are well qualified and have frequent chances

to upgrade their skills through overseas training. It also has some useful assets, notably the vessel MV Manaui, which allows service delivery to the outer islands as well as earning revenue through charters. However, the Department is constrained by the following:

- Most of the budget is consumed by wages (including that for the community fisheries centres) and subsidies, leaving very little for actual activities (or even maintenance of assets);
- Partly as a result of this, nearly all activities are donor driven – they either require donor funding, or result from initiatives of regional organizations, or both;
- Senior staff are new in their roles, and are heavily committed to regional issues requiring frequent travel overseas.

Other important fisheries institutions in Tuvalu are the Funafuti Fishermen 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.

Some of the important internet links related to fisheries in Tuvalu are:

- www.spc.int/coastfish/Countries/Tuvalu – Information on Tuvalu fisheries, links to other sites
- www.spc.int/coastfish/news/Address_Book/Address_book.htm – fisheries address and contact in Tuvalu
- www.fishbase.org – information on fish found in Tuvalu

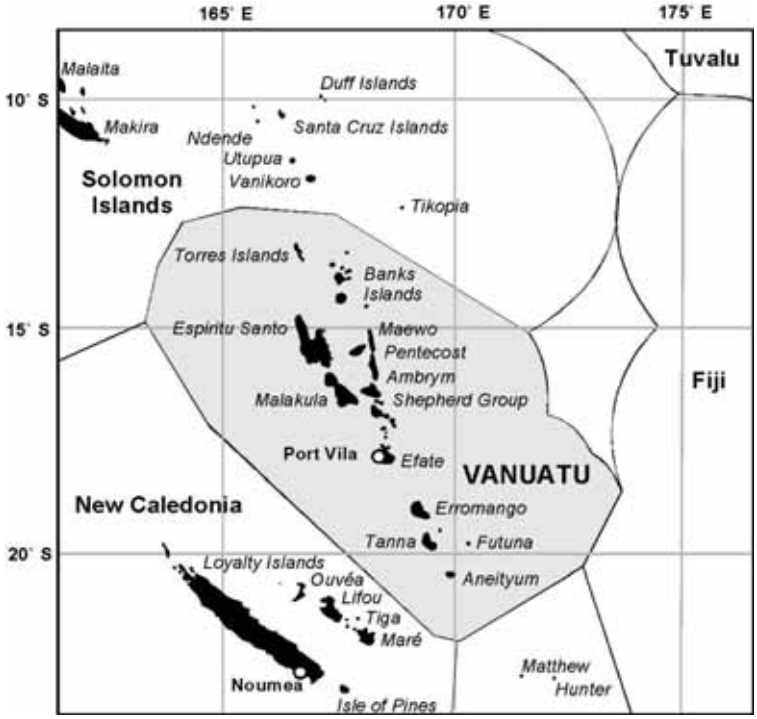
8. GENERAL LEGAL FRAMEWORK

The Marine Resources Act 2006 is the main law dealing with fisheries in Tuvalu. It is a 79 page document in 11 parts. The main features of the Act are:

- The principal objective of the Act is to ensure the long-term conservation and sustainable use of the living marine resources for the benefit of the people of Tuvalu.
- The Minister responsible 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 the fisheries and make regulations as he sees fit.
- The Minister may appoint in writing a fisheries officer and such other officials as needed to discharge fisheries related functions.
- The Minister may dclare that a fishery important to the national interest is a "designated fishery".
- The Fisheries Officer shall prepare a management plan for each designated fishery.
- 13 requirements for each fisheries management plan are specified.
- All vessel engaged in fishing must have a valid/applicable permit under the Act or a valid/ applicable license under a multilateral access agreement in accordance with the Act.
- The transshipment of fish in the Tuvalu EEZ is regulated.
- The requirements for a Tuvalu fishing vessel operating outside of Tuvalu waters are given.

Other relevant legislation includes the Marine Zones (Declaration) Act of 1993 and the National Fishing Corporation of Tuvalu Act of 1980, revised in 1982. The relevance of the latter has diminished due to the activities of NAFICOT being greatly reduced in recent years.

VANUATU



1. GENERAL GEOGRAPHIC AND ECONOMIC DATA

Area	12 190 km^2
Water area	680 000 km^2
Shelf area	[no continental shelf]
Length of continental coastline	1 920 km (length of the coast of islands)
Population (2007)	228 000
GDP at purchaser's value (2007)	512 977 000 USD[315]
GDP per head (2007)	2 242 USD
Agricultural GDP (2007)	73 818 000 USD[316]
Fisheries GDP (2007)	3 883 000 USD[317]

2. FISHERIES DATA

2007	Production	Imports	Exports	Total supply	Per caput supply
	tonnes liveweight				kg/year
Fish for direct human consumption[318]	78 187	3 035	73 565	7 657	33.6
Fish for animal feed and other purposes	7 200	–	–	–	–

[315] 2007 average exchange rate: US$1 = Vanuatu vatu 104.0; GDP source: unpublished data kindly provided by the Vanuatu National Statistics Office.

[316] This is the contribution of "total agriculture" in an unpublished document kindly provided by the Vanuatu National Statistics Office. "Total agriculture" includes commercial and subsistence fishing.

[317] This is the official fishing contribution to GDP. A recalculation shows the total fishing contribution to be USD$6.7 million: Gillett (2009). The Contribution of Fisheries to the Economies of Pacific Island Countries and Territories. Pacific Studies Series, Asian Development Bank, Manila.

[318] Data from FAO food balance sheet of fish and fishery products. The production/export amounts apparently include the foreign-owned Vanuatu-flagged vessels.

Estimated employment (2007)	
(i) Primary sector (including aquaculture)	15 758[319]
(ii) Secondary sector	Unavailable
Gross value of fisheries output (2007)	34.4 million USD[320]
Trade (2007)	
Value of fisheries imports	2.8 million USD
Value of fisheries exports	62.7 million USD

3. FISHERY SECTOR STRUCTURE

3.1 Overall fishery sector

Vanuatu is a Y-shaped archipelago of about 80 islands, 67 of which are inhabited, and twelve 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. 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. Nearly 80 percent of the population reside in rural areas.

With respect to the current situation, fisheries in the waters of Vanuatu can be placed into six categories. These categories and the associated production in 2007 are estimated as:

	Coastal commercial	Coastal subsistence	Offshore locally-based	Offshore foreign-based[321]	Long-distant fleet (domestic)	Fresh-water	Aquaculture	
							Fishes and crustaceans (tonnes)	Giant clams and corals (pieces[322])
Volume of production (metric tonnes or pieces)	538	2 830	81 092	12 858	2 265	80	31	2 500
Value of production (USD)	2 176 923	5 740 385	n.a.	26 003 657	n.a.	173 077	389 000	

Source: FAO – offshore domestic, long-distant fleet, and aquaculture; Gillett (2009)

The main trends and important issues in the fisheries sector

The main trends in the sector include:

- Increasing exploitation of the coastal resources, especially those close to urban markets
- Increasing numbers of Asian longliners based in Port Vila in recent years
- Increasing numbers of foreign fishing vessels fishing in Vanuatu waters
- Increasing tuna processing capacity in Port Vila
- Increasing enthusiasm on the part of the government for cooperation in fisheries matters with other Melanesian countries

[319] This is the number of "fishing households" as determined from the 2007 Agriculture Census. Source: NSO (2008). Preliminary Report Agriculture Census 2007. National Statistics Office, Port Vila.

[320] From Gillett (2009); includes the six fishery production categories: (1) coastal commercial fishing, (2) coastal subsistence fishing, (3) locally-based offshore fishing, (4) catch by foreign-fleets (5) freshwater fishing, and (6) aquaculture.

[321] This is the catch taken by the foreign fleet within the Vanuatu EEZ. In FAO statistics of capture fisheries production, this catch is accounted under the catch of the nation(s) under which the vessel(s) is (are) flagged.

[322] Corals and giant clams are commonly measured in pieces, rather than kg.

Some of the major issues in the fisheries sector are:

- Reconciling the benefits of increasing Asian fishing and processing with impacts on Vanuatu's important tourism industry. From a larger perspective, better coordination with the growing tourism sector is required to prevent potential areas of conflict from growing.
- With the demise of the government fish market and ice plants in the rural areas, there is a shortage of fish in the Port Vila urban area.
- For the subsistence fisheries, there is a need to support and strengthen traditional management to resist growing commercial pressure.

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 longline and purse vessels as well as by foreign based longline vessels.
- Coastal fishing is primarily carried out for subsistence purposes and for sales for local markets. In addition, there are some coastal fisheries that are export oriented, including trochus, bêche-de-mer, and aquarium fish.

3.2.1 Marine catch profile

The WCPFC Yearbook indicated the catch of offshore fishing reported under the Vanuatu based fleet as:

	2005	2006	2007	2008	2009
Volume total catch (tonnes)	87 778	78 363	81 092	47 673	48 011

Estimates of the volumes and values of the offshore catches of the four main commercial species of tuna (Bigeye, yellowfin, skipjack and albacore) taken by foreign based fleet within the Vanuatu EEZ have been made by the Forum Fisheries Agency, using data sourced from the Oceanic Fisheries Programme of the Secretariat of the Pacific Community. By adding in volumes and values of catch of non-tuna species, estimates of total catches in the Vanuatu zone can be made:

	2003	2004	2005	2006	2007
Volume total catch (tonnes)	8 351	8 901	11 550	18 292	12 858
Value total catch (US$)[323]	18 814 929	18 002 775	25 593 701	43 820 071	26 003 657

Source: FFA (2008), Gillett (2009)

Estimates of catches from the coastal fisheries vary widely. Studies to estimate production were carried out by external researchers in 1996, 2000, and 2001– but the estimates were very different. Gillett (2009) used those studies plus (a) the results of the 2006 household income and expenditure survey, (b) export data, (c) estimates of production from recent specialized studies, (d) the results of the recent 2006/07 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).

The aquarium fishery has been in existence in Vanuatu for the last 15 years. Although Vanuatu's reefs are not extensive, they provide sufficient habitat for ornamental resources that can maintain a small, but sustainable industry. In Vanuatu, about 300 species of non-food reef fish are important ornamental species, including many species of invertebrates, clams, soft corals, and cultured hard corals. In 2007 216 466 pieces of aquarium items worth USD$200 403 were exported. (Source: National Marine Aquarium Trade Management Plan, 2008).

[323] This is the "in-zone" value; the value in destination markets, less the cost of shipment to those markets.

3.2.2 Marine landing sites

The foreign vessels that operate in the Vanuatu EEZ land their catches in a variety of locations. The Fiji-based longliners, many of which are flagged under Taiwan Province of China, offload their catches in Suva (fresh fish) or Levuka (frozen fish). Other Asian longliners either transship at ports in Vanuatu or neighbouring country, or deliver their catch to Asian ports.

The Asian vessels that are based in Port Vila generally operate under the Vanuatu flag through joint venture arrangement or other arrangement. They usually operate out of the Vanuatu EEZ and offload their catch at Port Vila.

No discussion of fish landing sites in Vanuatu would be complete without some mention of the history of the large facility at Palekula (Box).

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 the group. 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 US 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 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 engine room was also installed with three large Yanmar diesels with alternators for power, and four large compressors for the ammonia refrigeration system. The bait freezers and quick-freeze rooms were retained. The ice facility was abandoned with ice made by filling plastic bags with water and placing them in the quick-freeze rooms. 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 1971-1973 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 this 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.

Source: Chapman (2000)[324]

Vanuatu operates the Vanuatu International Shipping Registry (VISR) under contract to the Vanuatu Maritime Services with some 500 ships registered under contract through an office in New York, USA. The VISR also allows foreign fishing companies to register as Vanuatu flagged vessels. The number of Vanuatu flagged vessels registered as fishing vessels in 2005 was 86 (up from 33 in 2002) with eleven of these being longliners licensed to operate within Vanuatu waters. In the wider WCPO area, 82 Vanuatu flagged vessels were registered, the fleet included 55 longliners, 24 purse seiners and 3 pole and line vessels. Vanuatu now has the second largest fishing fleet operating in the Eastern Pacific, and has the fastest

[324] Chapman, L. (2002). Development Options and Constraints Including Infrastructure and Training Needs Within the Tuna Fishing Industry and Support Services in Vanuatu. Secretariat of the Pacific Community, Noumea.

growing fleet in the Indian Ocean. In the recent past, some of these vessels were implicated in illegal, unreported and unregulated fishing activities and a number of international tuna commissions expressed their concerns to the Department of Fisheries. Consequently, the Department has taken steps to regulate their fishing fleet through implementing a number of administrative and management measures including performing background checks on vessels applying to the registry, ensuring the timely submission of catch data, introducing certificates of origin, and placing a ceiling in fleet size of 116 vessels. (Naviti and Taleo, 2006; Hickey and Jimmy, 2008).

In 2009 Vanuatu had a fleet composed of 90 vessels (larger than 18 m LOA) of which 27 were purse seiners, 62 longliners and 1 pole and line.

The commercial food fish catch (i.e. deepwater 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.

3.2.3 Marine fishing production means

WCPFC Yearbook indicated that the number of vessels operated in the Western and Central Pacific in 2009 was 74, including 6 purse seiners and 68 longliners. Regarding to the foreign flag vessels, the Chinese fleet is currently the dominant fleet operating in the Vanuatu EEZ, both in terms of vessel numbers and capacity, followed by Taiwan Province of China, then Fiji.

The 2007 Agriculture Census does not contain information on fishing production means. Preston (1996)[325] uses the 1991 Agriculture Census to conclude that fishing lines were by far the most common coastal fishing gear and were used by 94 percent of the 14 041 fishing households enumerated at that time. The second most common gear, hand-spears, were used by 46 percent of households, followed by spearguns (36 percent), bows and arrows (33 percent), and gillnets (19 percent). Most households owned more than one gear type, and had several of each type owned, with fishing lines averaging three per household.

It should be noted that some important fishing activities in Vanuatu (e.g. shell collection, lobster capture) do not require "fishing gear" (as used in the Agriculture Census), but rather just a diving mask or goggles.

3.2.4 Main resources

Vanuatu Fisheries Department (2009)[326] reports that in 2007 the major species in the longline catch was albacore (60 percent by weight), yellowfin (16 percent) and bigeye (10 percent). On the other hand, WCPFC Yearbook indicated that the majority (around 80 percent with some fluctuation) of catch taken by purse seine was skipjack.

With respect to inshore fishing, Bell and Amos (1993)[327] list the twenty-two 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*

[325] Preston, G. (1996). Masterplan for the Sustainable Management of Development of Vanuatu's Inshore Fisheries Resources. Technical Report 2. TCP/VAN/4552. Food and Agriculture Organization of the United Nations, Bangkok.

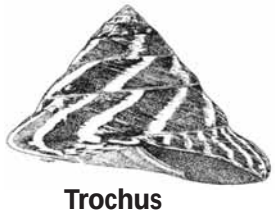
[326] Vanuatu Fisheries Dept (2009). National Tuna Fishery Report. Report WCPFC-SC5-AR/CCM-27, Western and Central Pacific Fisheries Commisssion, Pohnpei.

[327] Bell, L. and M. Amos (1993). Republic of Vanuatu Fisheries Resources Profiles. Report 93/49, Forum Fisheries Agency, Honiara.

(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), *Shyraena genie* (blackfin barracuda), *Valamugil seheli* (bluespot mullet), *Caranx melampygus* (bluefin trevally) and *Geres oyena* (oyena mojarra).

Invertebrate species are also very important in the inshore commercial and subsistence fisheries. These include rock lobsters, slipper lobster, coconut crab, green snail, trochus, aquarium fish, various crustaceans, and bêche-de-mer.

Trochus is especially important in Vanuatu. It is a source of cash for remote communities, it 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. The box gives some information on this shell.[328]



Trochus

Trochus *(Trochus niloticus)* 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 metres. 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 US$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 the Vanuatu for a long time. However, since the end of the 19th century, the sale of trochus shells 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.

For the aquarium ornamentals, the National Marine Aquarium Trade Management Plan 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 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). (Source: National Marine Aquarium Trade Management Plan).

3.2.5 Management applied to main marine fisheries

Tuna fishery management

The Vanuatu is a member of the Western and Central Pacific Fisheries Commission that 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.

[328] Sources: (1) Gillett, R. (1995). Aspects of Trochus Industries, Trade and Marketing Relevant to the Pacific Islands – a report prepared for the World Bank, 75 pages. (2) Bell, L. and M. Amos (1993). Republic of Vanuatu Fisheries Resources Profiles. Report 93/49, Forum Fisheries Agency, Honiara.

The "Revised Tuna Management Plan – A National Policy for the Management of Vanuatu Tuna Fisheries" is a 62-page document which (1) Identifies the fishery and assesses the present state of its exploitation, (2) Specifies the objectives to be achieved; and (3) Specifies the management and development measures to be taken. The revised plan was endorsed by the Government and launched by the Minister responsible for fisheries in December 2008.

The main objectives of the management of tuna fisheries in the Plan are:

- 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.
- To ensure the harvest is taken in a way that maximizes the long term economic and social benefits received by the peoples of Vanuatu.
- To contribute to the food security of Ni Vanuatu.[329]
- To meet regional and international responsibilities for tuna management.

The main measures given in the Plan to achieve the objectives are:

- A licensing programme for all commercial fishing vessels
- Limitations to be applied to fishing operations
- A total allowable catch for foreign fishing, locally base foreign, local and sport fishing vessels.

Coastal commercial fisheries management

Management plans for the coastal commercial fisheries have been prepared for aquarium ornmentals, trochus, and bêche-de-mer. These plans have been made in accordance with Part 2 Section 3 of the Fisheries Act. As an example of the content of a management plan, the National Marine Aquarium Trade Management Plan contains sections on:

- Description of the Marine Aquarium Trade Fishery
- Precautionary approach
- Management measures
- Monitoring
- Training
- Amendments
- Research
- Various forms/applications

No management objectives/goals are given in the aquarium plan. With respect to actual management measures, the following general measures are specified:

- Limitations
- Quota allocation
- Licensing
- Fishing methods and collection practices
- Prohibitions
- Facilities and husbandry
- Employment of foreign workers
- Use of underwater breathing apparatus
- Areas of operation (Access agreements)
- Conservation
- Reporting
- Observers

[329] "Ni-Vanuatu" is a term that means the indigenous inhabitants of Vanuatu.

Subsistence fisheries management

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 that 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 the customary owners rights to manage their land and reefs as they have traditionally done for centuries through the use of taboos and other fisher behaviour restrictions. 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 includes the placement of marine closures or taboos for up to seven years or more upon the death of a chief, or any clan member, the ordination or grade taking of a traditional leader and seasonal prohibitions on consuming certain fisheries resources following agricultural cycles, respect and avoidance of areas of symbolic significance and behavioural restrictions for fishers that limited 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 to manage their own resources well. (Hickey and Jimmy, 2008).[330]

Institutional arrangements for fishery management

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 a section below.

3.2.6 Fishermen communities

The concept of "fishermen 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".

3.3 Inland sub-sector

The Vanuatu Fishery Resource Profiles[331] contain extensive information on the country's freshwater fish and invertebrate resources. 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. The profiles cover 18 families of local freshwater fish, 3 families of introduced fish, and several species of shrimps and crab. The most important taxa for fishery purposes are:

- Local species of fish: Five genera of fish *(Khulia*, *Lutjanus*, *Gerres*, *Monodactylus*, *Scatophagus)*, four species of mullets, and several species of freshwater eels.
- Introduced species of fish: *Cyprinus* and two species of tilapia
- Invertebrates: Several species of *Macrobrachium*

[330] Hickey, F. and R. Jimmy (2008). Fisheries. In: Gay, D. Vanuatu Diagnostic Trade Integration Study 2008 Report. Blue Planet Media + Communications, Port Vila, Vanuatu.

[331] Amos, M. (2007). Vanuatu Fishery Resource Profiles. Pacific Regional Environment Programme, Apia, Samoa.

Recent annual production from freshwater fisheries in the country is about 80 tonnes per year, worth about USD$173 100. This 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 section above).

3.4 Recreational sub-sector

Hickey and Jimmy (2008) indicate that the sport fishing industry has steadily grown from two to three charter boats a decade ago to a current level of eight. Vanuatu currently holds blue marlin world records and is increasingly being recognized as an international game-fishing destination. Each boat lands approximately six to eight tonnes of pelagic fish annually. Fish landed by game boats remain the property of the boat, not the game fisher and the sale of these fish are used to offset fuel and operation costs. This equates to some 48 to 64 tonnes of fresh pelagic fish supplying the hotel, resort and restaurant trade.

The Vanuatu Game Boat Operators Association (VGBOA), established in 2004, indicates that 1 120 people came to Vanuatu in 2005 on pre-booked fishing charters and spent over US$2.6 million in-country. Three quarters of this was spent on airfares, accommodation, food and drinks, entertainment, transport, sightseeing and outer island travel. The VGBOA funds, deploys and maintains three fish aggregating devices off Efate, although all fishers have access to them.

Currently, the Tourism Office grants a tourism licence for sport fishing boats while the Department of Fisheries grants a fishing licence. That licence comes within the scope of the Vanuatu Tuna Management Plan, which states that "charter sportfishing vessels that sell their catch are considered to be commercial fishing vessels and are required to obtain a commercial fishing licence and will follow the same rules for determining fees and license conditions as any other commercial vessel".

3.5 Aquaculture sub-sector

Vanuatu's 2007 aquaculture production is estimated to be 31 tonnes of fishes and crustaceans and 2 500 pieces of giant clams and corals, with the estimated total value of about USD389 000.

Recent aquaculture production in Vanuatu

	2005	2006	2007
Cultured giant clams (pieces)	0	1 310	2 186
Cultured coral (pieces)	815	1 205	403
Red tilapias (tonnes)	0	90	13
Nile tilapia (tonnes)	1	2	n.a.
Monkey river prawn (tonnes)	0	0	n.a.
Blue shrimp (tonnes)	0	22	18

4. POST-HARVEST USE

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 USA. Much of the albacore is sent to canneries in American Samoa, with some going to canneries in Southeast Asia. The non-tuna catch and rejected tunas landed by the offshore fishing vessels that are based in Port Vila are consumed locally.

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 deepwater demersal fish, lobsters and coconut crab.
- The bêche-de-mer is shipped to China.
- The aquarium fish and associated coral products are shipped to the USA.
- 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).

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 (PVFL), but 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 market the high value deepwater fish that was caught from the rural fisheries centres in the two urban centres where there was a growing demand from the tourism and urban markets. Airfreight was relied upon for shipment 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.

5. FISHERY SECTOR PERFORMANCE

5.1 Economic role of fisheries in the national economy

A recent study by the Asian Development Bank attempted to quantify the fishery-related benefits received by Vanuatu. The study gave the available information on the contribution of fishing/fisheries to GDP, exports, government revenue, and employment. The results can be summarized as:

- Official estimates show that fishing in 2007 was responsible for 0.8 percent of the GDP of Vanuatu. A recalculation using a different methodology shows it was 1.3 percent in 2007.
- Exports of fishery products were about 3.4 percent of all export in FY 2006/07.
- Access fees paid by foreign fishing vessels represent 1.2 percent of all government revenue.
- 72 percent of the rural households in Vanuatu are engaged in fishing activities.

From the above it can be seen that fisheries make a relatively important contribution to rural employment.

5.2 Demand

The per capita consumption of fish in Vanuatu, based on the 2007 FAO Food Balance Sheet, is 33.6 kg. Various other studies have made estimates ranging between 15.9 and 25.7 kg. Considering Vanuatu's population, 25 kg of fish consumption per capita translates into a 2010 demand for 6 131 tonnes of fish.

Factors influencing the future demand for fish are increase in price of fish (over-exploitation of inshore areas, gradual devaluation of the local currency, fuel cost increases), increase in the tourism industry, relative cost of fish substitutes, and changes in dietary preferences.

5.3 Supply

The government has several strategies to increase the national fish supply. These involve supporting the marketing of fishery products in Port Vila from other parts of the country, deploying offshore fish aggregation devices, installation of ice machines in all six provinces, promoting aquaculture, and supporting village-level fisheries management.

Major factors affecting the local supply of fish are the cost of fuel, employment alternatives, transport links to the outer islands, and the offloading of fish by the locally-based longliners.

5.4 Trade

Over the 2004-2007 period the FOB value of annual fisheries exports from Vanuatu fisheries averaged US$1.2 million, which does not include tunas taken by Vanuatu flag vessels and exported. The major exports are trochus, bêche-de-mer, and aquarium products. FAO estimates of the average export of tunas over 2004-2007 period were around USD72 millions.

Fishery exports, excluding tunas, are responsible for about 3.4 percent of all exports of the country.

5.5 Food security

Fish is an important element of food security in Vanuatu. However, relative to other Pacific Island countries, fish is not as significant in Vanuatu. Many fish consumption studies show that Vanuatu and Papua New Guinea have the lowest per capita fish consumption in the region.

The FAO Food Balance Sheets show that in 2007 fish contributed an average of 15.8 percent of all protein to the diet and 39.2 percent of animal protein.

Animal protein substitutes for fish consist mainly of various types of imported and domestic meat.

5.6 Employment

The most recent information on the degree of participation in fishing activities comes from the 2007 Agriculture Census. The report of the census states:

- 72 percent of the rural households in Vanuatu possess fishing gear and are engaged in fishing activities during the last 12 months.
- These fishing households number 15 758. Of those 11 577 (73 percent) fish mainly for home consumption, 4 127 (26 percent) for home consumption with occasional selling, and 74 (less than 1 percent) mainly for sale.

The earlier 2006 Agriculture Census had slightly different findings. 78 percent of all Vanuatu households (urban and rural) engage in fishing, with 48 percent in urban areas and 86 percent in rural areas.

A study by the Forum Fisheries Agency[332] tracked the number of people in Vanuatu employed in tuna fishing and processing in Vanuatu over a seven-year period:

	2002	2006	2008
Local jobs on vessels	54	20	30
Local jobs inshore facilities	30	30	30
Total	**84**	**50**	**60**

[332] Gillett, R. (2008). A Study of Tuna Industry Development Aspirations of FFA Member Countries. Forum Fisheries Agency, Honiara, 70 pages.

5.7 Rural development

The Fisheries Department's Capture and Development Section 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. This is carried out through a variety of ways, including market facilitation, advice on fisheries management, deployment of offshore fish aggregation devices, and provision of ice-making equipment.

6. FISHERY SECTOR DEVELOPMENT

6.1 Constraints and opportunities

Some of the major constraints in fisheries development are:

- 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 greatest 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 opportunities in the fisheries sector include:

- Taking advantage of the proximity of Port Vila to good longline fishing grounds.
- Having smaller longline operations "piggyback" on to the new fishing/processing infrastructure.
- Establishing closer linkages between the fishing and tourism sectors.
- Encouraging more onshore processing of fish caught by vessels fishing in Vanuatu waters.

A report by the Forum Fisheries Agency[333] summarized the opinions on opportunities in Vanuatu domestic tuna industry development of (1) senior Fisheries Department officials and (2) the operator of an Asian longline fleet based in the country:

> Present and former fisheries officials indicate that the two longline processing facilities under construction will result in a large increase in interest in longlining. In addition, all vessels licensed to fish in Vanuatu that do not offload in Vanuatu will pay significantly higher fees. These two factors will contribute to making the aspiration of having a substantial longline fleet based in the country a reality. A major operator of longline vessels (who is building the tuna processing facility in Vanuatu) aspires to have a fleet of 25 to 45 longline vessels based in Port Vila within a few years – but he stresses that fleet survival will be the main aspiration for the next decade. The desire to increase the fleet based in Port Vila is because the port is closer than in Suva (where much of his fleet is based) to the longline fishing ground that he targets.

6.2 Government and private sector policies and development strategies

The Fisheries Department annual reports contain information on the government's policies and development strategies. Recent reports indicate that the Department is concentrating its development efforts on five main activities:

- Ice machines and fish aggregation devices
- Improvementin the coordination and monitoring of fisheries development/management

[333] Gillett, R. (2008). A Study of Tuna Industry Development Aspirations of FFA Member Countries. Forum Fisheries Agency, Honiara, 70 pages.

- Provision of technical advice, information and training
- Improving the marketing from rural areas
- Development of alternative fisheries

Many of the government's policies and development strategies in fisheries are found in the document "Revised Tuna Management Plan – A National Policy for the Management of Vanuatu Tuna Fisheries". The plan gives information on both small-scale and tuna industry development policies and strategies:

Small-scale fisheries development:

- Local Development Fund – A component of licence revenues will be set aside in the Fisheries Development and Management Fund specifically for the purposes of funding rural fishery and aquaculture development activities.
- A FAD development programme will be developed under the supervision of the Director of Fisheries. The Local Development sub account in the Fisheries Development and Management Fund will be utilized for the construction and maintenance of FADs within the six provincial government regions of Vanuatu. This sub account will in part be funded by the users themselves through a portion of their licence fees.
- The Fisheries Development and Capture Division Officers will: (1) in collaboration with respective provincial enforcement officers carry out the duties of the Authorized Officers within their area of jurisdiction pursuant to the Fisheries Act No. 55 of 2005; (2) act as a liaison between the Vanuatu Maritime College (VMC), the Provincial Governments and fishermen to promote standard courses developed by the VMC; (3) provide specific rural training on tuna fishing and handling techniques where this is not available from the VMC; (4) develop and assist in the implementation of the provincial FAD programme activities in rural areas; (5) be an information resource on fisheries laws, regulations, and management plans; and (6) provide fisheries related technical support in rural areas when traveling for other purposes.

Support for Tuna Fishery Development

- **Duty free concessions:** To encourage participation in the development of the domestic tuna industry, all locally based vessels with a valid Commercial Fishing Licence will be eligible for duty exemptions on fuel and fishing gear including bait, fishing equipment and spare parts for their fishing operation.
- **Infrastructure development:** The current lack of basic infrastructure impedes the development of a larger-scale tuna fishing industry in Vanuatu. Development plans that include the construction (or reconstruction) of infrastructure and resources with long-term benefits to the domestic fishing industry such as wharves, processing facilities and slipways will be given preference by the Fisheries Department.
- **Information resources:** The Fisheries Department will provide appropriate technical assistance to facilitate development of domestic tuna business in Vanuatu.
- **Foreign investment:** In order to assist in attracting foreign investors the Fisheries Department will provide information and support to the Vanuatu Foreign Investment Board and other agencies to actively promote and attract genuine foreign investment in the Vanuatu tuna industry. Joint ventures with significant involvement of Vanuatu companies and individuals will be given preference.
- **Legislation to facilitate fish exports:** To facilitate the export of tuna and tuna products to foreign markets as the US and European Union, the Tuna Management Advisory Committee (TMAC will actively support the development and implementation of appropriate health and other legislation required to ensure that the food safety requirements of importing countries can be met.

– **Ni Vanuatu crewing requirements:** All Vanuatu flagged fishing vessels and all locally based foreign fishing vessels will be obligated to employ Ni Vanuatu as officers and fishing crew, while placement of Ni Vanuatu on foreign fishing vessels operating in Vanuatu EEZ will be strongly encouraged. Local vessels must be crewed by Ni Vanuatu and wherever possible this will include the master and engineer.

The Government's aquaculture development strategy is given in the Aquaculture Development Plan 2008-2013. The plan identifies seven critical areas that need to be addressed in order for aquaculture to develop:

- putting in place appropriate aquaculture policy and legislation;
- establishing credit and finance schemes for the public and private sector;
- ensuring that adequate infrastructure is in place, including basic utilities and transportation;
- instigating research and development that will address bottlenecks in farming, marketing, etc.;
- ensuring that environmental management and biosecurity programmes maintain development within limits and at an acceptable level of risk;
- providing adequate extension support to farmers and communities; and
- undertaking human resource development to ensure that the public and private sector have the necessary skills and training for aquaculture.

The private sector's policies are not formalized. Judging from the attitudes and recent action of the companies engaged in offshore longline fishing, the main policy is not one of expanding but rather surviving during a period of poor profitability – as has been the case for the last few years.

6.3 Research

A very large number of fisheries research projects have been carried out in Vanuatu. Most areas of Vanuatu and most types of resources have been covered by various research endeavors. The older research is listed in the Vanuatu Fisheries Bibliography.[334] The results of many of the research projects are summarised by resource in the Vanuatu Fisheries Profiles.[335]

Many of the research activities have been carried out or supported by regional or international agencies, in particular the French research organization ORSTOM[336] which until 1997 maintained a field centre in Vanuatu.

Historically, the main areas of research projects have been:

- biological studies on deep-bottom fish
- studies on the distribution and yield potential of tuna baitfish species
- resource assessments of trochus, green snail and bêche-de-mer
- biological and population dynamics studies on coconut crab
- experimental hatchery rearing of trochus and green snail
- juvenile release experiments with trochus, and subsequent population monitoring

Presently, a research priority of the Fisheries Department is to carry out stock assessment of important inshore resources such as trochus, green snail, sea cucumber and giant clams.

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[334] Gillett, R.D. and D. Kenneth (1987). Vanuatu Fisheries Bibliography. Document 87/7, FAO/UNDP Regional Fishery Support Programme, Suva, 67 pages.

[335] Amos, M. (2007). Vanuatu Fishery Resource Profiles. Pacific Regional Environment Programme, Apia, Samoa.

[336] Now known as IRD – Institute de recherché pour le development.

6.4 Education

As part of earlier EU funded fisheries development efforts a Fisheries Training Centre (FTC) was established in Luganville on Espiritu Santo in 1991. This centre provided training to island fisherman who resided at the centre for a month while they received training in deepwater and pelagic fishing gear and methods, fish handling, outboard engine and boat maintenance as well as basic financial management. Hundreds of fishers from throughout the group received training through the centre through 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 the centre to the newly formed Vanuatu Maritime College (VMC) in 2001. The College trains seafarers for employment on merchant and fishing vessels as well as for cruise ships. The VMC includes in its mandate to provide practical fisheries training to 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, fisherman's associations and/or from the Department of Fisheries (Hickey and Jimmy 2007).

Higher-level or academic training in fishery-related subjects is generally sought overseas. Overseas education 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: the Secretariat of the Pacific Community in New Caledonia and the Forum Fisheries Agency 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.

6.5 Foreign aid

Vanuatu has enjoyed fisheries sector assistance from a range of multilateral and bi-lateral 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, ICOD and CIDA. Assistance is also obtained from the international organizations of which Vanuatu is a member, including FAO, UNDP, ESCAP, and other United Nation agencies. The regional organizations serving Pacific Island countries, including the Forum Fisheries Agency, the Secretariat of the Pacific Community, the South Pacific Regional Environment Programme, the Forum Secretariat, and the South Pacific Applied Geoscience Commission have been active in supporting Vanuatu's fisheries sector.

7. FISHERY SECTOR INSTITUTIONS

Administration, development and management of the fisheries sector is the responsibility of the Fisheries Department within the Ministry of Agriculture, Quarantine, Forestry and Fisheries. The Fisheries Department headquarters are in Port Vila with a regional office in Luganville, and smaller provincial centres in each of Vanuatu's six provinces. The Fisheries Department is headed by a Director, and has five functional divisions (Amos 2007).

According to the most recent annual report of the Fisheries Department (Raubani 2008), the functions of the five divisions are:

- The Management and Policy Division is the Fisheries Department's arm responsible for coordinating all the Department's activities relating to management and policy matters. The core activities of the Division are to: (1) Appraise investment proposals, (2) Provide investment advice on potential areas, (3) Develop and manage Departmental database, (4) Review and development of new management policies, regulations and fishery plans, (5) Manage the Department's Information Technology section, and (6) Maintain close collaboration with line government agencies.
- The Compliance, Licensing and Enforcement Division ensures that fishing activities within Vanuatu's 200 miles EEZ comply with Fisheries laws and regulations: in particular, the Fisheries Act No. 55 of 2005. This governs the harvest of resources, access to resources and penalties.
- The Research and Aquaculture Division deals mainly with research work, which includes stock assessment of resources, aquaculture and development of awareness materials. The Division's objectives include: (1) Exploring potential marine resources and new initiatives for rural people, (2) Carrying out stock assessment and analysis on all edible and commercial marine resources, and (3) Developing effective materials and information for fishers.
- The Development and Capture Division deals directly with domestic fisheries development activities within the six-mile provincial zones. Its objectives are to encourage private, commercial and subsistence fishing enterprises to improve livelihood in the rural areas. This division plays a vital role in ensuring that essential services provided by the Department are delivered to the rural areas. However, due to budget constraints, only five out of six centres operated in 2007.
- The Finance and Administration Division is the Department's gateway to other government departments and ministries. It provides the financial and administration backup that allows smooth delivery of fisheries programmes to the people of Vanuatu.

Other institutions in the country that are relevant to fisheries are the Vanuatu Maritime College, the Sports/Charter Boat Association, the Vanuatu Fishermen Association, and the Vanuatu Chamber of Commerce and Industry.

Some of the important internet links related to fisheries in Vanuatu are:

- www.spc.org.nc/coastfish/Countries/Vanuatu/vanuatu.htm – Information on Vanuatu fisheries, links to other sites concerning Vanuatu, and some SPC reports on fisheries in Vanuatu.
- www.adb.org/Documents/Reports/Vanuatu – Contains the Asian Development Bank review of Vanuatu agriculture and fisheries.
- www.sprep.org/att/publication/000557_IWP_PTR49.pdf-Contains the Vanuatu fishery resource profiles.

8. GENERAL LEGAL FRAMEWORK

The Fisheries Act No. 55 of 2005 is the main fisheries law of Vanuatu. The main provisions of the Act deal with:

- Fisheries management, development and conservation
  - ❍ Designated fisheries
  - ❍ Fisheries management plans
- Local fishing vessels
  - ❍ Obligation of local fishing vessels
  - ❍ Local fishing licences

- Foreign fishing vessels
  - Obligations of foreign fishing vessels
  - Access agreements
  - Related agreements
  - Foreign fishing licences
  - Locally based foreign fishing vessels
- Compliance with international obligations
- General licensing provisions

The Act's sections on management/development are especially important and deserve additional mention. The framework for management is based on designated fisheries and management plans. With respect to these two features, important provisions of the Act are:

Designated fisheries:

- The Minister may, on the recommendation of the Director, by notice published in the Gazette, 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 must prepare, and review as necessary, a plan for the management and development of each designated fishery.
- The Minister may make regulations, not inconsistent with this Act, relating to the determination of designated fisheries and the management, development and conservation of those fisheries, and the enforcement of any matter identified in a plan relating to a designated fishery.

Fisheries management plans

- Each fishery management plan must: identify each fishery and its characteristics, including the present state of its exploitation; and (a) specify the objectives to be achieved in the management of the fishery to which it relates; and (b) specify the management and development strategies to be adopted for the fishery to which it relates; and (c) provide for a scheme of licensing, if necessary, or other appropriate management measure; and (d) 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 (e) specify the information and other data required to be provided by persons licensed to fish for that fishery; and (f) take into account any relevant traditional fishing methods and practices.
- During the preparation of each fishery management plan the Director must consult with appropriate government ministries and departments; and fishermen, local authorities and other persons likely to be affected by the plan.
- Every fishery management plan is to be submitted to the Minister and comes into operation on approval by the Minister in writing.
- The Minister may make regulations, not inconsistent with this Act, for the purpose of enforcing fisheries management plans.

The most recent regulations under the act were made by the Minister in 2009. The Fisheries Regulations Order No. 28 of 2009 are 105 pages in length and provide for the implantation of most aspects of the Act.

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