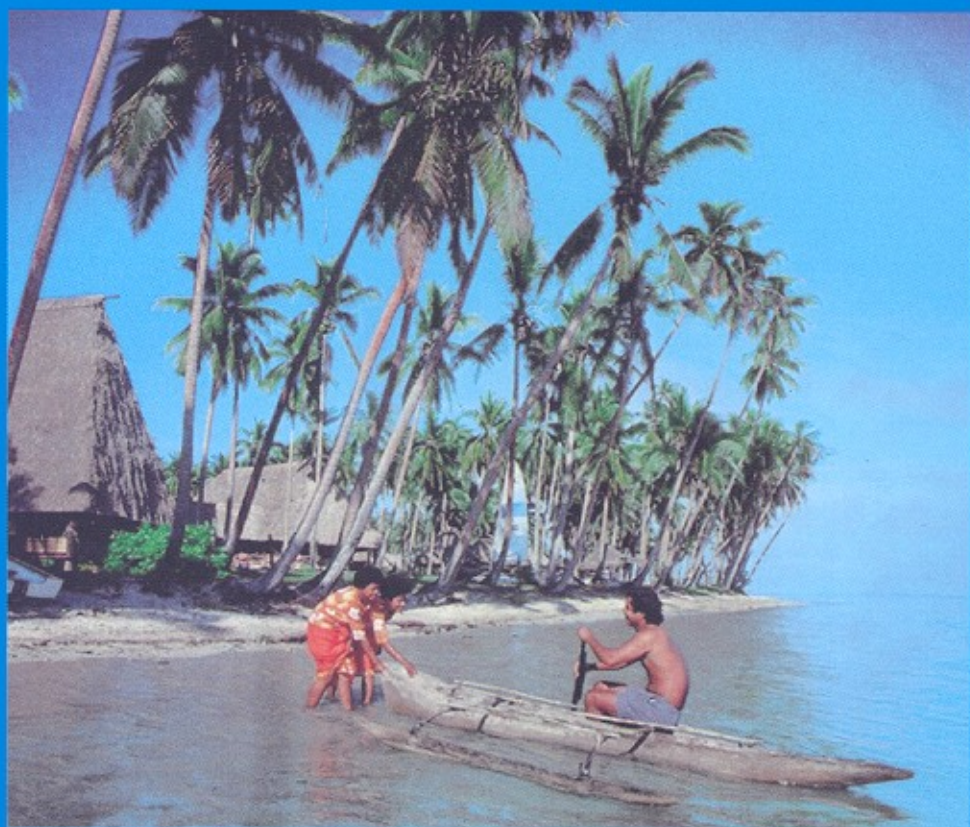




PACIFIC ISLAND FISHERIES

Regional and country information



Asia-Pacific Fishery Commission
Food and Agriculture Organization of the United Nations
Regional Office for Asia and the Pacific
Bangkok, Thailand

Regional Information on Pacific Island Fisheries

The Pacific Islands Region

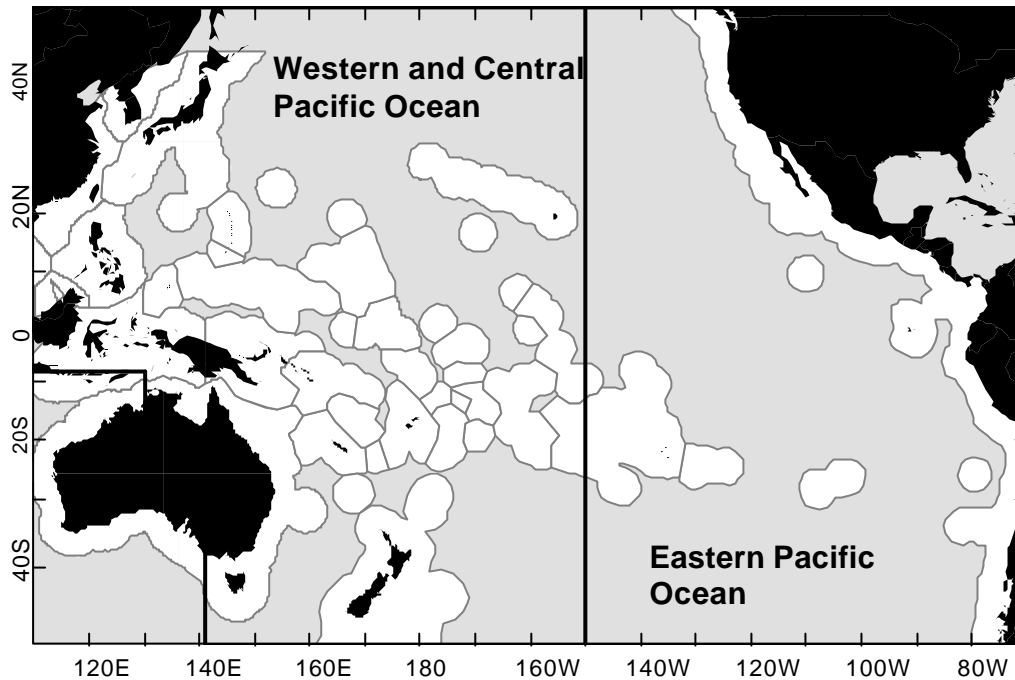
In general, the Pacific Islands increase in size from east to west. Most islands rise steeply from the deep ocean floor and have very little underwater shelf area. Coral reefs characteristically surround the islands, either close to the shore (fringing reef) or further offshore (barrier reef), in which 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.

Because of the relatively small size of most islands, major bodies of fresh water are not widespread in the sub-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 area are usually clear and low in productivity. Upwellings occur in the boundaries between currents and in other localized 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 inshore 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 (high seas) among the region's EEZs greatly complicates the region's fishery management efforts.

Fishery Statistics in the Region

The long time series of FAO catch statistics used in the compilation of the Catch Profiles for other regions are aggregated by FAO Statistical Area and thus cannot be used where the region to be reviewed incorporates parts of one or more areas, as is the case with the Pacific Islands. In addition, much of the region's tuna catch is taken by distant-water fishing nations (DWFNs) and is thus reported by FAO in the catches of other statistical areas.



The boundaries of the Western and Central Pacific Ocean

Fishery Resources

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, 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 or inshore resources** include a wide range of fin-fish 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.

Fisheries

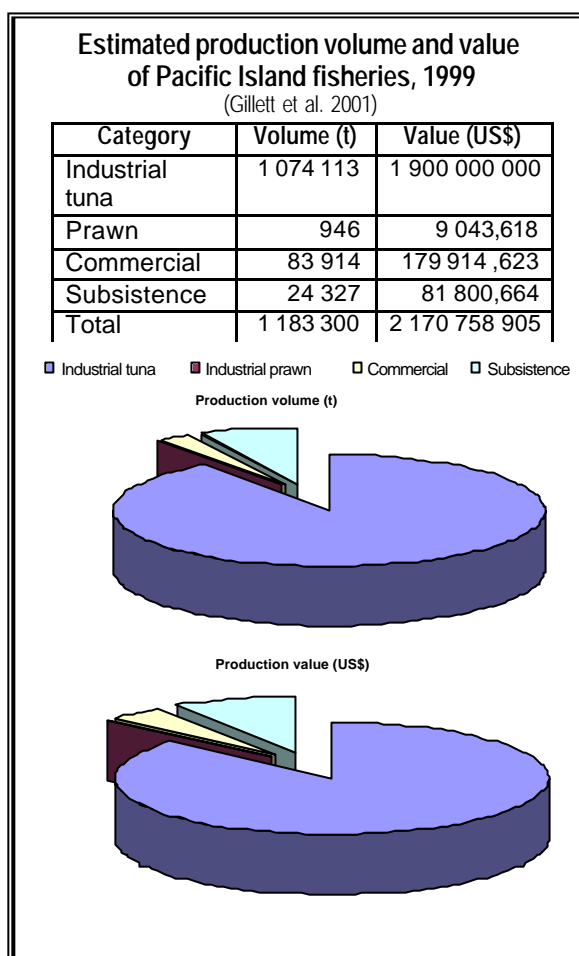
Pacific Island fisheries can be categorized in several ways. One of the most commonly used is the scale of the operation:

- **industrial fisheries**, which are almost exclusively for tunas and allied species. (The only other industrial fishery in the region is for prawns, in Papua New Guinea);
- small-scale **commercial fisheries**, which can be further broadly sub-divided into those producing export commodities, and those supplying domestic markets; and
- **subsistence fisheries**, which support rural economies and which are extremely important to the region's nutrition and food security.

It has been estimated that there are about 25,000 non-motorized and 17 000 motorized fishing vessels operating in the Pacific Islands (McCoy, 1991). These range from simple canoes to sophisticated purse seiners over 70 m in length, many of which are equipped with helicopters.

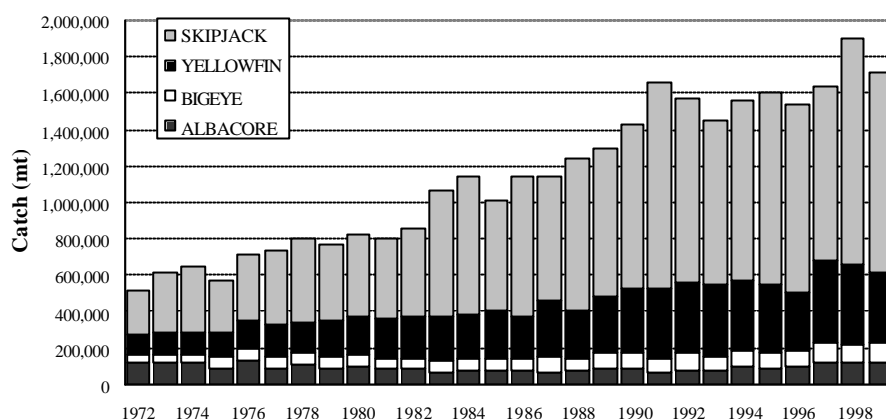
The distinction between subsistence and commercial fishing is becoming increasingly blurred in many areas as monetization of rural economies proceeds and growing amounts of marine produce are traded for cash. In addition, the region's principal coastal fishery export products (trochus and beche-de-mer) are produced in a manner which resembles subsistence rather than commercial fishing.

In the Pacific Islands region, tuna is not only the most important of the fishery categories, it produces almost ten times the amount of fish as *all* of the other fisheries of the region combined. In terms of value, tuna fisheries are worth over seven times that of all other fisheries combined. The landed value of tuna catches from the region was estimated at about \$375 million in 1982 (Clark, 1983), \$1.2 billion in 1993 (World Bank, 1995), \$1.6 billion in 1994 (FFA, 1995), \$1.7 billion in 1995 (FFA, 1996), and \$1.9 billion in 1998 (Van Santen and Muller, 2000).



Oceanic Resources

Resource status



Tuna catches in the Western and Central Pacific Ocean 1972-1999

Source: SPC

Regional Fisheries Cooperation

Fisheries cooperation, fostered by the regional organizations, is a prominent feature of the Pacific Islands. The region has three organizations with major involvement in fisheries matters and several others with peripheral involvement:

- The South Pacific Commission (SPC) headquartered in New Caledonia has a fisheries programme which is primarily concerned with scientific research on the tuna fisheries and with research, development, and management of the coastal fisheries for the 22 countries and territories in the Pacific Islands.
- The Forum Fisheries Agency (FFA) headquartered in the Solomon Islands is concerned primarily with economic and policy aspects of the offshore tuna fisheries in the 14 independent Pacific Island countries plus Australia and New Zealand. The FFA has achieved a high degree of success in coordination leading to the regional and international treaties.
- The South Pacific Regional Environment Programme (SPREP) headquartered in Apia Samoa has a number of initiatives relevant to the fisheries of the region, including work on protected species, marine biodiversity, and the Pacific Islands component of the International Waters Programme of the Global Environment Facility.

In addition, to these three regional organizations, there are regional programmes important to fisheries at the University of the South Pacific (USP) and the South Pacific Applied Geo-Science Commission (SOPAC), and the Forum Secretariat.

About 1.6 million tonnes of tuna, as well as an unknown amount of by-catch, have been caught in the western and central Pacific each year in the 1990s. According to the SPC Standing Committee on Tuna and Billfish, (SCTB 2000), the estimated total tuna catch for 1999 was 1 718 776 mt, the second highest total catch on record after 1998 (1 900 290 mt). With respect to the four main tuna species in the catch, the SCTB reports:

- **Skipjack** contribute two thirds of the WCPO catch of the four main tuna species. The best available estimates indicate that the 1999 skipjack catch in the WCPO was approximately 1.1 million mt (slightly less than the record 1998 catch), with purse-seine fleets providing the majority of this catch (71 percent). Available indicators (purse seine, pole-and-line) show variable catch rates over time in the fishery
- **Yellowfin** landings in the WCPO have increased since the 1980s, when the purse-seine fishery began its significant expansion in the WCPO. Since 1990, the catch ranged from 320 000 mt (1996) to 458,000 mt (1997). The majority (55 percent) of this catch is produced by purse seiners. In 1999, poor market conditions for purse-seine caught fish resulted in reduced purse-seine fishing effort and catch. In addition, the longline yellowfin catch for 1999 of 52 580 mt was the lowest for nearly 30 years. The overall catch for 1999 fell from 440 000 mt in 1998 to about 397 000 mt, well below the peak of 458,000 mt in 1997. Catch rates for purse-seine fleets continue to be variable and show no clear trend in the available time series of data.
- **Bigeye** accounts for a relatively small portion (8 percent) of the total tuna catch in the WCPO, its economic value is substantial (approximately US\$1 billion annually). The 1999 total Pacific catch was 184 546 mt, with 105 365 mt and 79 181 mt in the WCPO and EPO, respectively. Both regions recorded increases in bigeye catch (around 13 000 mt and 8 000 mt respectively) in 1999 due to increases in purse-seine catches. This increased catch in the WCPO appears to be associated with the extensive use of drifting FADs.
- **Albacore** landings, estimated at 37 080 mt in 1999, was less than in 1998 when catches reached the 10-year peak of over 42 000 mt. In 1999 longline catches were 33,353 mt and troll catches 3 641 mt. Longline catches of several South Pacific island States and territories exceed 2 000 mt, contributing substantially to the total albacore catch. The combined albacore longline catch in 1999 by Fiji, French Polynesia and Samoa was slightly lower than 1998 in all three areas. This catch, more than 11 000 mt, constitutes 29 percent of all longline catches of albacore in the South Pacific. Catches in Samoa have rapidly increased from 560 mt in 1994 to over 4 000 mt in 1998, but declined in 1999 to 3 400 mt.

In general, the major tuna stocks on which the fishery is based are not believed to be biologically overexploited at present. On the contrary, SPC scientists believe that present skipjack catches could be increased. There is, however, some evidence for a declining trend in bigeye catch rates.

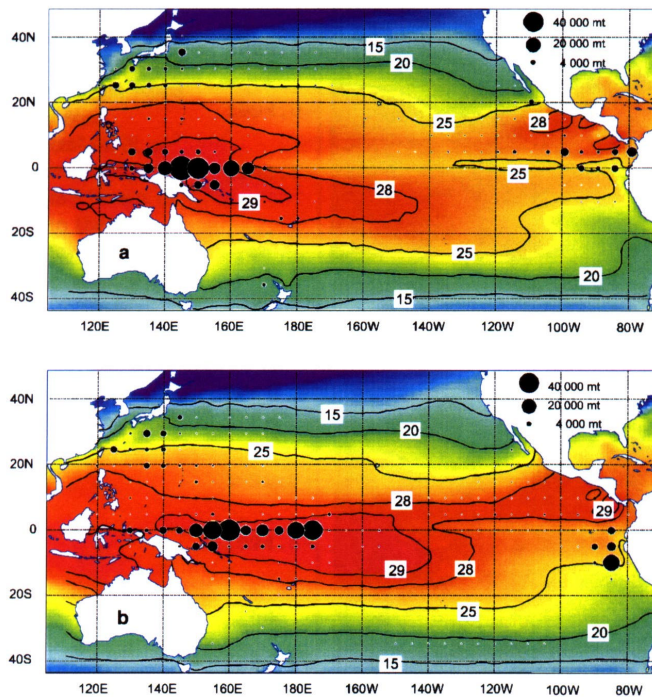
Like most other fishing methods, industrial tuna fishing results in the capture of non-target species, or by-catch, including:

- **marlins, sailfish, mahimahi, wahoo** and other species which are valued by sports fishermen;
- **sharks** which are the subject of growing concern due to their vulnerability to over-fishing;
- **marine reptiles, marine mammals, and sea birds** which may be endangered or formally protected in some jurisdictions;

The Western Pacific Warm Pool

The Western Pacific Warm Pool is one of the 56 biogeochemical provinces defined by Longhurst (1995) and corresponds to the definition of a Large Marine Ecosystem (LME), i.e. a zone of 200 000 sq. km. or more, characterised by distinct bathymetry, hydrography, productivity and trophically dependent populations. LMEs have been described as regional units for the management of fisheries in accordance with the principles of UNCLOS, and can provide a framework for the achievement of UNCED commitments (Lehody et. al., 1997).

The Western Pacific Warm Pool is a zone of low productivity which can extend over 80° of longitude and which has the warmest surface waters of the world's oceans. It produces virtually 100 percent of the purse-seine catch, 90 percent of the pole-and-line catch and 60 percent of the longline catch of tunas in the region. The pool's boundaries are dynamic, moving in response to oceanographic features. The warm pool can undergo spectacular displacements of over 40° of longitude (nearly 4 000 km) in less than 6 months as part of the El Niño/ La Niña phenomenon. Tuna abundance and yields are also displaced eastwest by the same phenomena, and the geographic location of catches of the US purse-seine fleet can be accurately predicted several months in advance based on both the eastwest movements of the 29°C isotherm, and variation in the Southern Oscillation index (a measure of the difference in barometric pressure between the eastern and western Pacific rims).



Location of the Warm Pool (within 29°C isotherm) and US purse-seine tuna catches during (a) La Niña and (b) El Niño events (from Lehody et. al., 1997)

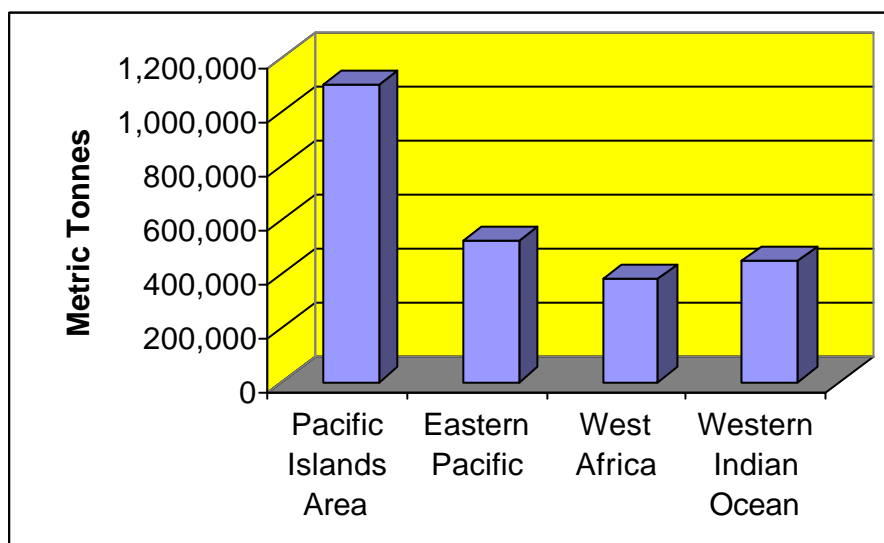
The Warm Pool appears to encompass a functional ecological unit which includes fish stocks, their prey, predators, and various physical factors, and which is of global significance. Apart from the highly visible commercially-exploited elements of the ecosystem, there are many other trophic levels of plankton, fish, sharks, marine mammals and birds. The sustainable utilisation of the Warm Pool's resources could be enhanced if the various components of the ecosystem were to be studied and managed as a coherent whole rather than in isolation from each other.

In recent years there is a growing amount of concern over the by-catch in the tuna fisheries of the region. Reasons for this include attention to obligations in international treaties and in non-binding international agreements, increasing involvement of environmental non-government organizations in the issue, and the closure in 2000 of the swordfish longline fishery in Hawaii. It is generally agreed that a more precise knowledge of the situation, to be obtained primarily through increased observer coverage, is an important foundation upon which any future management measures should be based.

Much of the tuna purse seine catch in the region is caught in the equatorial region. This area of warm surface water has become known as the western Pacific warm pool (see box).

Oceanic Fisheries

There are four major tuna fishing areas in the world: that of the Pacific Islands, the eastern Pacific (average annual tuna catches of about 525 000 mt), west Africa (385 000 mt), and the western Indian Ocean (450 000). The Pacific Islands fishery dwarfs the other three in volume (see graph) and because a large component of the catch is for the high value sashimi market, the relative value of the Pacific Islands tuna is even higher



The World's Major Tuna Fishing Areas

Industrial tuna fishing is carried out mainly by distant water fishing nations including China, Japan, Republic of Korea, Philippines, Taiwan China and USA. The Forum Fisheries Agency, a regional fisheries organization based in the Solomon Islands, has estimated that in August 2000 there were 949 foreign fishing vessels licensed in the region, made up of 716 longliners, 194 purse seiners, and 39 pole-and-line vessels.

These vessels pay fees for fishing in the exclusive economic zones of Pacific Island countries. In many cases, these fees make up a substantial portion of all government revenue. Estimates of access fees paid to Pacific Island countries in 1999 are:

An International Tuna Fleet

Industrial tuna fishing vessels of 27 different nations - 15 Pacific Island countries and 12 Distantwater fishing nations (DWFNs) - have operated in the Pacific Islands region during the last 25 years, and vessels of 20 countries operated in 1999. However the vast majority of the regional tuna catch harvested by the vessels of five DWFNs - Japan, Rep. of Korea, China, Taiwan China, and the United States. In 1999 these fleets harvest 72 percent of the tuna catch in the Pacific Islands region.

Numbers of Fishing Vessels on the FFA Regional Register (Licensing period: 1/9/99 to 31/8/00)

Longliner	Purse Seiner	Pole/Line	Total
716	194	39	949

In late 1999 there were about 174 US, Japanese, Korean, and Taiwan China tuna purse seiners operating in the Pacific Islands region, along with about 20 other vessels of other nationalities. These vessels represent about 40 percent of all the large tuna seiners in the world.

	Longline	Purse seine	Pole/line	Total (US\$)
Japan	5 128 000	9 199 000	1 405 000	15 732 000
USA	0	16 693 026	0	16 693 026
Korea, Rep. of	3 492 000	6 250 000	0	9 742 000
Taiwan China	2 099 000	10 642 000	0	12 741 000
China	500 000	0	0	500 000
FSM Arrangement¹	0	579 357	0	579 357
Others	90 000	4 200 000	0	4 290 000
Total	11 309 000	47 563 383	1 405 000	60 277 383

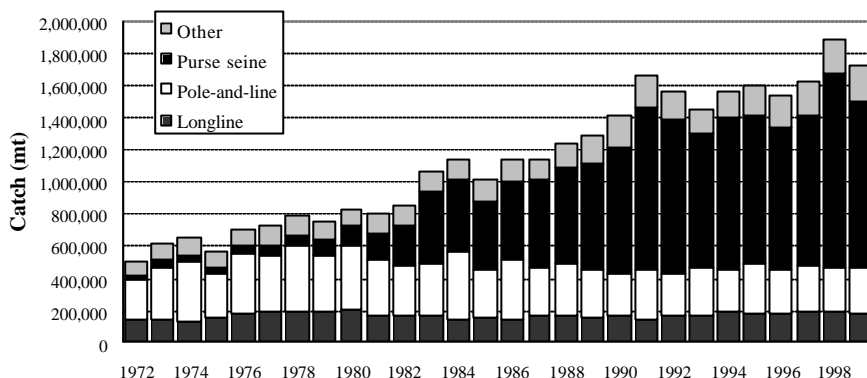
Source: Gillett et al. (2001); Units: US\$

¹ An arrangement providing for preferential access for purse seine vessels of Pacific Island countries that are parties.

In the 1970s and 1980s, few Pacific island nations were fishing on a large-scale for tuna. Recently, their participation in tuna fishing has increased with the advent of small-scale longline fisheries for sashimi-quality yellowfin and bigeye tuna. The nominal catch attributed to Pacific Island nations has also grown with re-registration to countries in the region of longline and purse seine vessels from Asia.

Tuna Catches in the WCPO by Gear Type

Source: SCTP (2000)



In the WCPO the main industrial fishing methods are purse seine, longline, pole-and-line and troll. The majority of the catch is harvested by vessels from Asia and the United States. Some 60 percent by weight was taken by purse seine gear, with the portion by pole and line vessels and longliners being 17 percent and 11 percent respectively. Trolling and artisanal methods harvest the remainder.

Although the purse-seine fishery took over three-quarters of the total catch volume in 1998, it accounted for only about 59 percent of the total value, while the longline fishery, with only 11.5 percent of the volume accounted for 27.5 percent of the value (Van Santen and Muller, 2000). The final destination of most purse-seine caught tuna is canneries, while longline tuna is mainly destined for the higher-value sashimi market in Japan. There are five tuna canneries in the region: two in Pago Pago in American Samoa (see box), and one each in Levuka in Fiji, Noro in Solomon Islands, and Madang in Papua New Guinea.

Pago Pago – the tuna town

Pago Pago is on the island of Tutuila which lies approximately half way between Auckland, New Zealand and Honolulu, Hawaii. Since 1900 Tutuila and four other smaller islands have comprised the U.S. territory of American Samoa of about 200 square km of land and 47 000 residents.

The tuna products shipped overseas from Pago Pago, nearly a half-billion dollars per year, are virtually 100 percent of all exports. Direct employment at the canneries accounts for nearly half the non-government jobs in American Samoa and the two canneries alone employ over 3 000 Pacific Islanders. In addition, the tuna fleet spends in excess of US\$30 million in port each year. The fairly small place now has 25 superseiners, 80 longliners, refrigerated transport vessels, two major canneries, a can factory, a 3 000 tonnes marine slipway, and a busy net repair facility.

U.S. law has helped Pago to become a tuna fishing centre. Unlike mainland U.S., non-U.S. flag vessels are permitted to land fish in American Samoa. The biggest legal advantage, however, concerns tariff provisions – fishery products can be exported to the U.S. duty free if the local component is a least 30 percent of the value. This is a substantial advantage as canned tuna imported into the U.S. from other countries are subject to a 35 percent duty for an oil pack or from 6 percent to 12.5 percent for tuna canned in water.

The tuna fisheries provide income to Governments of the region and employment for Pacific Islanders, but has the potential to provide much more. Less than 0.25 percent of the catch from the regional tuna fishery enters the domestic food supply of Pacific Island countries, even though a substantial amount of fish is discarded at sea due to being undesirable species or the tuna being too small. Fees paid for access to tuna resources by distant-water fishing nations equate to less than 4 percent of the catch value, and only a small proportion of crews of the industrial tuna vessels operating in the region are Pacific Islanders. Increasing the benefits they derive from tuna resources is a development objective of many countries in the region.

Management

The new legal regime of the seas and the declaration of 200-mile EEZs gave Pacific Island countries a great deal more power to manage their fishery resources. The collective size of their EEZs and a strongly regional approach to management have allowed a progressively increasing degree of control over the region's international fishing activities.

Despite the high value of the tuna fishery, many of the benefits that it generates have historically flowed out of the region. Until recently efforts by Pacific Island states to manage the resource have focussed principally on trying to improve this situation by forcing licence revenues upwards and, more recently, promoting greater domestic participation in the fishing industry and associated service activities, and increasing the number of local people employed. Much of this has taken place on a regional basis, mainly through the Forum Fisheries Agency.

Current management arrangements include a multilateral treaty with the USA, the Niue treaty on regional surveillance arrangements, harmonized minimum terms and conditions of access among bilateral arrangements, a ban on catch transshipment at sea, strong biological and compliance observer programmes, and the introduction of a compulsory satellite-based vessel monitoring system.

In recent years management has also come to focus more on resource sustainability. This has been prompted both by the continued expansion of the fishery (especially in some areas) and by the requirements of the Implementing Agreement (IA) for UNCLOS. The region's first conservation-oriented management move was the Palau Agreement for the Management of the Western Pacific Purse-Seine Fishery. The Arrangement entered into force in November 1995 and placed a ceiling on the number of purse-seine licenses that could be issued by the seven Pacific Island countries party to the agreement.

In the past few years most Pacific Island countries have developed tuna management plans. These plans, mostly developed with assistance of the Forum Fisheries Agency using Canadian funding, have been effective catalyst in many countries for the creation of an awareness of tuna management issues.

After four years of complex negotiations between the coastal states of the WCPO and states fishing in that region, the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean was opened for signature in September 2000². 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. 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 Convention applies to all species of highly migratory fish stocks within the Convention Area, except sauries.

Coastal Resources

Coastal fisheries resources are 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 of the region. 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 region's coastal fisheries provide most of the non-imported fish supplies to the region and hence have a crucial role in food security. Coastal fisheries harvest a very diverse range of finfish, invertebrates and algae by thousands of subsistence, artisanal and commercial fishers throughout the region. Unlike the tuna fishery, virtually all the coastal catch is taken by Pacific Islanders themselves, with very little access by foreign fishing vessels.

² The source of this information is the website of the Preparatory Conference.

Statistics on coastal fisheries are not readily available, and those that are available are often unreliable. The present production estimates are typically 'guesstimates' produced by agricultural censuses, household surveys, or nutrition studies. Visser (2001) reviewed the fishery statistics in the region and concluded that subsistence fishing is almost never included in national fishery statistics and artisanal fisheries are at best only partially covered near the administrative center and extrapolated over the whole nation.

In order to encourage an improvement in the information on the coastal fisheries of the region, Dalzell et al. (1996) using a wide variety of sources available at the time, made a concerted effort to estimate coastal fishery landings in each Pacific island country. ADB (2001) updated those estimates for the 14 independent countries of the region. These estimates are shown in the table opposite.

Consumption of Coastal Fish

If Papua New Guinea, with its largely inland population is excluded, the regional per capita consumption of fish from coastal areas, about 35 kg annually, is quite large. For some of the individual countries (eg. Tuvalu, Kiribati, Tokelau) dependence on fish from the coastal zone as a food source is remarkably important and is among the highest in the world. According to FAO data, fish (of which the vast majority is from coastal areas) represents 38.7 percent of the total animal protein intake in the Pacific Islands region which is much greater than the world average of 16.1 percent.

In general, Pacific Islanders have a strong tradition of eating fish and this preference often takes precedence over economic considerations, especially in Micronesia and Polynesia. Fresh fish will frequently be purchased even though it is more expensive than the alternatives, often imported mutton flaps, turkey tails, or canned meat.

It is also important to note that this food-related importance of coastal resources appears to be increasing. The table below gives the results of three studies and suggest an increasing trend.

Country	Fisheries production (t)		
	Subsistence	Commercial	Total
American Samoa	215	52	267
Cook Islands	795	80	875
Fed. States of Micronesia	5 000	5 000	10 000
Fiji	21 600	9 320	30 920
French Polynesia	3 691	2 352	6 043
Guam	472	118	590
Kiribati	10 000	6 000	16 000
Marshall Islands	2 800	444	3 244
Niue	194	12	206
Nauru	110	315	425
New Caledonia	2 500	981	3 481
Northern Marianas	2 825	141	2 966
Palau	1 250	865	2 115
Papua New Guinea	26 000	5 500	31 500
Pitcairn Islands	8	0	8
Samoa	4 293	2 876	7 169
Solomon Islands	13 000	3 200	16 200
Tokelau	191	0	191
Tonga	2 863	4 173	7 036
Tuvalu	880	220	1 100
Vanuatu	2 700	230	2 930
Wallis & Futuna	621	296	917
Total	102 008	42 175	144 183

* Estimates in bold are those updated in 2002

Trends in per capita fish consumption

SPC has published estimates of coastal fisheries production in the region on three occasions. The results are not strictly comparable due to different methodology, but the general trends are instructive.

Historical Estimates of Coastal Fisheries Production

Period	Coastal fisheries production (t)	Population of region	Per capita fish supply from coastal fisheries (kg)	Source
1960	31 420	3 150 000	10.0	Van Pel (1961)
Late 1970s	55 130	4 410 000	12.5	Crossland and Grandperrin (1979)
Early 1990s	108 242	6 068 000	17.8	Dalzell and Adams (1994)

Total fish consumption in the Pacific Islands has a strong relationship to coastal fisheries production, so annual per capita fish consumption has probably increased substantially during the last three decades. In some outer island areas it is estimated to be more than 200 kg per year.

Subsistence Fisheries

According to the best available information, the subsistence fisheries of the Pacific Islands region capture about 102 000 mt per year, or about 70 percent of the total harvest from coastal areas. In some countries over 80 percent of the coastal catch is from the subsistence sector. In all Pacific Island states these fisheries make extremely important contributions to household food security, dietary health and import substitution.

In a recent review of benefits from Pacific Island fisheries, ADB (2001) estimated that the contribution of subsistence fisheries to gross domestic product was actually quite large in a number of Pacific Island countries. In Samoa “non-monetary fishing” represents about 5 percent of GDP. In Tuvalu “non-market fishing” is about 7 percent.

The latest Regional Economic Review (World Bank 2000a) studied the value of subsistence fisheries for food security in selected Pacific Island countries. It was concluded that the value of annual subsistence production of finfish and shellfish in protein equivalent was US\$6.7 million in Fiji, \$18 million in Kiribati, 13.9 million in the Solomon Islands, and \$14.7 million in Vanuatu.

Despite this importance, governments in the region characteristically have not focused much attention on the subsistence fisheries sector. Studies, development initiatives and management efforts of the government fisheries agencies are usually oriented to the commercial fisheries sector. Much of what is known about subsistence fisheries of the region arises from the attention of NGOs, academics, women’s programmes, nutrition workers, and regional/international organizations.

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 recent study of coastal resources management in the Pacific Islands (World Bank, 2000b), residents in coastal villages in five countries identified what they considered were the major coastal resources. They were:

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

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.

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 activity, 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 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."

Commercial Coastal Fisheries

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), sea cucumber (7 percent), and estuarine fish (6 percent).

Estimated annual exports of major coastal fisheries commodities from the Pacific islands region (data from SPC)

Commodity	Amount
Sea cucumber	1 500 tonnes (dried, equivalent to 15 000 t live weight)
Trochus shell	2 300 tonnes of shell
Pearl shell	400 tonnes (mainly spent farmed shell)
Pearls	About 1 tonne, with a value of more than US \$ 100 million
Deep-water snappers (mainly Tonga)	300 tonnes
Giant clam (mainly Fiji)	20 tonnes of adductor muscle
Live groupers	Unknown but growing
Aquarium fish	Small in tonnage but relatively large in value

Much commercial production from coastal areas in the Pacific Islands is exported. In general, the region exports high value commodities (see table above), while importing mainly inexpensive food supplies, such as canned mackerel. Much of the traditional export commodities are actually harvested by 'subsistence' type fishers, processed in some cases, and then sold on to middlemen for subsequent further processing and re-sale in bulk quantities.

Fisheries development effort 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 of these export fisheries.

Commercial coastal fishing operations can be very small-scale (e.g. women in many countries who glean reefs for a few hours and then sell the majority of what they have obtained) or much larger, such as fishing for Tonga bottomfish in which the fishers are out for week-long trips in vessels up to 15 meters in length. In general, the larger the scale, the more likely that the fishers are employees of a non-fishermen who own the vessel. Most of the typically small vessels fishing for flying fish in the Cook Islands are operated by their owner, some of the catamarans fishing in Western Samoa are owned by non-fishing businessmen, while most of the active snapper boats in Tonga are not owned by the people that crew them.

During the past decade, the commercialization of coastal fisheries has increased considerably. The commercial coastal catch in the Federated States of Micronesia increased significantly in the 1990s. A mid-1990s survey of coastal fishing on the major island of Fiji showed that the commercial catches were considerably higher than that estimated from an extrapolation of the results of a survey done during the previous decade.

Some of the more notable resources and associated new developments in coastal fisheries of the Pacific Islands include:

Trochus: Although the natural range *Trochus niloticus* is limited to the western part of the region, the gastropod has been transplanted to almost all Pacific Island countries. The annual harvest of *Trochus niloticus* in the region in recent years was about 2 300 metric tonnes with an export value of about US\$15 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.

Sea cucumber: About 20 species are currently exploited in the region, primarily for export to Asia. Like trochus, villagers can process sea cucumber 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. For example, in Papua New Guinea over 500 mt of sea cucumber was harvested annually in the early 1990s, but a few years later the abundance was so low that complete export ban was being considered.

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. Yields in the region have been estimated to be between five and fifty kg per hectare per year (Wright 1993). Commercial export of shallow water reef fish is not a major industry; most of the overseas shipments of these fish are made by Pacific Islanders as airline baggage during visits to Guam, Hawaii, Australia, and New Zealand.

Deep-slope snappers and groupers: These fish are found on slopes 100-400 meters in depth off most Pacific Islands. Because they receive a high price in overseas markets and are under-exploited in most countries, deep-slope snappers and groupers have been the subject of considerable development interest in the 1970s and 1980s. Many operators have subsequently converted to small-scale tuna longlining, with only Tonga harvesting substantial amounts at present.

Lobsters: The commercial lobster fishery in the region is based on three species in the genus *Panulirus*, one of which, *P. ornatus*, supports a sizeable fishery of up to 400 tonnes in the area between Papua New Guinea and northern Australia. In the rest of the region, a remarkably large number of export-oriented lobster fishing efforts have been attempted, but most have failed due to rapid depletion of what initially appeared to be a substantial resource.

Aquarium fish: Aquarium fish collectors target a large number of species, with the major families being butterfly fish (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. Collection operations have been established in most Pacific Island countries in the past 20 years. An appealing aspect is that these fish are rarely taken for food in the Pacific Islands and therefore this fishery does not interfere with subsistence activities. The nominal reported FOB value of exports of aquarium fish for the year 1999 are available for a few countries: Fiji US\$178 000, Marshall Islands US\$473 000, Vanuatu US\$16 500, Cook Islands US\$73 500, and Kiribati US\$1 160 000. The relatively recently-established aquarium fish industries in the Kiribati and the Marshall Islands now account for 78 percent and 95 percent of all fishery exports from those countries respectively.

Live food fish: Starting in Palau in the mid-1980s, many live food fish ventures have operated in the Pacific Islands, especially the western part of the region. The target species, typically groupers (Serranidae) and coral trout (Plectropomus spp.), are exported to markets in large Asian cities. 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 spawning aggregations. Although the fishery is attracting considerable attention in the region, there are no estimates of the volume or value of the trade of live fish in the Pacific Islands.

Sport game fishing: This a specialized form of small-scale commercial fishing which is growing in importance 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. There are presently sport fishing operations in most Pacific Island countries. Another aspect of this fishing is the international tournaments held annually in most countries of the region

Management of Coastal Fisheries

The importance of coastal resources is matched by the range of challenges facing them. The most serious problems are:

- Over-harvesting: excess fishing effort has been created by commercial incentives, increased market access, population growth, modern fishing technology, and urbanization;
- Land-based threats: such those created by logging, mining, and sewage disposal
- Destructive fishing: dynamiting and fish poisoning;
- Competing uses of the coastal zone: land fill, infrastructure construction, and buildings;
- Coral and mangrove harvesting; and
- The breakdown of traditional authority which is usually considered to be essential for the community management of coastal resources.

A less obvious problem affecting coastal resources is the loss of biodiversity. Many commercially important species (eg. sea cucumber, pearl oysters) have been over-fished to the point of exhaustion, making it no longer economic to harvest them in many areas. Worse still, some coastal species have been harvested nearly to the point of biological extinction. These includes the coconut crab, some species of giant clams, most species of turtles, and mangroves in some island groups.

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, as well as through 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 appears to be a marked decreased in effectiveness of the former systems of coastal resource management.

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. Adams (1997) states that the first 50 years of the 20th century were characterized by government indifference to marine issues. Starting in the mid-1950s most Pacific Island governments introduced various forms of centralized coastal resource management, most typically through various 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 centers.

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 as management tools. 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 that the culture of marine organism could lead to

reduced pressure on coastal resources. Campaigns to raise the awareness of coastal residents are another widely-used management tool, particularly by environmental agencies.

Among fishery managers there is growing recognition that, to improve effectiveness, much of the management of coastal fisheries resources must be devolved to the community level. This trend is also noticeable among the conservation community, where the initial failure of attempts to establish conventional marine protected areas has led to heightened efforts to involve communities in formulating and following conservation agreements. There are, however, large differences between Pacific Island countries with respect to community coastal fisheries resource management, in terms of political will, legal basis for lower level initiatives, available funding, and actual community management activities.

There is also a growing awareness that the realities of fishery statistics in the region dictate that a different approach is required for the information to manage fisheries (see box on dataless management).

Dataless management

There is an increasing realization that the challenge of collecting stock assessment data on widely-dispersed, multi-species tropical reef fisheries is so great as to be effectively insurmountable. For instance Johannes (1998) has estimated that it would take 400 man-years of scientists time just to provide a basic, statistically-valid estimate of reef fish abundance around Indonesia's coast. Tropical countries cannot afford such research, and even if they could it would be grossly cost-ineffective. In the face of such challenges, fisheries managers are beginning to look at the prospects of dataless management.

Dataless does not mean management without information. In the Pacific islands, dataless management has been carried out for centuries, in the form of customary marine tenure. In most cases modern, science-based fishery management methods have failed to produce better results than traditional systems, and in many the outcome has been resource failure.

Customary marine tenure does not necessarily optimize fishery production, and may lead to differences in management arrangements from one locality to the next. However it is generally easier and more cost-effective to have communities to enforce their own management rules than it is to carry out centralized policing. In addition, community-based management systems are often in line with the precautionary principles of fisheries management.

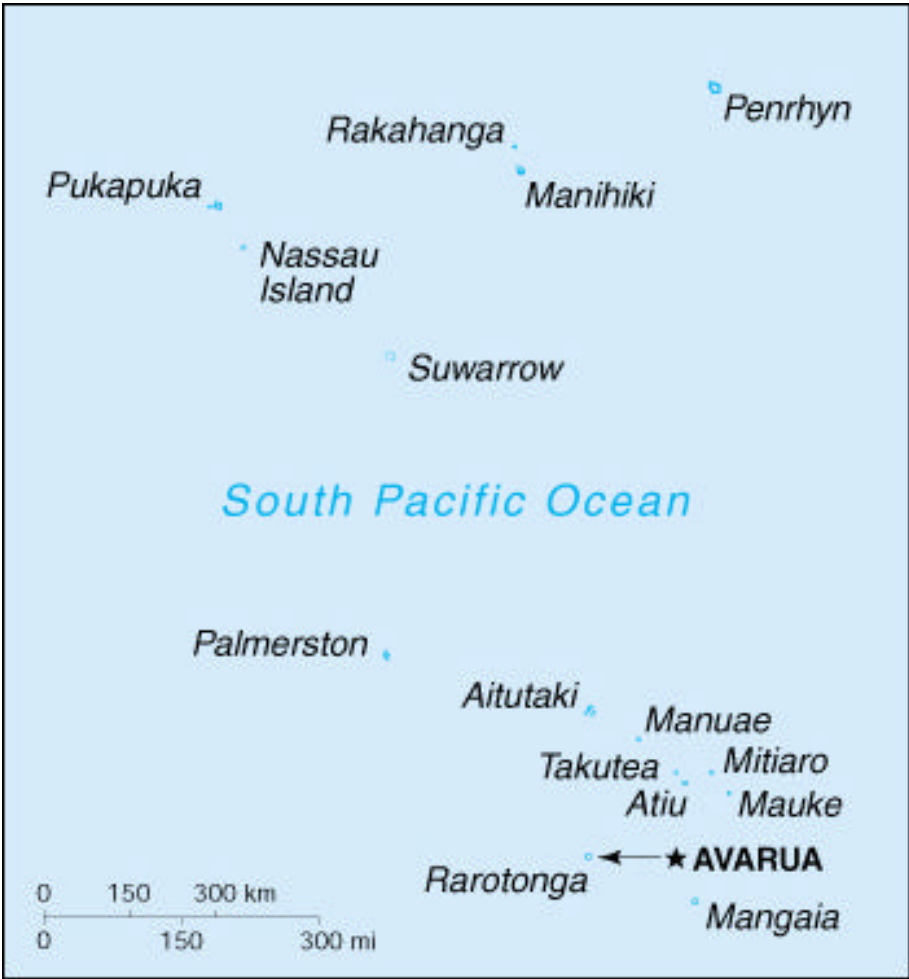
In a recent World Bank study, coastal fisheries management was examined at 31 locations in the Pacific Islands. One of the important conclusions of the study was there is an urgent need to reduce overall fishing effort. Although many of the communities surveyed had adopted restrictions to fishing by outsiders, few were effective in regulating their own harvest. Further efforts are needed to raise the awareness of traditional leaders of the benefits to restricting fishing effort, and especially the most efficient fishing technologies (Bettencourt and Gillett, 2001). That study also made observations on fisheries management regulations, and concluded that some of these rules work better than others. Three types of rules were perceived by communities as having the best compliance:

- National rules which were seen as relevant and subsequently adopted by community leaders were seen as being more effective than purely national or purely local rules.
- Simple rules, such as complete bans or closures, were perceived as being more effective than more complex or conditional rules such as size limits or closed seasons/areas.
- Rules which could be enforced by the buyers or exporters, such as crocodile exports in the Solomon Islands or trochus exports in Palau, were seen as being especially effective.

(coloured paper)

**INFORMATION ON FISHERIES
IN INDIVIDUAL PACIFIC ISLAND COUNTRIES**

COOK ISLANDS



COOK ISLANDS

I. GENERAL ECONOMIC DATA³

Land area ⁴ :	237 sq. km.
Ocean area:	1 830 000 sq. km
Population (2000) ⁵ :	18 700
Gross Domestic Product (2000) ⁶ :	US\$ 79.8 million
Fishing/aquaculture contribution to GDP:	US\$ 8.6 million
GDP per capita (2000):	US\$ 4 266

II. FISHERIES DATA

Commodity Balance (2000)⁷:

	Production Tonnes live weight equivalent	Imports kg/yr	Exports ⁸	Total supply	Per caput supply
Fish for direct human consumption ⁹	950	200	0	1 150	61.2
Fish for animal feed and other purposes	0	0	40 ¹⁰	0	-

Estimated employment in fisheries (1996)¹¹:

(i) Primary sector:	160
(ii) Secondary sector:	n/a
(iii) Subsistence fisheries:	4 435

Gross value of fisheries output (2000)¹²: US\$ 11 880 821

Trade (2000):	Value of imports	US\$ 400,000 (est.)
	Value of exports ¹³	US\$ 18 922 000

³ Average 1999 rate of exchange US\$ 1.00 = New Zealand dollar (NZ\$) \$1.896; 2000 – 2.2012

⁴ Source: South Pacific Commission Statistical Summary 2000.

⁵ Source: South Pacific Commission 2000 mid-year population estimate

⁶ Source for GDP data: Gillett and Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, Manila.

⁷ Production breakdown (tonnes): subsistence 795; coastal commercial 80; offshore locally-based 75; total 950. The total does not include the 300 tonnes caught by foreign-based offshore vessels.

⁸ Exports of fishery products in 2000 did not include items for human consumption

⁹ Source: Gillett and Lightfoot (2001)

¹⁰ Trochus and pearl oyster shells

¹¹ Source: 1996 Cook Islands census

¹² Value breakdown: subsistence US\$1 164 268; coastal commercial (including pearls) US\$10 319 644; offshore locally-based US\$396 909; total US\$11 880 821. Not included in the total is the value of the offshore catch by foreign-based vessels, US\$407 494.

¹³ Source: Ministry of Marine Resources (unpublished data).

III. STRUCTURE AND CHARACTERISATION OF THE INDUSTRY

General

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.

The cash economy is best developed on Rarotonga, the capital and seat of government and where about half the population resides. The next most developed island is Aitutaki, which is a popular tourist destination.

Since 1965 the Cook Islands have been a self-governing country in free association with New Zealand. The national government is based on the parliamentary system and lower levels of government consist of island, district, and village councils. Cook Islanders are citizens of both the Cook Islands and New Zealand. The free movement of Cook Islanders to New Zealand has major implications for employment and development; there are almost twice as many people of Cook Islands descent in New Zealand as in the Cook Islands.

There are no major bodies of freshwater in the Cook Islands. Marine fishing and mariculture activities are therefore the dominant components of the fisheries sector.

Marine Fisheries

The Cook Islands' marine fisheries include extensive subsistence and artisanal harvesting of a wide variety of inshore reef and lagoon fish and invertebrate species, as well as a small longline fishery for tuna, and the commercial collection of ornamental fish for the aquarium market.

In the Northern Group and in the smaller islands of the Southern Group, fishing remains largely subsistence in nature and is mostly conducted from small outboard-powered craft and canoes in the lagoons and along the outer reef edge. Bottom handlining, spearing, gill netting, scoop-netting of flying fish and reef gleaning for invertebrates are common activities throughout the group.

In addition to subsistence harvesting, small-scale commercial fishing occurs in the more populated southern islands, particularly Rarotonga and Aitutaki where urban populations and tourism have created a strong demand for fresh fish and seafood. The 1996 census indicated a total of 1 291 fishing boats, of which 26 percent were located on Rarotonga.

Since the 1980s there has been an active programme of fish aggregation device (FAD) deployment in the Cook Islands to facilitate the capture of tuna and other pelagic species. In the past two decades 60 FADs were deployed in the Cook Islands – mainly off Rarotonga, but also near Aitutaki, Mangaia, Atiu, Mauke, Mitiaro, Palmerston, Manihiki, and Penrhyn. The FADs, costing about US\$2 250 apiece, have lasted an average of 18 months. According to the Ministry of Marine Resources, the FADs have been responsible for a large increase in the landings of pelagic fish species. In mid-2001

a New Zealand-sponsored FAD project commenced. Over a three-year period the project will develop a more cost-efficient FAD and conduct a study of the benefits.

Tuna is also caught by a small fleet of locally-based longliners, as well as fleets based in foreign countries. In the four-year period 1994 to 1997 the total catch taken by local longliners was 300 mt or 75 mt per year. It is reported that in 1998 and 1999 the foreign longliner tuna catch was 688 mt and 295 mt, respectively. Although the Cook Islands is located outside the area where most tuna purse seining occurs, some seine catches have been made. The US purse seine fleet, fishing in the region under a multi-lateral treaty, reported catching 216 mt of tuna in the northern part of the Cook Islands in 1999.

The catching of flying fish at night is quite important in the Cook Islands, especially Rarotonga. This commercial fishery evolved from a traditional Polynesian technique in which palm frond torches and dip nets were used from outrigger canoes. In modern times 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 maneuver a small outboard-powered boat and manipulate a dipnet for scooping flying fish. It has been estimated that about 60 mt of flying fish is taken each year in the Cook Islands.

Trochus (*Trochus niloticus*) was introduced to Aitutaki in the Cook Islands from Fiji in the late 1950s and first fished in 1981 when 200 t were harvested. Since then trochus has been harvested in Aitutaki during twelve specified periods in the 1980s and 1990s. During each of these harvests from 8 mt to 200 mt were landed. The Aitutaki trochus fishery is currently managed on an individual transferable quota system. Many fishery specialists in the Pacific Islands consider the trochus fishery in Aitutaki to be the best managed fishery in the region. Trochus has also been introduced to most of the other Cook Islands and is believed to be abundant at many locations.

A fishery for aquarium species began in Rarotonga in the late 1980s. About 35 species of aquarium fish are taken in depths ranging from 8 to 35 metres. According to the Ministry of Marine Resources, the most important species are the flame angel, red hawkfish, ventralis, Scott's wrasse, and lemon-peel angel fish. In the 1990s from 10 000 to 20 000 aquarium fish were taken per year. The aquarium fish are exported by air, mainly to the USA.

The Cook Islands has a long history of pearl shell fishing based in several of the atolls of the Northern Group. This fishery flourished up to the mid-1950s after which it suffered a catastrophic collapse due to reductions in the price of pearl shell on overseas markets.

Inland Fisheries and Aquaculture

The absence of any substantial freshwater bodies mean that there are no inland fisheries or freshwater aquaculture of significance in the Cook Islands. However mariculture (marine aquaculture) is now economically significant.

Culture trials of the black-lipped pearl oyster (*Pinctada margaritifera*) commenced in Manihiki around 1973. By 1988 more than 40 pearl farms had been established there, and were successfully producing both half and whole pearls. The number of farms increased rapidly thereafter and by 1990 97 farms were in operation. The first annual pearl auction was held in 1990 and approximately 6,000 pearls were sold for US\$ 0.78 million. 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). The Ministry of Marine Resources operates a pearl oyster hatchery on Penrhyn and is encouraging the spread of pearl farming to Palmerston, Aitutaki, and Pukupuka. Recently the hatchery was upgraded and the production of spat from the facility was improved. A census and mapping of the pearl oyster farms in Manihiki was completed in early 2000.

A giant clam hatchery was established on Aitutaki in the 1980s and is successfully producing juvenile clams. The hatchery has worked with three introduced species of giant clam (*Tridacna derasa*, *T. gigas*, *Hippopus hippopus*) as well as the two local species (*T. maxima*, *T. squamosa*). With respect to increasing the number of clams in the lagoons, the current thinking of the Ministry of Marine Resources is that the most effective way is to manage existing stocks to allow them to re-populate the lagoons naturally.

There is a tradition in some Cook Island atolls of stocking brackish water ponds with juvenile milkfish (*Chanos chanos*) and harvesting them once they have grown to maturity. This traditional form of ranching is limited in extent and is essentially a form of subsistence fishing for periods of inclement weather.

Utilization of the Catch

In the outer islands where subsistence fishing prevails, fish catches often exceed demand and simple preservation techniques such as salting and drying are regularly employed to prevent wastage of surplus catches. On Rarotonga, and to a lesser extent on Aitutaki, where the cash economy is better developed and where tourism is concentrated, demand for fresh fish and seafood often exceeds supply. A survey of fish prices in 2000 showed that the limited amount of fish sold in the northern group islands commanded around US\$1.15 to \$1.40 per kg, compared to about US\$2.75 in Aitutaki and \$4.50 per kg in Rarotonga.

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.

According to the Ministry of Marine Resources, there were no fresh fish exports from the Cook Islands in 2000. During some years high quality tuna taken by locally-based longliners are occasionally shipped to markets in Hawaii, the US mainland and New Zealand, with the lower value-component of the catch being disposed of on the local market. Small quantities of seafood products, mostly from reef and lagoon fisheries, are also exported, often as the personal consignments of passengers traveling to New Zealand

Korean and Taiwanese longliners that have in the past been licensed to fish in the Cook Islands have generally landed their catches at canneries in Pago Pago or transshipped

frozen product for consignment to other ports. The tuna catches made by US purse seine vessels are offloaded at Pago Pago. Little or no tuna transshipment takes place in Cook Island ports.

The trochus shell in recent years has been exported to mainly Europe where it is used in the manufacture of high quality buttons. The pearls and pearl-based jewelry products are both sold locally and shipped to markets in metropolitan countries.

Demand

Fish and marine resources have always been an important component of the diet of Cook Islanders. In the less-populated outer islands where subsistence fisheries prevail, resources generally have been adequate to supply demand and it has been possible on occasions to send surplus catches for sale in Rarotonga, or to salt and dry them for later use or trade. On Rarotonga, and to a lesser extent on Aitutaki, the predominance of the cash economy and a rapid growth in tourism has created strong demand for fresh fish which has resulted in prices that are beyond the reach of many local residents.

There have been several estimates of fish consumption in the Cook Islands. A study on Penrhyn in the early 1990s indicated the annual per capita consumption of fish was very large - 219 kg. Most country-wide estimates of fish consumption during the last decade suggest an intake from 47 to 71 kg per person per year.

Economic Role

A recent review of the Cook Islands economy by the Asian Development Bank indicated that pearl production has expanded recently, though the extent of this expansion has been disguised by the under-reporting of sales to evade tax and royalty payments.

Using the Ministry of Marine Resources estimate of pearl and other fishery production, it is estimated that that fishing and aquaculture contributed about US\$ 8.6 million to the Cook Islands' GDP of US\$ 79.8 million, or about 10.8 percent of the total.

The 1996 census of the Cook Islands indicates 4,435 people (3 517 males, 918 females) were involved in subsistence fishing. This represents about 22 percent of the population. Data on formal employment in the fisheries sector is more difficult to obtain but census data and information from the Ministry of Marine Resources suggests that about 160 people were directly employed in fisheries in 1966.

According to the Cook Islands Statistics Office, exports of fishery/aquaculture products in 1999 accounted for about 82 percent of all exports from the country.

IV. DEVELOPMENT PROSPECTS

The Cook Islands Government's stated priorities for the conservation and utilization of fisheries and marine resources are to increase self-sufficiency in marine-sourced foods and to encourage import substitution. There is still scope for the further development of Cook Islands' fisheries, especially for offshore pelagic species. Coastal reef and lagoon species offer less potential for economic development, especially in the northern islands due to their remoteness, fragility, and importance as a source of subsistence nutrition.

Economic restructuring measures in 1995 resulted in a more than 50 percent reduction in public service employment, and this resulted in a significant increase in subsistence and artisanal fishing effort. Partly due to this, the Ministry of Marine Resources was involved in the establishment of marine reserves in some areas, implementation of a giant clam re-stocking programme and continued the FAD deployment programme.

The recent rapid development of the black pearl industry in Manihiki has given much cause for optimism in other islands, and the government is encouraging the emulation of this success at other sites. On Penrhyn, where it has been recently estimated that only one percent of the area available to pearl farming is being utilized, a pearl farming research and training facility has been established. The spread of pearl farming to Palmerston, Aitutaki, and Pukupuka is being promoted. This enthusiasm must be tempered with the susceptibility of such aquaculture enterprises to natural disasters - most of the pearl farming installations in Manihiki were destroyed or severely damaged by a cyclone which struck the island in late 1997.

The introduction of trochus to Aitutaki and the subsequent management measures were quite successful. The secondary transplantation to the other islands of the country have resulted in establishment of trochus populations at several locations. Provided that effective management can be implemented, the long-term prospects for trochus in the Cook Islands appears promising.

Access fees paid by foreign fishing fleets to longline for tuna in the Cook Islands' EEZ have generated substantial income. Continued participation in multi-lateral licensing arrangements is likely to continue to be quite favorable to the Cook Islands. Despite initial problems, a domestically based small-scale tuna longline fishery appears to have good potential. The present efforts to develop a long-term management plan for tuna should clarify the major opportunities and required measures for maximizing benefits from the tuna resources.

V. INSTITUTIONAL ARRANGEMENTS

The Marine Resources Act (1989) is the cornerstone of the Cook Islands' control over the exploitation and management of the fisheries resources. The major features of the Act are:

- Designated Fisheries – The Minister may authorize a fishery as a “designated fishery” where it is determined that such fishery: (a) is important to the national interest; and (b) requires management and development measures for effective conservation and optimum utilization. For each designated fishery a fisheries plan for the management and development must be prepared and kept under review.
- Local Fisheries Committees - The Secretary may appoint a Local Fisheries Committee in any island to advise on the management and development of fisheries in relation to that island. The functions of a Local Fisheries Committee shall be to (a) Advise the Secretary on issues related to the management and development of fisheries in relation to the island; (b) Make recommendations to the local Island Council with respect to the adoption or amendment of bylaws regulating the conduct of fishing operations and the issuing of fishing licenses for any designated fishery of the island.

- Power of Island Councils to recommend the promulgation of bylaws - Each Island Council may recommend the promulgation of bylaws in respect of any designated fishery of the island in accordance with the procedures set out in Section 15 of the Outer Islands Local Government Act 1987. (2) Every bylaw recommended for promulgation under this section must be consistent with the relevant provisions of the fisheries plan and the Marine Resources Act (1989) and any regulations made under the Act. (3) Every bylaw recommended for promulgation under this section must be officially approved by the Minister.
- Local fishing licenses - All local fishing vessels 10 metres or more, other than a local fishing vessel used solely for sport fishing, may not be used for fishing or related activities in the fishery waters without a valid licence.
- Foreign fishing vessels - No foreign fishing vessels may be used for fishing or related activities in the fisheries waters except in accordance with a valid license.
- Access agreements - The Minister may, on behalf of the Government of the Cook Islands, enter into international, bilateral or multilateral access agreements providing for fisheries access, related activities or such other matters as may be provided pursuant to the Act.

Minor amendments were made to the Act in 1990 and 1991. The most significant change was increasing the maximum fine from "not exceeding \$100 000" to "not less than \$100 000".

Marine Resources (Licensing and Regulation of Fishing Vessels) Regulation 1995 gives license applications, fees, grounds for refusal, and general conditions for local fishing, sport fishing and foreign fishing. Also covered are the requirements for transshipment, fish processing establishments, fish aggregation devices, and aquarium fish fishing.

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

Responsibility for fisheries and marine resource matters is vested in the Ministry of Marine Resources (MMR), headed by the Secretary for Marine Resources. The Ministry was established in 1984 under the Ministry of Marine Resources Act, when it replaced the Fisheries Department of the Ministry of Agriculture and Fisheries. The MMR is headquartered at Rarotonga, but also maintains staff on the islands of Pukapuka, Manihiki, Aitutaki, Rakahanga, Penrhyn and Mitiaro. There are currently 48 staff in the Ministry.

The MMR is structured in four divisions:

- Policy and Resource Management
- Research
- Economic Development
- Central Administration

VI. INTERNATIONAL ISSUES

The Ministry of Marine Resources maintains direct contact on technical issues with regional and international organizations dealing in fisheries. Policy and other matters are managed in the first instance through designated contact points, most often the Department of Foreign Affairs. Cook Islands is a member of the Secretariat of the Pacific Community (SPC), the South Pacific Forum Fisheries Agency (FFA) and the South Pacific Regional Environmental Programme (SPREP). Cook Islands is party to a number of treaties and agreements relating to the management of regional fisheries, including:

- the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America;
- the Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific; and
- the Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region.

Cook Islands is a signatory 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

VII. RESEARCH AND TRAINING

The Ministry of Marine Resources undertakes fisheries and aquaculture research in the Cook Islands. The research that has taken place is grouped in the following categories:

- Lagoon monitoring: baseline surveys and monitoring of fish, corals, and other invertebrates. Monitoring of the pearl culture industry, including the associated water quality, is an important feature of the lagoon monitoring work programme.
- Ciguatera programme: alerting the public to outbreaks of ciguatera poisoning around Rarotonga.
- Marine reserves: providing technical assistance to the managers of marine reserves in Rarotonga and Aitutaki.

The Ministry of Marine Resources operates a pearl hatchery at Penrhyn, a giant clam hatchery at Aitutaki, a marine laboratory at Manihiki, and a water quality laboratory at Rarotonga.

There is no institution offering formal fisheries-related training in the Cook Islands. Scientific and vocational training are usually arranged through institutions in Fiji, New Zealand, Australia or elsewhere, often using the numerous short-term opportunities available through bilateral and multilateral aid programmes.

VIII. 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.

IX. INTERNET LINKS

www.spc.int/coastfish/Countries/CookIslands - is the website of the Cook Islands Ministry of Marine Resources. It has comprehensive information on Cook Island fishery resources and their management.

www.wwfpacific.org.fj - has information on sea turtles in the Cook Islands

www.cookislands-invest.com - contains information on investing in the Cook Islands, including that in the fisheries sector

www.adb.org - has detailed information on the economy of the Cook Islands and the contribution of fisheries

www.seafari.co.ck - has information about sport fishing in the Cook Islands

FEDERATED STATES OF MICRONESIA



FEDERATED STATES OF MICRONESIA

I. GENERAL ECONOMIC DATA¹⁴

Land area ¹⁵ :	701 sq. km.
Ocean area:	2 980 000 sq. km.
Length of coastline:	n/a
Length of 200 m isobath:	2 468 km.
Population (1998) ¹⁶ :	114,100
Gross Domestic Product (1998) ¹⁷ :	US\$ 229.8 million
Fishing contribution to GDP (1998):	US\$ 21.9 million
GDP per capita (1998):	US\$ 2 014

II. FISHERIES DATA

Commodity Balance (1999): Tonnes live weight equivalent;

	Production Tonnes live weight equivalent	Imports kg/yr	Exports	Total supply	Per caput supply
Fish for direct human consumption ¹⁸	12 499 ¹⁹	1 100	900	13 599	119.2
Fish for animal feed and other purposes	-	-	-	-	

Estimated employment (1999)²⁰:

(i) Primary sector:	500 full-time, 1 200 part-time
(ii) Secondary sector:	150
(iii) Subsistence fisheries:	unknown but large

Gross value of fisheries output (1999)²¹: US\$ 36 995 000

Trade:	Value of imports (1995) ²²	US\$ 4 400 000
	Value of exports (1994) ²³	US\$ 9 075

¹⁴ The currency used in Federated States of Micronesia is the US dollar.

¹⁵ Source: South Pacific Commission Statistical Summary 2000.

¹⁶ Source: South Pacific Commission 1998 mid-year estimate.

¹⁷ Source for GDP data: Gillett and Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, Manila.

¹⁸ Sources: various government and non-government sources in Gillett and Lightfoot (2001)

¹⁹ Breakdown (tonnes): subsistence 5 000; coastal commercial 5 000; offshore locally-based 2 499; total 12 499. The total does not include the 127 000 tonnes caught by foreign-based offshore vessels, nor the catch by FSM-registered vessels outside the FSM zone, nor the 90 500 tonnes transshipped through FSM ports.

²⁰ Estimated using employment information in the 1994 census and in Gillett and Lightfoot (2001).

²¹ Value breakdown: subsistence US\$10 000 000; coastal commercial US\$14 500 000; offshore locally-based US\$12 495 000; total US\$36 995 000. Not included in the total is the value of the offshore catch by foreign-based vessels, US\$144 000 000, nor the catch by FSM registered vessels outside the FSM.

²² Estimated from the 1998 Household Income and Expenditure Survey, primarily the value of imported canned fish.

²³ Estimated from information in Gillett and Lightfoot (2001).

III. STRUCTURE AND CHARACTERISATION OF THE INDUSTRY

General

Federated States of Micronesia (FSM) occupies a major part of the group of Micronesian Islands called the Carolines, a chain stretching over 2 500 km. in an east-west direction roughly parallel to the equator. There are four states in FSM, which from east to west are Kosrae, Pohnpei, Chuuk and Yap. Although the total land surface of FSM's 600 islands (65 of which are populated) is only about 701 sq. km. the EEZ covers a vast area of almost 3 million sq. km. and includes some of the richest tuna fishing grounds in the Pacific.

FSM is an independent state associated with the USA in a Compact of Free Association in effect since 1986. FSM has a federal government as well as four state governments which have a high degree of autonomy. The states have jurisdiction over waters within 12 nautical miles from islands, while the national government has the control over water beyond 12 miles to the outer boundary of the EEZ. Each state has its own administrative organizations, several agencies involved in fisheries, and its own plans for fisheries development and management.

Marine Fisheries

Marine resource use consists of inshore fisheries (those taking place in mangroves, reef areas, and lagoons), nearshore and bottom fisheries, and offshore fisheries (mainly for tuna). Subsistence fishers make the greatest use of inshore resources, coastal commercial fishers concentrate on nearshore and bottom resources, and offshore resources are exploited by local and foreign-based tuna vessels.

Subsistence and coastal commercial fishing employing a wide range of fishing gears and techniques is widespread in FSM. It is of primary importance in outer island communities and areas most distant from the main population centers. The most common 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, gill-netting and cast-netting. A 1995 report on subsistence fishing in Pohnpei alone estimated that a total of around 1 710 to 1 850 tons per year are caught by subsistence fishers. In both the Chuuk lagoon and the main island of Yap, traditional ownership of reefs is maintained and formally recognised, limiting access to these areas.

In the main islands of each state small-scale fishers sell catch in excess of their own requirements through various outlets. A few fishers and traders export small quantities of fish to Guam and Saipan, often as baggage on passenger aircraft. These fisheries are essentially extensions of the subsistence fishery and mostly rely on inshore species, which are susceptible to over-exploitation. Artisanal fishers also harvest trochus, some beche-de-mer, crabs, and some lobster for export. Pohnpei state has prohibited the export of its mangrove crabs.

The greatest cash value inshore resource is trochus (*Trochus niloticus*) shells, a commodity introduced to various locations within FSM by the Japanese before 1940. About 200 t of trochus, with an estimated value of US\$1.2 million, is harvested annually in the FSM.

Attempts to develop and structure the small-scale commercial fishery, through projects such as the financing of fishing craft in Chuuk and Kosrae, as well as other schemes, have met with limited success. Problems with catch distribution and marketing have remained important constraints.

Nearshore and bottom fish resources are utilized by small-scale commercial fishers operating mainly from outboard boats of 5 to 7m in length. Most hand-line bottom-fishing is conducted in waters shallower than 100 m, as the bathymetry of FSM's islands does not provide much demersal habitat below that limit. Hand-line trolling is a common method employed by these vessels. Ice is usually not carried and the catch is either sold immediately upon landing, or else iced or refrigerated on shore for later sale.

FSM's EEZ contains substantial tuna stocks that are fished primarily by foreign longline, purse seine and pole-and-line vessels under access arrangements. The operation of these vessels in FSM waters has increased steadily since the establishment of FSM's Micronesian Maritime Authority in 1979. During the years 1991-99, an estimated 1 250 300 tonnes of tuna were caught in the FSM EEZ. Of this amount, 86.3 percent was caught by purse seine, 8.8 percent by longline, and 4.8 percent by pole and line. In 1999 about 130,000 tonnes of tuna was taken in the FSM zone, of which only about 2 percent was captured by locally-based vessels. The overall catch consisted of 74 percent skipjack, 20.5 percent yellowfin, and 4.6 percent bigeye.

Purse seine fishing is currently permitted in FSM by vessels registered in Japan, Taiwan, China, Republic of Korea, USA, and Vanuatu, in addition to four locally-owned seiners. Longline fishing is currently carried out in FSM by Japanese, Chinese, and Taiwanese vessels in addition to those that are locally-owned. The number of vessels fluctuates from year to year, and even within years, depending on fishing conditions in FSM and elsewhere. Pole and line tuna fishing in FSM is exclusively by Japanese vessels, which are all based in Japan.

There is much inter-annual variation in the amount of tuna captured in FSM. The 1998 catch of target species in FSM was only 18.5 percent of the 1995 catch. This decline followed the climatic event known as *La Niña* that occurred in 1995. During such periods, surface tuna schools are most active in the western Pacific Ocean in the area of the FSM EEZ. In contrast, 1998 was a particularly severe *El Niño* year and the surface schools were concentrated more to the eastern part of the central Pacific.

The fees from foreign fishing in the FSM zone are extremely important to the country. In early 2000 there were 7 bilateral and one multilateral foreign fishing agreements in place. Between 1979 and late 2000 the FSM received over \$170 million in fees for the rights to fish for tuna.

In recent years many Taiwanese and Korean purse seiners have used ports in FSM for transshipping tuna caught in FSM and in the zones of neighboring countries. In 1999 90 500 tonnes was transshipped through FSM ports, mainly Chuuk and Pohnpei.

FSM is keen to participate more directly in the harvesting of its substantial tuna resources, and national investment in domestic tuna fishing and processing capacity has been substantial, at more than US\$ 100 million. The National Fisheries Corporation (NFC), a commercial entity established in 1989, has been the lead agency charged with developing a domestic tuna fishery.

In 1995 an Asian Development Bank fisheries development loan for \$6.5 million was extended to FSM Government for the purpose of developing a fleet of locally-owned longline vessels targeting the fresh sashimi market. The Micronesian Longline Fishing Company was founded and in mid-2001 was operating seven longliners from Pohnpei.

Inland fisheries

FSM has no significant inland fisheries.

Aquaculture

Aquaculture has been the focus of technical and development attention in FSM, as well as in some neighbouring countries, for over 20 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 reseedling.

A National Aquaculture Center (NAC) was established in Kosrae in 1991 to explore aquaculture potential and to undertake research, demonstration and training. Its primary work involved propagation of giant clams for farming and re-seeding in other states. In its early days the NAC was the operational base for aquaculture extension agents funded through the US Center for Tropical and Sub-Tropical Aquaculture (CTSA)/ Land Grant Program, but these have now relocated their activities to Pohnpei.

Despite the activities of the Center, so far no private commercial culture operations for giant clam have commenced in FSM, there has been little reseedling activity carried out, and there appears to be little prospect of any such development in the foreseeable future.

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 CTSA, the College of Micronesia, Japan Overseas Cooperation Volunteers, the Pohnpei Agricultural Training School, and the FAO South Pacific Regional Aquaculture Development Programme. 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 1980's, 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 but have not yet reached commercialization. Ventures in farming milkfish, tilapia, carp and prawns have been attempted or proposed but so far have failed to lead to commercial development.

Despite widespread interest among both national and state governments in the commercial potential of various aquaculture pursuits, there has been very little commercial development of aquaculture.

Utilization of the catch

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 centers 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 center has two or three smaller markets which operate privately as re-sellers. Chuuk has two cooperative societies that market their members' catch in the population center. Yap's fresh fish is mainly marketed through the Yap Fishing Authority retail outlet in Colonia.

In Pohnpei the road system now links most inhabited areas of the island with the population center, 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 1995 survey found 51 such markets scattered around the island, with an average daily fish sales volume of 73 kg. The total fish consumption in Pohnpei was estimated at around 3 000 t per annum.

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 artisanally-caught seafood 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.

The majority of fish landed in FSM by locally-based longline vessels (most vessels are based in Pohnpei) is air-exported to Japan air, via Guam. Estimated production by these vessels (about 35 total) in mid-2001 was about 80 to 100 tonnes per month. Fish 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.

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.

Although each of the states has considered establishing tuna canneries, including Chuuk States consideration of a US\$35 million plant at Tonoas island, none have yet been established. The Pohnpei Fisheries Corporation operates a fish processing facility that produces a range of tuna products, including vacuum-packed fresh and frozen loins and smoked fish. The plant sources fresh tuna from landings by foreign and domestic longliners, buying fish that have been graded as not of appropriate size or sufficiently high quality to justify air freighting. The facility has not been profitable due to many factors including insufficient/erratic fish supplies.

In late 2001 there were four tuna purse seiners wholly-owned by FSM entities. These four vessels (two based at Pohnpei, and one each at Yap and Chuuk) sell their catch on the world market, landing at either the canneries in American Samoa or transshipping from various overseas ports.

Demand

Fish and marine resources have traditionally been an important component of the Micronesian diet. Increased urbanization in all four centers has meant increases in demand at each location. This has been met partly by imports of cheap fish, such as canned Asian mackerel, as locally-produced fish and other traditional protein sources have increased in price.

The local market for fresh fish continue to operate in urban centres , however reductions in government employment due to reduced overseas support has meant somewhat less consumption in several locations.

There have been several attempts to calculate fish consumption in FSM. In recent years those estimates encompassing the whole country have ranged from 72 to 114 kg per person per year. Data from a 1997 household income and expenditure survey suggest that canned fish is responsible for about 25 percent of this consumption.

Economic Role of the Fishing Industry

It has been recently estimated by the Asian Development Bank that in FSM the catches by subsistence fishing are worth US\$10 million, by coastal commercial fishing US\$14.5 million, by locally-based offshore fishing US\$12.5 million, and by foreign based vessel US\$144 million. The same study also calculated that locally-based fishing in FSM in 1998²⁴ was responsible for about 9.5 per cent of the country's GDP.

Fish is the top export from the country. In 1997, the last year for which total export data is available, total exports recorded in government statistics amounted to \$4.9 million, of which "fish" exports were \$4.6 million or 94 percent.

The fees from foreign fishing in the FSM zone represent a very important source of income for the FSM government. In fiscal year 1999 access fees represented an estimated 39 percent of non-tax revenue and 22 percent of total domestic revenue for the national government.

Employment data in FSM is not thought to be very accurate and fisheries-related job data is scarce. Some idea of the employment situation is provided by a recent study by the Forum Fisheries Agency which examined FSM's tuna industry in 2000 and estimated the various types of jobs related to tuna fishing. Using the most recent estimates of numbers of local longliners and purse seiners, the number of FSM people working on locally-based tuna vessels is estimated to be 254, of whom 86 are FSM citizens. About 150 FSM citizens are employed aboard foreign tuna vessels. There are 178 FSM citizens shore-based employed by the tuna enterprises, including processors/exporters. The artisanal tuna fishing activity equates to about 200 jobs. It therefore appears that about 614 people from FSM are directly employed in the tuna industry.

IV. Development prospects

Much of the fisheries development potential in FSM is dependent on the condition of the country's tuna resources. The latest full-scale assessment of the status of FSM tuna

²⁴ The latest year for which FSM GDP information is available.

stocks was done in August 1995 by Dr J. Sibert. The report of the assessment concluded that:

- the stocks are in good condition, and it would be safe to increase harvest levels somewhat.
- The tuna fishery has many components, and the decision on whether to allow increases in all components or to confine increases to selected components depends on specific fisheries development goals of the FSM.
- Current harvest levels do not pose a threat to the sustainability of the fishery, but high purse seine catches may be depressing the yield of longline fisheries.
- Harvest levels of the longline fleets could be increased cautiously, but there should be no increase in purse seine harvest levels

An earlier assessment of FSM's tuna was done by the Secretariat of the Pacific Community in 1991. The SPC report concluded "taking into consideration the available information on the biology of the species and fisheries, there does not appear to be a case at present for the introduction of regulatory measures for the biological conservation of skipjack, yellowfin or bigeye in the FSM EEZ".

In the past, the government of FSM has attempted to benefit from the relatively abundant tuna resources by direct government participation in fishing and processing. This has proven to be quite unprofitable, resulting in huge financial losses for the country. Privatization of the government-owned fisheries enterprises has commenced but much remains to be done.

There appear to be tuna-related development opportunities, especially in servicing locally-based fishing vessels and supplying transshipping vessels. The feasibility of operating longliners from FSM ports is likely to improve with economies of scale; as more vessels base locally, the support infrastructure and logistics will improve. It is likely that this progression will also improve the airfreight situation, although the country's longline industry is likely to remain vulnerable to problems associated with air transport. If the government's present efforts to improve the business environment in FSM are successful, the economics of operating longline vessels from FSM ports should improve substantially.

It is likely that fees from foreign fishing activity in the FSM will continue to be a very important source of income for the FSM government. Recent studies have suggested that any changes to the present licensing regime should focus on lowering transaction costs associated with the licensing, reducing compliance costs, improving transparency, reducing confrontations with the foreign fleets and the FSM Congress, and taking active steps to increase rent in the fishery, such as a reduction in allowable effort. Several observers of the Pacific Islands fishing situation have concluded that multi-lateral licensing between Pacific Island countries and foreign fleets could increase benefits to FSM and neighboring countries.

Value-added processing industries have been operating for some time in Pohnpei utilizing non-sashimi grade tuna and by-catch of the fishery. The supply is erratic however, and a more stable fleet of foreign vessels needs to be in place to assure raw material supply.

Small-scale fisheries operating in coastal areas will be able to take advantage of export markets in Guam and Saipan, but resource concerns will probably limit any substantial expansion.

There have been critical reviews of aquaculture potential in FSM in 1990 and again in 2000:

- The 1990 review concluded: “The present status of aquaculture in the FSM indicated that the prospects for commercial activities has been exaggerated. Expectations have been inflated to unrealistic levels through uncritical assertions about the commercial viability of aquaculture. On the evidence obtained in the course of the review, and from analysis of similar activity throughout the Pacific and Asia, aquaculture will not be a significant revenue earner for the FSM”.
- The review in 2000 concluded: “despite widespread interest among both national and state governments in the commercial potential of various aquaculture pursuits, there has been very little commercial development. Traditional land tenure systems are a further impediment to the development of terrestrial aquaculture projects in some areas. Prospects for commercial activities have probably been overstated, and it seems unlikely that the sector will become a significant revenue earner for FSM, at least in the near future.”

It should be noted that some aquaculture specialists in FSM believe there is some potential and feel that the future development of aquaculture in the country will revolve around high-value export products such as pearls, aquarium life, sponges, and perhaps organisms with pharmaceutical properties.

V. INSTITUTIONAL ARRANGEMENTS

The main legislation dealing with fisheries in FSM is Title 24 of the Code of the Federated States of Micronesia. The preamble of this law states: “The purpose of this Title is to promote conservation, management, and development of the marine resources of the Federated States of Micronesia, generate the maximum benefit for the Nation from foreign fishing, and to promote the development of a domestic fishing industry”. Title 24 has the following components:

- General Provisions
- Domestic Fishing
- Management Authority
- Foreign Fishing
- Violations and Penalties
- State Entities for Development of Marine Resources
- National Fisheries Corporation

Title 18 of the Code establishes a territorial sea twelve nautical miles in breadth from an island baseline. Chapter 23 of the Code deals with marine species preservation. It prohibits the catching of marine life through the use of explosives, poisons, chemicals or other substances, or the use of those substances with the intent to kill marine life. There are also limitations, in the form of seasonal closures and size restrictions, on the taking of turtles, sponges, black-lip mother-of-pearl oyster shell and trochus. The taking of marine mammals for commercial purposes or by commercial fishing parties is prohibited.

An important facet of the legislation in FSM with respect to fisheries is the partitioning of jurisdiction between the national government and state governments. Article IX of the Constitution gives the National Government power "...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." Fisheries within the territorial sea and the internal waters of FSM are subject to the legislative control of the adjacent FSM State.

Fisheries legislation in all four 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, in each case, 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 – by mid-2001 only Kosrae had enacted the new fisheries legislation.

FSM's main national fisheries bodies are:

- The Micronesian Fisheries Authority (MFA), which is the government's regulatory and management arm, established to control the use of and manage and conserve the resources within FSM's 200-mile EEZ;
- The National Fisheries Corporation (NFC), responsible for promoting the development of pelagic fisheries and related industries.
- The Fisheries Section of the National Government Department of Economic Affairs (DEA), which provides national and state governments with technical services and support for development and management of marine resources, including non-living resources. The Section is also responsible for administration of the National Aquaculture Centre (NAC) in Kosrae, established in 1991 as a focal point for aquaculture demonstration, training and advisory services.
- The Maritime Surveillance Wing of the Department of Justice, which is responsible for surveillance and enforcement. The Division operates three patrol boats provided under grant-aid by Australia.

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.

There is some overlapping of responsibilities and activities with those of the federal organizations.

VI. INTERNATIONAL ISSUES

Both the Micronesian Fisheries Authority and the national Fisheries Section of DEA maintain direct contact on technical issues with regional and international organizations dealing in fisheries. Policy and other matters are managed in the first instance through

the Department of External Affairs. FSM is a member of the Secretariat of the Pacific Community (SPC), the South Pacific Forum Fisheries Agency (FFA) and the South Pacific Regional Environmental Programme (SPREP). FSM is also party to a number of treaties and agreements relating to the management of regional fisheries, including:

- the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America;
- the 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.

FSM is a signatory 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.

VII. RESEARCH AND TRAINING

On-site marine fisheries research has in the past been undertaken mostly by foreign governments and institutions. The country's past ties with Japan and its relative proximity has meant that FSM has often been used as a research area for Japanese university research vessels and training ships.

The national Fisheries Section of DEA undertakes fisheries and aquaculture research at the national level. This has included monitoring, intended to allow ongoing assessment of the status of the main fisheries; surveys and assessments of specific resources; and development-oriented research to identify new grounds or techniques with commercial fishing or aquaculture potential. Activities have included investigation of clam farming, bait fishing, grouper spawning aggregations, trochus re-seeding and tuna fishing.

The Micronesian Fisheries Authority employs a staff biologist whose main tasks are to analyze catch and effort data of the foreign and domestic fleets and operate the Authority's onboard observer programme.

The College of Micronesia (COM) in Pohnpei undertakes its own research on inshore fisheries. A resident extension agent seconded from the University of Hawaii Sea Grant Program undertakes some research at the college.

At the state level, inshore fisheries research is undertaken to varying degrees by the relevant government department in charge of marine resources. Most research is undertaken using extra-budgetary funding as governmental budgets do not allow for such activities.

The College of Micronesia offers a two-year Associate Sciences degree in Marine Resources. Higher-level education is generally obtained at overseas institutions.

As regards training, the Fisheries and Maritime Institute (FMI) was established in Yap in 1990 as a private institution but is now a part of COM. The Institute's current role is training for the existing needs of the fishing sector through the running of skipper, deckhand and marine engineer courses.

The Ponape Agriculture and Technical School (PATS) started a marine program in 1997. This includes instruction in SCUBA and aquaculture operations, including sponge farming, giant clam cultivation, pearl oyster farming and coral fragmentation. The school is equipped with raceways, pumps, small boats and other equipment needed for this purpose.

VII. AID

FSM's fisheries aid comes from a variety of sources but Japan is by far the largest donor with numerous infrastructure projects being completed over the years. The Japan International Cooperation Agency (JICA) and the Overseas Cooperation Foundation (OCF) have provided volunteer services as well as training programmes in Japan. Recently JICA has funded ten aquaculture volunteers and a fishery statistician to work with FSM's state governments, as well as three environmental volunteers. Coastal management training is offered in Japan and an estimated one-third of FSM fisheries personnel have participated in this training. Technical cooperation has included the provision of four technical experts and supporting grant-aid to the Fisheries and Maritime Institute in Yap, as well as support for the extension of fishing ports in Pohnpei and Chuuk, the provision of longline fishing vessels to the FSM Federal Government, and supply of artisanal fishing vessels and support facilities to all four states.

In recent years, institutional strengthening in the fisheries sector has come mainly from the Asian Development Bank. The Bank has provided seven technical assistance projects and one loan related to fisheries since 1990.

The FSM Development bank administers an Investment Development Fund created by the Compact of Free Association with the United States. Funds can be utilized to finance projects in the private sector requiring US\$ 500,000 or more.

Programmes of technical cooperation, collaboration and assistance are maintained with the Governments of Japan, Australia, New Zealand, and through the Compact arrangements with the United States. Other assistance to the fisheries sector has been provided from a range of sources, including FAO, UNDP, USAID, ACIAR, FFA, SPC, and the World Bank.

IX. INTERNET LINKS

www.spc.org.nc/coastfish/Countries - Information on FSM fisheries, links to other sites concerning FSM, and some SPC reports on fisheries in FSM.

www.fsmgov.org - Information on the FSM government agencies, including those involved with fisheries.

www.nmfs.noaa.gov/sfweb/sk/saltonstallken - information on a management plan for beche de mer in Micronesia.

www.micsem.org - Discussions of important issues in FSM, including those related to fisheries.

www.visit-fsm.org/pohbusbdf.html - Information on FSM businesses, including those involved in fishing.

FIJI



FIJI

I. GENERAL ECONOMIC DATA²⁵

Land area ²⁶ :	18 272 sq. km.
Ocean area:	1 290 000 sq. km.
Shelf area (10-100 m):	About 15 000 sq. km.
Slope area (100-400 m):	About 11 376 sq. km.
Length of coastline:	5 010 km
Population (1999) ²⁷ :	812 100
Gross Domestic Product (1999) ²⁸ :	US\$ 1 821 million
Fishing contribution to GDP (1999):	US\$ 42.9 million
GDP per capita (1999):	US\$ 2 242

II. FISHERIES DATA

Commodity Balance (1999, unless otherwise noted):

	Production ²⁹	Imports ³⁰ (1998)	Exports	Total supply	Per caput supply
Fish for direct human consumption ³¹	36 420	16 584	12 445	40 559	49.9
Fish for animal feed and other purposes ³²	10 000			10 000	

Estimated employment (1996):

(i) Primary sector:	6 246
(ii) Secondary sector:	5 000
(iii) Subsistence fisheries:	30 000

Gross value of Fisheries Output (1999) ³³ :	US\$ 65 546 304
Trade: Value of imports (1998)	US\$ 22 106 517
Value of exports (1999)	US\$ 29 193 745

²⁵ Average 1999 rate of exchange US\$ 1.00 = Fiji dollar (F\$) \$1.9696; 2000 – 2.1286

²⁶ Source: Secretariat of the Pacific Community Statistical Summary 2000.

²⁷ Source: Secretariat of the Pacific Community 1999 mid-year estimate.

²⁸ Source for GDP data: Gillett and Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, Manila.

²⁹ Breakdown (tonnes): subsistence 21 600; coastal commercial 9 320; offshore locally-based 5 500; total 36 420. The total does not include the 917 tonnes caught by foreign-based offshore vessels. The estimated 1 600 mt of fish caught by PAFCO-associated longliners is also not included as much came from outside the Fiji zone.

³⁰ The corresponding official figure for 1999 is 5 170 t, which appears to be in error

³¹ Sources: various government and non-government sources in Gillett and Lightfoot (2001)

³² Fish meal in Fiji is produced from tuna canning waste and may therefore already be included in the 'Fish for direct human consumption' production figure.

³³ Value breakdown: subsistence US\$24 675 061; coastal commercial US\$15 231 519; offshore locally-based US\$25 639 724; total US\$65 546 304. Not included in the total is the value of the offshore catch by foreign-based vessels, US\$554 936.

III. STRUCTURE AND CHARACTERISTICS OF THE INDUSTRY

General

Fiji is an archipelagic nation comprising about 322 islands with a total land area of 18 272 sq. km. and a surrounding EEZ of about 1.3 million sq. km. The group includes two large high islands, several medium-sized high islands, and numerous small islands and atolls. Most of the islands are surrounded by fringing and barrier coral reefs. Much of Fiji's coastal waters occur off the main islands of Viti Levu and Vanua Levu and the islands of the Mamanuca and Yasawa groups.

There are three substantial rivers, a few lakes and some man-made impoundments where fishing and aquaculture take place, but marine fisheries are predominant.

About forty per cent of the residents of Fiji are descendants of immigrants from India. The indigenous Fijians control much of the inshore fishing areas and do most of the subsistence fishing, but a substantial portion of the coastal commercial fishing is carried out by Indians.

Although fisheries are important in the economy of Fiji, tourism is one of the largest industries in Fiji. Coastal tourism is an important component and this has important implications for fisheries development and management.

Marine Fisheries

Fiji's marine fisheries are estimated to generate annual landings of about 36 400 tonnes. Fishing is divided into three sub-sectors: subsistence, coastal commercial, and offshore/industrial. The distinction between subsistence and the coastal commercial fishing in the larger, less isolated islands is often blurred as small-scale fishing activity is becoming increasingly monetised in these areas.

The subsistence fishery targets mainly finfish, beche de mer, octopus, seaweed, lobster, mud crab, and various bivalve molluscs. These resources make a large contribution to domestic food supplies. It has recently been estimated that 50 percent of all rural households are involved in some form of subsistence fishing and that about 21 600 t of fish are landed each year, or slightly more than half of all domestic production.

According to Fisheries Division data, 1 012 vessels and 2 304 fishers participated in the coastal commercial fishery in 1999. It is estimated that 9 320 t of finfish and non-fish (i.e. invertebrates and plants) were harvested by this component of the fishery in 1999. By weight the finfish was responsible for about 52 percent of the landings.

The four most important exports from the coastal commercial fishery are beche de mer, trochus, aquarium fish, coral, snapper, and live food fish. According to the Fisheries Division, the annual production of beche de mer in the late 1990s was about 250 t. The 1999 production of trochus was estimated to be 92 t. In the same year the four aquarium fish businesses exported about US\$762 000 worth of aquarium fish and about twice that value in various forms of coral. Coral extraction is one of the most contentious issues in the fisheries sector. In 2000 about 80 tonnes of snapper was caught, of which 29 tonnes was exported. About 8.4 tonnes of live food fish was exported the same year.

A survey on the main Island of Viti Levu in the mid-1990s showed that 60 percent of small-scale fishing took place in lagoonal areas. Close to population centres fishing driven by market demand has resulted in the over-exploitation of commercially important species in the inshore areas. Area closures and bans on gill netting for reef fish, particularly in the north and west of the country, seem to have been effective in restoring stocks of some species. Between 1998 and 1999 there was a 2.9 percent decrease in the number of fishing licenses issued for inshore waters. In the more remote areas, artisanal fisheries are not fully developed because they are constrained by lack of access to markets.

The industrial fishery is entirely tuna-oriented and has the following components:

- a pole-and-line fishery, mainly targeting skipjack and small yellowfin tuna. This fishery has declined in recent years. Seven vessels were active in the mid-1990s, but during the 2001/02 season only two vessels participated. Problems related to access to bait fishing areas and the economics of pole-and-line fishing are the major factors for the decline.
- a longline fishery targeting large bigeye and yellowfin tuna, taking most of its catch within Fiji fisheries waters, and landing the chilled catch for export by air to fresh fish markets in the United States and Japan. The fleet of domestic longliners has increased substantially. In recent years there have been between 40 and 50 vessels and landings are now about 5 500 t per year.
- a freezer longline fishery involving mainly Taiwanese vessels fishing under charter to the Pacific Fishing Company (PAFCO). These vessels, which target mainly albacore tuna, fish within Fiji's EEZ as well as the EEZs of neighbouring countries, and international waters in the area. These vessels have landed between 2 000 and 3 000 t of tuna in recent years, primarily at the PAFCO tuna cannery in Levuka, but with some transshipment to other destinations.
- an occasional tuna purse seine fishery in the northern portion of the EEZ under the terms of the U.S. multilateral treaty. US and occasionally other purse seine vessels sometimes visit Fiji but this is usually only to obtain duty-free fuel. Actual fishing by these vessels normally only occurs in El Niño years, at which times it takes place in the extreme north of the country.

Apart from the multi-lateral tuna treaty with the United States, under which only sporadic fishing occurs, Fiji has access agreements in place with Japan, but only a very small amount of fishing has been done by Japanese vessels in Fiji waters in recent years.

Inland fisheries

The freshwater mussel (*Batissa violacea*) is the major freshwater species of commercial importance. It has been estimated that market sales of this species is around 1 000 t per year. Other inland fisheries for species such as freshwater prawns (*Macrobrachium* spp.) and fish, are at the subsistence level and there is no estimate of the amount of catch.

Aquaculture

The most important form of aquaculture in Fiji is the culturing of various species of tilapia (*Oreochromis* sp.). It was estimated that in 1999 subsistence and semi-commercial farmers produced a total of 297 t. According to the Fisheries Division, in 1999 there were 46 ha. of tilapia ponds in 16 commercial and 268 subsistence farms.

Culture of giant clams (*Tridacna* sp.) is undertaken at the Fisheries Division's mariculture research facility on Makogai Island. In 1999 about 270 000 clams of various sizes were being maintained at the ocean and land nurseries.

Two local companies produced about 150 to 200 t of penaeid shrimp annually in the late 1990s. A single farm cultures blacklip pearl shell (*Pinctada margaritifera*) for pearl production in north-eastern Viti Levu. An experimental pearl farm was set up at Nasavusavu with funding and technical assistance from ACIAR and ICLARM. About 3 000 pearl shells are under culture at the facility.

In 1999 a beche de mer hatchery was set up for studying the techniques of breeding and re-seeding reefs with juveniles.

Farming of *Eucheuma* seaweed took place during the late 1980s but ceased in the early 1990s, mainly as a result of changed market conditions. It was revitalized in the late 1990s under a promotional scheme known as the Commodity Development Fund. In 1999, 632 farms produced seaweed for export.

An initiative is currently under way to culture milkfish (*Chanos chanos*) for use as tuna longline bait. Twenty ponds of five hectares each have been constructed in 1998 and 22 additional sites were surveyed for development in 1999.

Attempts have been made to culture various other species in Fiji, but these have generally been unsuccessful. These have included bass carp, bivalves (*Anadara*, *Gafarium*, and *Batissa*), cockles, mangrove crab, molly (*Poecilia mexicana*), mullet, green mussel, eleven species of oysters, freshwater prawns, rabbitfish, tarpon, two species of donor fish (*Puntius* sp.), and two species of turtles,

Utilization of the catch

Most of the fish from inshore waters is consumed fresh locally. According to the Fisheries Division, about 70 percent is for home consumption by the harvestors and the remainder is sold through municipal markets and other outlets.

The beche de mer is dried and processed locally and exported to China by 13 licensed companies. Exports peaked in 1988 with 700 tonnes. The trochus is made into button blanks which are then exported to button factories in Asia and Europe. Aquarium fish are air freighted to the west coast of the United States and Europe.

There are a few small canneries and two major fish canneries in the country:

- the Pacific Fishing Company (PAFCO) cannery at Levuka on Ovalau Island, which cans domestically caught and imported tuna, principally for export and produces tuna loins for overseas canneries
- the Voko cannery outside Suva, which cans imported mackerel, mainly for the domestic market.

In 1999 PAFCO exported about US\$8 million of canned tuna and tuna loins. In 2000 the value was about US\$7.1 million for the 9 920 tonnes processed. During the same year about 5 000 t of fresh chilled fish (mostly tuna) were exported by air freight, mainly to the United States and Japan.

Demand

Studies in the mid-1990s have shown that 99.3 percent of coastal villages on the main island consume marine products at least once per week and that 50 percent of all rural households participate in fishing activities. The per capita consumption of fish has been estimated by the Fisheries Division to be between 44 and 62 kg in recent years. This is comprised of 45 percent subsistence production, 15 percent artisanal production, and 40 percent imports (both canned and frozen).

Economic Role of the Fishing Industry

It has been recently estimated by the Asian Development Bank that the catches by subsistence fishing are worth US\$24 675 061, by coastal commercial fishing US\$15 231 519, and by locally-based offshore fishing US\$25 639 724. The same study also calculated that this fishing is responsible for about 2.4 per cent of Fiji's GDP. Because fish processing and other post-harvest activities are considered in other sectors of Fiji's economy for GDP calculation purposes³⁴, the contribution of fisheries to the economy of Fiji is substantially larger than the 2.4 per cent from fishing alone.

The 1996 census shows that fishing provides jobs to 2.22 percent of the 280 505 people formally and informally employed in the country. The census indicates that an additional 1 100 people are employed in "processing fish".

Data from the Fiji Islands Revenue and Customs Authority shows that the fishery products represent 6 percent of the value of all commodity exports from the country.

Fiji receives about US\$212 000 annually in fees for access by foreign fishing vessels to Fiji waters.

IV. DEVELOPMENT PROSPECTS

Much of the potential for increasing fisheries production is from the offshore areas, especially the tuna resource. Promotion of the semi-industrial sashimi longline fishery has been quite successful in recent years and efforts to further develop the fishery will continue. Expansion of this fishery is highly dependent on regular airfreight service at viable rates. Through the use of fish aggregation devices (FADs), artisanal fishermen will be encouraged to utilize the large offshore tuna resources, thereby diverting effort away from the heavily-exploited inshore and coastal areas.

Aquaculture production, although still quite small, is gaining momentum. Tilapia farming, which has been carried out for several decades at the subsistence level, is now being attempted on a commercial scale. The production of penaeid shrimp has expanded recently and this trend will probably continue. Export oriented aquaculture will continue to face stiff competition from countries with low production costs and efficient transportation links to major markets.

The scope for increasing production from inshore and coastal areas is generally considered to be limited, and the government is focusing an increasing amount of

³⁴ For example, under international conventions the contribution to the economy of the PAFCO tuna cannery is considered to be in the manufacturing sector.

attention on the management of over-exploited inshore fisheries. A central feature of the new management initiatives is the devolution of management authority to local government units and, beyond this, to coastal communities having traditional rights of marine tenure.

There is nevertheless scope for improving the value of the landings from coastal and inshore fisheries, mainly through improvements in the post harvest area. Increased use of ice and value-adding activities appear to be the most promising areas for future development. The scattered nature of the islands presents difficulties for marketing, but the growing demand for fishery products presents new opportunities for many of Fiji's islands. As a consequence, there is a need for improved fish transport arrangements and practices so that fishery products can be harvested in rural areas for marketing in urban centres.

Much fisheries development activity in the past has been carried out by government, but in future if this could be devolved to the private sector, the government will be able to focus more closely on fisheries management issues. This change in focus will involve skills that are not presently available, and some re-training of government staff will probably be required. Mechanisms need to be developed to ensure that any government interventions in the fisheries sector are relevant to the interests of stakeholders.

V. INSTITUTIONAL ARRANGEMENTS

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 fisheries waters as all internal waters, archipelagic waters, territorial seas and all waters within the exclusive economic zone.
- Establishes a Native Fisheries Commission charged with the duty of ascertaining the customary fishing rights in each province of Fiji.
- Prohibits the taking of fish in Fiji 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, licenses are personal to the holder, and licenses are 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.
- 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 fisheries waters or in any specified part thereof; (e)

regulating the procedure relating to the issue of and cancellation of licenses and the registration of fishing boats and prescribing the forms of applications and licenses therefore and the conditions to be attached; (f) prescribing the fees to be charged upon the issue of licenses 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 licenses/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. Formal declaration of the archipelagic waters and the exclusive economic zone is contained in the Marine Spaces (Archipelagic Baselines and Exclusive Economic Zone) Order.

The management of living marine resources in Fiji is the responsibility of the Fisheries Division of the Ministry Fisheries and Forests. The Fisheries Division, headquartered at Lamia near Suva, had 109 staff positions in 2000, of which 17 were vacant.

The Division's organization reflects Fiji's national administrative divisions, so that divisional offices are located in Lautoka (Western Division), Labasa (Northern Division), Nausori (Central Division) and Lamia (Eastern Division). To better serve rural fishers the Division also maintains offices at Rakiraki, Tavua, and Ba, in Western Division; Taveuni, Savusavu, Lekutu and Nabouwalu in Northern Division; Navua, Tailevu and Wainibokasi in Central Division; and Lakeba, Vunisea and Levuka in Eastern Division.

VI. INTERNATIONAL ISSUES

The Fisheries Division maintains direct contact on technical issues with regional and international organizations dealing in fisheries. Policy and other matters are managed in the first instance through designated contact points, most often the Ministry of Foreign Affairs.

Fiji is a member of the Secretariat of the Pacific Community (SPC), the South Pacific Forum Fisheries Agency (FFA) and the South Pacific Regional Environmental Programme (SPREP). Fiji is also party to a number of treaties and agreements relating to the management of regional fisheries, including:

- the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America;
- the Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific; and,
- the Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region.

Fiji was the first signatory to the United Nations Convention on the Law of the Sea (UNCLOS). Fiji is also a signatory to:

- 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.
- the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean.
- the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

VII. RESEARCH AND TRAINING

The Fisheries Division plays an active role in research in support of resource assessment, development, management, and aquaculture promotion. The Division has a research section within its Lamia headquarters, which carries out a range of research and monitoring projects, as well as freshwater aquaculture research stations at Naduruloulou and Dreketi and a mariculture research station on Makogai island.

Past research activities carried out by the Fisheries Division include:

- Aquaculture research: beche de mer, tilapia, pearl oysters, carp and milkfish
- Monitoring of sales of fish, invertebrates and aquatic plants through Fiji's main markets;
- Study of the nature and extent of the subsistence fishery;
- Assessment of baitfish stocks and of the impacts of baitfish harvesting on juveniles of other commercially important species;
- Experimental culture and re-seeding of giant clams (*Tridacna* spp); and
- Stock assessment of fresh-water prawns (*Macrobrachium* species), fresh water mussels (*Batissa violacea*) and mud-crabs (*Scylla serrata* and allied species).

The University of the South Pacific (USP) also regularly undertakes marine research activities in Fiji, often focusing on commercially important species. The University has undertaken biological studies on sea cucumbers, deep-water shrimps and marine algae, as well as carrying out social, economic and post-harvest research relevant to fisheries.

Two main institutions offer education and training relevant to fisheries:

- the University of the South Pacific, which is based in Suva, offers diploma and degree courses in fisheries and marine biology as well as specialisations in maritime law and post-harvest fisheries; and
- the Fiji Institute of Technology (FIT) offers training in engineering, refrigeration and other vocational skills relevant to the fishing industry. The Fiji School of Maritime Studies, which is a branch of FIT, offers seamen's training and certification, including various classes of skippers and engineers licenses;

In addition, many members of the Fiji fisheries sector have undertaken training at overseas universities and technical colleges.

VIII. AID

Fiji receives technical assistance in the fisheries sector from a number of bilateral donors including Japan, Australia, New Zealand, the United Kingdom, the European Union, and the United States. 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, as well as several UN agencies (UNDP, ESCAP) have also been active in supporting Fiji's fisheries sector.

Some of the major recent donor interventions are: Australian Centre for International Agriculture Research (giant clam resource management), Foundation for the Peoples of the South Pacific (coral reef management), the South Pacific Regional Environment Programme (marine turtle management), the Secretariat of the Pacific Community (assistance with community initiatives in coastal resource management in Macuatu), World Wide Fund for Nature (coral reef management), and Biodiversity Conservation Network in association with the University of the South Pacific (community-based coastal resource management in Verata).

IX. INTERNET LINKS

www.spc.org.nc/coastfish/Countries/fiji - Information on Fiji fisheries, links to other sites concerning Fiji and its fisheries, and some SPC reports on Fiji fisheries.

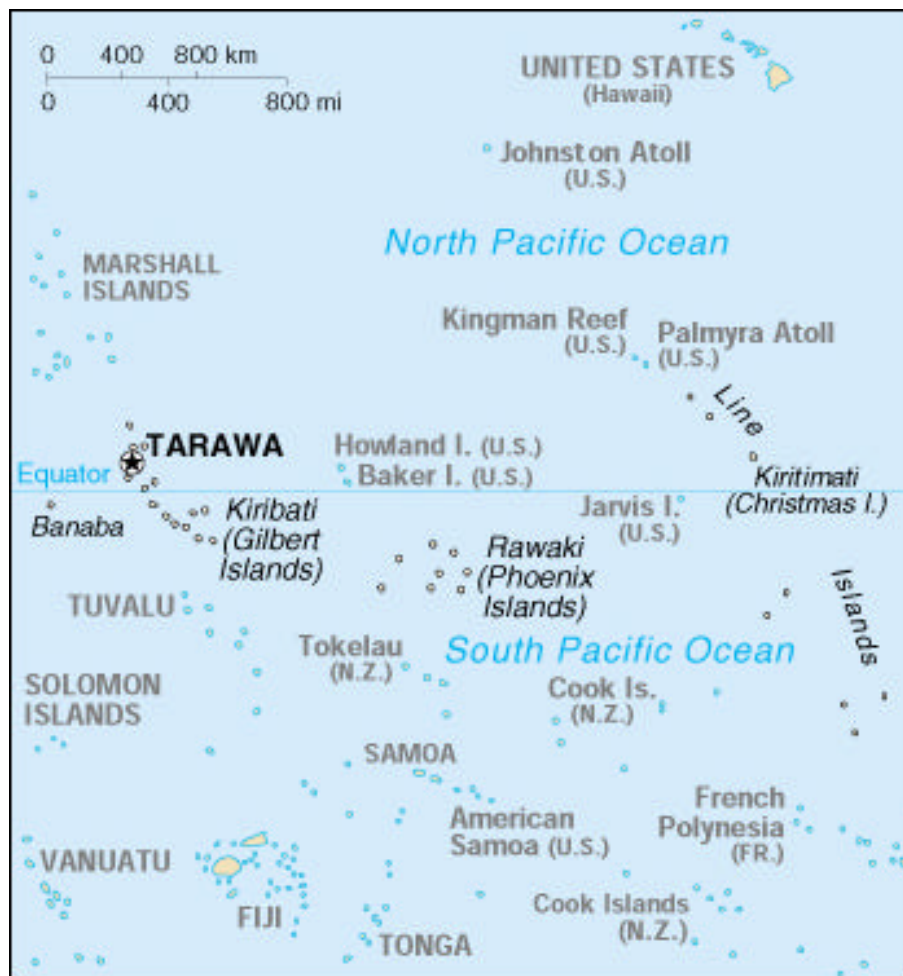
www.vanuatu.usp.ac.fj - Text of Fiji fishery legislation.

www.fiji.gov.fj - Details of the Fiji government's Fisheries Division.

www.unescap.org/drpad/vc/conference - Information on case study of community-based decision-making on coastal fisheries in Fiji.

www.aciar.gov.au/publications/db/subjects - Contains the ACIAR publications on fisheries, including several on Fiji fisheries.

KIRIBATI



KIRIBATI

I. GENERAL ECONOMIC DATA³⁵

Land area ³⁶ :	810 sq. km.
Ocean area:	3 550 000 sq. km.
Length of coastline:	1 296 km
Population (2000) ³⁷ :	90 700
Gross Domestic Product (2000) ³⁸ :	US\$ 54 460 000
Fishing contribution to GDP (2000):	US\$ 11 729 000
GDP per capita (2000):	US\$ 600

II. FISHERIES DATA

Commodity Balance (1999):

	Production ³⁹	Imports ⁴⁰	Exports	Total supply	Per caput supply
Fish for direct human consumption ⁴¹	16 000	380	139	16 241	183
Fish for animal feed and other purposes	0	0	0	0	-

Estimated employment (1996):

(i) Primary sector:	1 131
(ii) Secondary sector:	n/a
(iii) Subsistence fisheries:	20 000

Gross value of Fisheries Output (1999)⁴²: US\$ 14 200 000

Trade: Value of imports (1995)⁴³ US\$ 424 640

Value of exports (1999)⁴⁴ US\$ 1 485 160

³⁵ Average 1999 rate of exchange US\$ 1.00 = Australian dollar (A\$) \$1.5500; 1.7250 in 2000.

³⁶ Source: South Pacific Commission Statistical Summary 2000.

³⁷ Source: South Pacific Commission 2000 mid-year estimate.

³⁸ Source for GDP data: Gillett and Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, Manila.

³⁹ Breakdown (tonnes): Coastal subsistence – 10 000; Coastal commercial – 6 000; Offshore locally-based 0; Total 16 000.

Note: The above does not include the catch by offshore foreign-based vessels of 132 000 mt

⁴⁰ Data is from 1995 (latest available).

⁴¹ Various government and non-government sources as given in Gillett and Lightfoot (2001).

⁴² Breakdown: Subsistence fisheries US\$7 890 322, coastal commercial fisheries US\$6 309 677

⁴³ Data is from 1995 (latest available).

⁴⁴ From a variety of government sources given in Gillett and Lightfoot (2001).

III. STRUCTURE AND CHARACTERISTICS OF THE INDUSTRY

General

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, and therefore no freshwater fisheries.

Marine Fisheries

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.

The majority of small-scale fishing activity in Kiribati is for subsistence purposes. In outer island areas especially, customary obligations relating to the sharing of catch among family and kinship groups prevail. 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. The commercial fish catch from the coastal zone is principally made up of reef and deep slope fish (54 percent), molluscs (25 percent), and pelagic species (21 percent).

There are approximately 200 to 250 small, motorized skiffs based in South Tarawa trolling for tuna and other large pelagic species. Surveys by the Fisheries Division show that weekly landings of tuna in Tarawa by these small-scale fishers is about 33 mt, or about 1 650 mt per year. The weekly production for the other islands of Kiribati ranges from .5 mt to 20 mt per island, averaging 8 mt per island.

The arc shell *Anadara* is quite important in Tarawa and other lagoons in the northern part of the Gilbert Group. A study in the mid-1990s showed that the yearly catch of *Anadara* in Tarawa was 1 400 mt. The catches were about 9 kg per day from each of the estimated 500 subsistence gatherers, and 111 kg per day from each of the estimated 35 commercial divers.

The relatively recently-established aquarium fish industry in Kiribati now accounts for 78 percent of the value of all fishery exports from the country with the nominal reported FOB value of US\$1 160 000. Aquarium fish collectors target a large number of species, with the major families being butterflyfish (Chaetodontidae), damselfish and angelfish (Pomacentridae), and surgeonfish (Acanthuridae).

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. Since its establishment TML has been provided with assets and technical assistance with a value in excess of US\$14 million, including six pole-and-line vessels, a refrigerated carrier vessel, cold stores, an ice plant and a wharf. The company's best production was reached in 1989 with a catch of 2 272 mt. In 1990 TML's fishing vessels were relocated to Solomon Islands but catches there were insufficient to cover operating costs. In 1991, following the accumulation of losses totaling approximately US\$7 million the company's board suspended operations. Since that time four fishing vessels, the carrier vessel and a cold store were refurbished with donor assistance. The fleet operated intermittently in the Gilbert Group and in the Solomon Islands. In the late 1990s the refrigerated carrier vessel was leased for operations in other countries and became the sole source of income for TML. The company ceased operations in 2000. Recently the facilities have been refurbished and a new company, Central Pacific Producers, was created for tuna fishing operations.

In recent times the Government has entered into other industrial fishing ventures, notably a joint-venture purse-seine arrangement with a Japanese company. A single purse-seine vessel operates under this arrangement. Catches in 1999 by this vessel were about 5 000 mt, most of which were in the waters of Papua New Guinea. The seiner made no catches in Kiribati waters that year.

The Government has also undertaken negotiations with potential joint-venture partners with the intention of establishing a longline fishing base for the production of fresh tuna for sashimi markets. It is hoped to service such a fishery using shore facilities of the former TML.

Kiribati's EEZ is an important tuna fishing zone for industrial fleets from a number of distant-water fishing nations (DWFNs) including Japan, Taiwan, China, Republic of Korea, the United States and Spain. In 1999 a total of 132 391 mt of tuna were caught by DWFNs, using primarily purse seine gear. In early 2001 the licensed fleet consisted of about 260 longliners, 95 purse seiners, and 37 pole/line vessels.

An important point about tuna fishing in Kiribati concerns the oceanographic conditions and their affect on tuna purse seining. During El Niño periods, the areas which have conditions favorable to seining move from Papua New Guinea and the Federated States of Micronesia eastward to the Kiribati zone, resulting in large tuna catches in the Gilbert, Phoenix, and Line Islands.

Employment of Kiribati citizens on foreign vessels, both merchant and fishing, is a major source of revenue for the country, with remittances from Kiribati seamen forming a major part of household income, especially in rural areas. Fishermen are trained for foreign service by the Kiribati Fisheries Training Centre, and then hired on to DWFN vessels (mainly Japanese) through a locally-based recruitment agency, Kiribati Fisherman's Services (KFS) Ltd.. In 2000 about 350 Kiribati fishermen were employed on overseas fishing vessels. KFS has a target of placing 1 000 Kiribati crew on foreign fishing vessels.

Inland fisheries

There are no freshwater fisheries in Kiribati. Impoundment of milkfish (*Chanos chanos*) fry at spring tides occurs in brackish water lagoons on some islands and the fish are subsequently harvested after growing to a larger size. The deliberate impoundment and on-growing of milkfish has been developed to a commercial level in Christmas Island, where the naturally occurring brackish lagoons have been linked together by man-made channels to form a series of milkfish ranching impoundments with a total surface of over 1,000 ha. Fish are harvested for local consumption and for air export to Honolulu.

Aquaculture

An 80 ha milkfish farm was established by government on South Tarawa in the late 1970s to produce bait for the domestic pole-and-line fishery. However the farm has never operated with great success, partly because of infestation of the ponds by introduced tilapia, and partly due to the performance difficulties of the national pole-and-line fleet. There are plans to increase production of milkfish for food and to produce frozen bait for longline vessels. The Government is also attempting to promote private milkfish farming in suitable outer island areas.

Eucheuma seaweeds have been cultured in Kiribati since the early 1980s and farms established in suitable atolls throughout the country's three island groups. Farming involves attaching small pieces of seaweed to lengths of fishing line staked out in the lagoons. The seaweed is harvested after 45 to 60 days, sun-dried and packed into bales for shipping. Commercial exports commenced in 1990 when the government-operated Atoll Seaweed Company established to foster this industry and 100 mt was shipped to Denmark. Production increased significantly in 1995 following the establishment of a new programme of technical support by the Government. Production in 2000 was 1 435 mt of which 1 381 mt came from the Line Group.

Other forms of aquaculture are being investigated in Kiribati, including farming of pearl oysters (for pearl production), giant clams and beche-de-mer, but none of these are yet close to entering a commercial phase. Other species which have been tried in the past are brine shrimp, cockles, mojarra, molly, mullet, and mussel.

In the late 1990s trochus was transplanted from Fiji to a quarantine facility in Tarawa and subsequently to an outer island.

Utilization of the Catch

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. Some islands have been equipped with ice and cold storage plants with the intention of storing catches for transport to and sale in South Tarawa. Such schemes continue to meet with limited economic success due to the difficulties and cost of maintaining the infrastructure and transporting the product.

Catches taken by artisanal fishers in South Tarawa are mainly sold alongside the road from insulated ice boxes. Some are disposed of through a small commercial fish market. Although market preference is for fresh product, frozen fish is readily sold when demand for fresh fish exceeds supply, and salted fish is in steady demand due to taste

preference. A study by the Fisheries Department indicates that some 89 per cent of the catch taken around South Tarawa is marketed, compared to only 18 per cent in other areas of the Gilbert Group.

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 US\$57 960 was sent to Australia, New Zealand, Korea, Japan, and Hawaii. A new factory was built in 1999 and a new jerky product for cats was added to the exports.

The aquarium fish are exported to distributors the mainland United States via Hawaii.

The tuna catches by the offshore foreign-based fishing vessels are disposed of in a variety of ways. Tuna from the Japanese vessels (seiners, longliners, pole/line vessels) is delivered directly to Japan. The US vessels offload their catch at the canneries in Pago Pago, American Samoa. Most of the Taiwanese and Korean purse seine vessels usually transship their catch from Tarawa or Majuro to canneries in Thailand or elsewhere.

Demand

Seafood is a key source of nutrition for the Kiribati population, accounting for around three-quarters of animal protein in the national diet. Seafood is also a very popular and desired food and many cases is the largest component of household meals. The level of per capita seafood consumption is one of the highest in the world, with estimates variously ranging from 72 to over 200 kg over the past decade.

In the less-populated centres, supplies from subsistence and small artisanal fishing activities are normally sufficient to meet demand. In the urban areas, particularly Tarawa, shortfalls in supply may occur, especially now that TML vessels are not operational. In Tarawa there is a growing trend towards fish being replaced by cheap, low-grade imported forms of protein. Canned fish imports are about 380 mt annually equivalent in food value to about 760 mt of whole fish.

Economic Role of the Fishing Industry

A recent study by the Asian Development Bank estimated that the fishing contribution to GDP was about US\$11.7 million. This equates to 21.5 percent of GDP. This appears to be considerably higher than the fishing contribution of any other Pacific Island country.

Exports of fishery products were valued at US\$1 485 160 in 1999. This represents 16.9 percent of the value of all exports from the country in that year.

Surveys by the Fisheries Division indicate 88 percent of the households in Kiribati participate in fishing. Of those that do fish, 17 percent fish commercially full time, 22 percent fish commercially part-time, and 61 percent fish only for subsistence. The 1995 census showed that the main source of cash income for 29 percent of the 11 920 households in Kiribati was fishing.

Revenues derived from the licensing of foreign vessels for fishing access in Kiribati's EEZ have ranged from an annual average of around US\$200 000 in the early 1980s to

between US\$1.4 and US\$3.4 million during the period 1985-1990. Revenues increased significantly to more than US\$9 million in 1991-92, but this high level resulted from the payment of fees for fishing activity in previous years, record catches by the US purse seine fleet, and revenue from fines, settlements and forfeitures for illegal fishing. Nine prosecutions for illegal fishing activity were successfully pursued between 1987-91, generating revenues of US\$5.6 million. Fishing conditions in 1999 and 2000 resulted in a remarkable increase in access fees from foreign purse seine activity in the Kiribati zone. Almost US\$20 million was received annually for the two years. This is about one-third of all government income.

Kiribati fishing crew serving on foreign vessels remit over US\$ 0.8 million per year in wages back to Kiribati. Of this some 80 percent goes to the outer islands, making a significant contribution to their local economies.

IV. DEVELOPMENT PROSPECTS

Kiribati's coastal and marine habitats harbour many species of finfish and non-fish resources of commercial interest, including lobster, deep-water shrimp, giant clam, ark shell, pearl oyster and beche-de-mer. In general, however, these inshore resources are limited because of the small area of land, reef and lagoon, and would not be able to support large fisheries. Deep slope bottom-fish resources, for example, have been estimated as capable of sustaining a yield of between 73 and 219 mt/year. In addition, high levels of exploitation near population centres are already occurring in some cases. Potential for development of inshore resources is thus limited, although certain aquaculture ventures may possibly have long-term potential.

Regional skipjack tuna stocks are considered to be under-exploited and capable of withstanding significantly increased fishing effort. Although less is known about yellowfin and bigeye tuna, their stocks are considered healthy and current catch levels sustainable. However annual catches in Kiribati's EEZ vary widely depending on climatic and oceanographic conditions elsewhere in the western tropical Pacific. Tuna abundance may be very high one year, and then very low the next, causing severe difficulties for the sustainable operation of domestic-based commercial fishing ventures.

The problems experienced by the national fishing company, TML, and of some other schemes to develop commercial fisheries indicate that significant problems continue to stand in the way of fisheries development in Kiribati. These include: the poor competitiveness of pole-and-line fishing under current conditions; nearshore resource limitations; poorly developed cold storage, handling and shipping infrastructure; seasonal fluctuations in fish availability; indirect airline services; high overhead costs relative to low levels of production; insufficient water supplies; and the cost and difficulty of enforcing fishing regulations and licensing compliance.

There are nevertheless few options other than marine resource use to further national economic self-sufficiency in Kiribati. It is therefore likely that the government will have to pursue policies aimed at: improving efficiency in institutions responsible for marine resource management and development; ensuring long-term and sustainable revenue flows through DWFN access agreements; improving surveillance; and promoting diversification in the fishing industry likely to increase the flow of domestic benefits. With previous high levels of public investment in the fisheries sector having failed to result in successful enterprises it is likely that future development will depend on government

limiting its role to ensuring an attractive investment climate, providing infrastructure, and promoting entrepreneurship through the provision of credit and training programmes.

V. INSTITUTIONAL ARRANGEMENTS

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.”

The Act gives the President of Kiribati, acting in accordance with the advice of Cabinet, wide powers to make regulations, including the licensing of fishing vessels, the protection of all species of fish, prohibition of fishing gear and methods and the organization and regulation of seafood marketing and export. The Act also contains a provision to protect the traditional fishing rights of Kiribati communities by prohibiting the taking of fish in any traditional fishing area except by members of the area’s traditional owners or custodians, unless a license from the Minister has been obtained.

Regulations issued subsidiary to the Act are:

- Prohibited Fishing Areas (Designation) Regulations 1978.
- Fisheries Conservation and Protection (Rock Lobster - *Panulirus* species) Regulations 1979.
- Fisheries (Processing and Export) Regulations 1981.
- Fisheries (Vessel Licenses) Regulations 1981.
- Fisheries (Vessel Licenses) Regulation (No. 1) 1982.

Other legal instruments relevant to fisheries include:

- The Marine Zones (Declaration) Act 1983 which defines and establishes a twelve 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.

The Ministry of Natural Resources Development (MNRD) has comprehensive responsibility for policy and management matters relating to Kiribati’s marine resources. It is also responsible for development coordination and project evaluation prior to the consideration of such by the Planning Office of the Ministry of Finance.

The Fisheries Division of MNRD is the key agency dealing with marine resource development and management and is charged with undertaking research, data collection, project implementation, project evaluation, and the commercialization and privatization of marine resource projects. Fisheries management activities include

resource assessment, monitoring, regulation and enforcement. The Division has a staff of more than eighty, supervised by the Chief Fisheries Officer. Each of the Division's operational units, which includes Statistics, Aquaculture, Fisheries Development, Training, Extension, Marketing, Research, Licensing and Enforcement, and the Pearl Oyster Collaborative Project is headed by a Fisheries Officer or Assistant Fisheries Officer.

The Ministry of the Environment and Social Development and its Department of Environment and Conservation are responsible for evaluating the environmental impacts of marine resource export developments and are 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.

VII. RESEARCH AND TRAINING

The Fisheries Division, usually with the support of external donors or organizations, undertakes fisheries and aquaculture research in Kiribati. The objectives of the Division's Research Unit are to conduct research on marine resources that have potential for development and to coordinate collaborative research activities with regional research organizations. Past and current research activities include:

- The Seaweed Growth Monitoring Programme, which investigates *Eucheuma* seaweed growth rates at various locations and under various conditions with the aim of determining optimum sites and seasonality for farming;
- Monitoring of the beche-de-mer fishery, including plans to investigate the potential to culture some commercial species;
- Giant Clam Stock Assessment, including plans to investigate the potential for farming; and
- The Pearl Oyster Collaborative Project, which is funded by the Australian Centre for International Agriculture Research, is investigating the potential for developing Kiribati's black-lipped pearl oyster resources with the longer-term view of establishing commercial pearl farming.

Past research has included studies of deep-bottom fish, deep-water prawns, tuna baitfish, pelagic fish species in the Line Islands, and other resources. The Division's Aquaculture Unit is also involved in research aimed at eradicating tilapia from the Tarawa milkfish ponds.

Marine and fishery sector training in Kiribati is aimed mainly at enabling Kiribati citizens to find overseas employment on cargo or fishing vessels. The Kiribati Marine Training Centre (MTC) was established in the late 1970s in partnership with a commercial shipping agency to provide training for merchant seamen. For several years MTC also offered a training programme aimed at the fishing sector but this function has now been taken over by the Fisheries Training Centre (FTC), which was established in 1989 with Japanese aid support. The Centre currently trains up to 60 crew a year to the standards of discipline and safety required by Japanese fishing vessels. The graduates of the

school are then placed by Kiribati Fisherman's Services (KFS) Ltd., a company which is 99 percent owned by the Federation of Japan Tuna Fisheries Cooperative Associations, and which acts as an employment agency for this purpose. The activities of FTC and KFS are closely and actively coordinated. So far the Centre has trained over 500 people.

A certain amount of academic-level training in marine resources is available in Kiribati via the Atoll Research Centre, which is affiliated with the University of the South Pacific, as well as through USP's Kiribati Extension Centre.

International issues

The Fisheries Division maintains direct contact on technical issues with regional and international organizations dealing in fisheries. Policy and other matters are managed in the first instance through designated contact points, most often the Department of Foreign Affairs. Kiribati is a member of the South Pacific Commission (SPC), the South Pacific Forum Fisheries Agency (FFA) and the South Pacific Regional Environmental Programme (SPREP). Kiribati is also party to a number of treaties and agreements relating to the management of regional fisheries, including:

- the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America;
- the 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, and
- the FSM Arrangement for Regional Fisheries Access.

Kiribati is a signatory 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

VIII. AID

Bilateral programmes of technical cooperation, collaboration and assistance 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, and SOPAC. Significant assistance projects have included:

- Japanese funding for Outer Island Fish Centres, a pilot beche-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 Kiritimati;
- 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; and
- European Union funding of a Marine Resource Sector Review and support to the Atoll Seaweed Company.

The Kiribati Strategic Investment Programme lists priority projects over A\$50 000 for aid funding. Of the 32 projects listed, only the Fisheries Training Centre (A\$6.9 million) is in the fisheries sector.

IX. INTERNET LINKS

The following websites have information relevant to fisheries in Kiribati:

- www.spc.int/coastfish/Countries/Kiribati - Information on Kiribati fisheries and links to other sites concerning Kiribati.
- <http://www.collectors.co.nz/kiribati> - General information on Kiribati with many Kiribati-relevant links.
- www.janeresture.com - recent information on Kiribati fisheries and life in Kiribati.

MARSHALL ISLANDS



MARSHALL ISLANDS

I. GENERAL ECONOMIC DATA⁴⁵

Land area ⁴⁶ :	181 sq. km.
Ocean area:	2 131 000 sq. km.
Length of coastline:	n/a
Length of 200 m isobath	2 630 km.
Population (1999) ⁴⁷ :	50 840
Gross Domestic Product (1999) ⁴⁸ :	US\$ 93.7 million
Fishing contribution to GDP (1999):	US\$ 3.6 million
GDP per capita (1999):	US\$ 1 843

II. FISHERIES DATA

Commodity Balance (1999):

	Production ⁴⁹	Imports	Exports ⁵⁰	Total supply	Per caput supply
Fish for direct human consumption	3 244	150	0		66.7
Fish for animal feed and other purposes	0	0	1	0	-

Estimated employment (1999):

(i) Primary sector:	370
(ii) Secondary sector:	300
(iii) Subsistence fisheries:	4 700

Gross value of Fisheries Output (1999)⁵¹: US\$ 4 809 000

Trade (1999) ⁵² :	Value of imports	US\$ 500 000
	Value of exports	US\$ 473 000

⁴⁵ The currency used in Marshall Islands is the US dollar.

⁴⁶ Source: South Pacific Commission Statistical Summary 2000.

⁴⁷ Source: South Pacific Commission 1999 mid-year estimate.

⁴⁸ Source for GDP data: Gillett and Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, Manila.

⁴⁹ Breakdown (tonnes): subsistence 2 800; coastal commercial 444; offshore locally-based 0; total 3 244. The total does not include the 33 217 tonnes caught by foreign-based offshore vessels in the EEZ.

⁵⁰ In 1999 aquarium fish were the only fishery exports.

⁵¹ Value breakdown: subsistence US\$3 836 000; coastal commercial US\$973 000; offshore locally-based US\$0; total US\$4 809 000. Not included in the total is the value of the offshore catch by foreign-based vessels, US\$50 000 000.

⁵² Source: 1999 Marshall Islands Statistical Abstract.

III. STRUCTURE AND CHARACTERISTICS

General

The Republic of the Marshall Islands (RMI) 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.

RMI is an independent state associated with the USA since 1986 in a Compact of Free Association which is presently being renegotiated. The Republic is governed by a unicameral legislature and President elected from its members. Respect for traditional chiefs and traditional authority remains strong in the RMI.

The total land area of the Marshall Islands is only 181 sq. km., but the country has an EEZ which extends over more than 2.1 million sq. km.

A national fisheries policy was approved by the Government of the Marshall Islands in November 1977. The main objectives of the policy are to:

- Increase fisheries activities within sustainable limits;
- Support private sector-led development; and
- Strengthen the capability of the nation to manage its fisheries resources.

Marine Fisheries

Subsistence and artisanal fishing for inshore and offshore species is of prime importance in the outer atolls of RMI, providing the primary source of animal protein. Capture methods are diverse, including spearing, hand-lining, trolling, gill-netting, and cast netting. Paddling and sailing canoes are widely used for subsistence fishing in the outer atolls while most artisanal fishing is conducted from craft of 4.5-6 m in length, powered by outboard motors in the 15 to 40 hp. range.

In the inshore areas, subsistence fishing predominates. Outside of the islands which have urban areas (Majuro, Kwajalein), and islands where the government is promoting fish marketing (Arno, Likiep, Ailinlaplap, Namu, Aur, Maloelap, Jaluit), there is little commercial fishing.

The Arno Atoll Fisheries Development Project was established in 1989 to develop small-scale commercial bottom and troll fishing. The project operates a fleet of eight GRP fishing craft that are rotated between crews of two to four, at least one of whom has been trained to act as boat operator. More than 250 fishers have received training under the project. Fishing crews obtain gear, ice and bait through the project and pay for these from catch sales. The project has involved considerable infrastructure development, including the construction of causeways, docks, jetties, and a cold store. Over the years about three-quarters of the catch is reef fish, with the balance being pelagic species. During the early years, the project purchased about US\$80 000 to US\$90 000 worth of fish annually but in later years less was sold to the project (US\$38 500 in 1999) as the fishers sold more fish directly to the Majuro urban area. The Arno project model has

been extended to the atolls of Ailinlaplap, Likiep, Aur and Namu for the purpose of providing fresh fish to Ebeye island in Kwajalein atoll.

An aquarium fishery has operated in Majuro for more than 10 years, with one principal operator and several smaller ones. The small operators generally sell their catch to the principal operator, who also manages export marketing. 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. The most commonly exported species has been the flame angel fish (*Centropyge loriculus*). In 1999 about US\$473 000 worth of aquarium fish was exported from the Marshall Islands, which was the only significant fishery product export of the country.

Although both the Arno project and the South Pacific Commission have conducted deep reef-slope fishing trials in the Marshall Islands (around Arno and Majuro), this fishery has not been commercially developed. The maximum sustainable yield of this fishery is estimated at 110-330 t/ yr.

Trochus were transplanted to several atolls in the Marshall Islands from Chuuk and Palau by the Japanese in the 1930s. Over the ten year period 1985 to 1994 an annual average of 62 tonnes of trochus was harvested, most of this coming from Enewetak atoll. About 20 tonnes of trochus was exported in 1998. In the mid-1980s a trochus button blank factory opened in Majuro but closed due to erratic availability of raw material.

A survey of the role of women in fisheries in the Marshall Islands by the Secretariat of the Pacific Community in 1997 showed that women participate in processing fish caught by men, collect shellfish and crustaceans, cook seafood by boiling, frying, barbecuing, salting drying, and smoking, and make shell craft.

Tuna are taken by both small-scale and industrial gear in the Marshall Islands. Small-scale fishers take tuna mostly by trolling from small skiffs, and these landings form an important part of the national catch. On an industrial scale, tuna are caught by foreign pole-and-line, longline, and purse seine gear.

Pole-and-line fishing for skipjack tuna has been carried out in the Marshall Islands by Japanese fleets since the late 1920s, and by the mid-1930s live-bait and skipjack fishing grounds were accessed from bases at Ailinlaplap and Jaluit Atolls. Most of the skipjack caught was destined for the production of *katsuobushi*, a dried, smoked product, but a small cannery also operated on Jaluit Atoll. This fishery was interrupted by World War II, but resumed in the late 1950s, using vessels based in Japan. By the late 1970's almost 300 pole and line vessels participated seasonally in the fishery, with catches in excess of 50 000 tons per annum. However, by the 1990's changes in the structure of the Japanese distant water fishery meant far fewer vessels were engaged in this fishery, and from 30 to 40 vessels seasonally operated under annual license in the Marshalls EEZ. In the 1990s the catches by the pole-and-line fleet in the EEZ have been less than 8,000 tonnes per year.

Japanese vessels began longlining in the Marshall Island zone in the 1950s, followed by Korean and Taiwanese fleets in the late 1960s, and the Chinese in the 1990s. Peak production occurred in the 1970s when annual catches averaged 33 000 t.

Other longline fleets have also operated in RMI. Using technical assistance funds the government established a longline fishing base, comprising vessel provisioning and fish processing facilities, on the capital island of Majuro in the early 1990s. The operation of the base was then leased out to private operators, first a US company and subsequently a Chinese firm, both of which made charter arrangements with foreign vessel operators to establish a Majuro-based longline fleet. At the height of the fishery more than 150 Chinese longliners based their operations in Majuro, with catch being exported fresh to Japan. A main beneficiary of these arrangements was the RMI national airline, which provided much of the air cargo service to the base in the early years of the base's operation. The operations of the fish base declined in the mid-1990s due to a combination of worsening economic conditions, resource considerations, and disputes between the government and the base operators. The operations of the Chinese firm at the Majuro longline base ended in 1998.

In the 1990s the longline catches in the Marshall Islands EEZ by all fleets ranged from 2 206 tonnes (1997) to 6 664 tonnes (1992).

RMI has attempted to establish a domestic purse-seine fleet. In 1989 the government entered into a joint-venture arrangement with US interests to own and operate a 1 000 t capacity purse seiner, and in mid-1990 an interest in a second purse seiner was acquired. These vessels fished in areas other than the Marshall Islands. Both have since been sold and there is no longer any domestic involvement, government or private, in purse seine vessels.

Purse seine fishing by distant water fleets is an important component of tuna fishing in the country. Under the US Multilateral Tuna Treaty, to which Marshall Islands is party, up to 50 US purse seine vessels have been licensed to fish in the EEZ since the late 1980s. In the 1990s the major purse seine fleets operating in the EEZ of the Marshall Islands have been from the US, Japan, Korea, and Taiwan China. According to the SPC, the total purse seine catch in the Marshall Islands in 1999 was about 23 000 tonnes.

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 the Marshall Islands zone. The most recent event to affect the country occurred from November 1997 to May 1998.

The total number of foreign fishing vessels operating in the Marshall Islands in the 2000⁵³ reporting year was 219. According the Marshall Islands Marine Resources Authority, about US\$4.4 million was received from these vessels for fishing access.

Transshipment of purse seine-caught skipjack and yellowfin tuna began in Majuro during late 1998. The use of the port of Majuro for these activities depends greatly on oceanographic and other factors that can shift the focus of purse seine fishing. In 1999 118 transshipments involving 69,373 tonnes of tuna were made. In 2000 there were 192 transshipments involving 98 440 tonnes.

Inland Fisheries

There are no significant inland fisheries in Marshall Islands.

⁵³ The government reporting year is from October 1999 to September 2000.

Aquaculture

A hatchery for giant clams (*Tridacna* spp.) established at Likiep propagates clams for re-seeding of reef areas, provides juvenile clams to farmers for grow-out, and provides training in propagation and management for potential farmers. The hatchery was started by the national government but efforts are being made to have the Likiep community take over the facility. The 1999/2000 MIMRA Annual Report states: "...the main objective of the project is to re-seed sites around the Marshall Islands which appear or have been over-harvested. MIMRA, however, has not done any re-seeding activity since 1994, although this objective will still remain with the project."

At least one private clam farm is also in operation, at Mili atoll with a hatchery in Majuro . Seed from the local population of *Tridacna gigas* were produced at the Mili facility in 1986 and 1988. One thousand juvenile *Tridacna derasa* were imported to another farm in Kwajalein in 1989, but it is believed that this facility is no longer operating. The existing farm has produced juvenile clams for the aquarium trade and clam meat for the local market.

There has been black-lipped pearl culturing recently at Namdrik and Majuro atolls. The activities on Namdrik came to an end in 1999 due to a dispute with the Island Council, but the culturing continues on Majuro and is commencing at Arno atoll by two local firms.

Other aquaculture efforts in the Marshall have involved seaweed, sponges and shrimp.

Utilization of the catch

Artisanal catches are marketed locally, as are catches from the Arno Fisheries Development Project and similar centres in other outer atolls. The centres sell their catch at Majuro and Ebeye on Kwajalein, where demand for fresh, salted and dried fish is high.

In 1999 and 2000 the only coastal finfish exports were aquarium fish and informal food fish shipments as baggage on passenger aircraft, mostly to Honolulu.

In the mid-1980s a *katsuobushi* plant operated on Majuro and supplied the domestic market, but ceased operating in part because of the difficulty in obtaining sufficient supplies of suitable wood for the smoking process.

In the mid-1990s fresh tuna taken by locally-based longliners were landed in Majuro for shipment to Japan, Hawaii or the US mainland by air freight from time to time, using chartered air carriers. The catches of the Japanese pole-and-line fleet are sold directly to markets in Japan. Purse seine catches by US vessels are off-loaded to the canneries in American Samoa, while the catches by Japanese vessels is returned to Japan. Tuna from Taiwanese and Korean seiners is transshipped from Majuro and other Pacific Island ports to a variety of processing facilities.

A tuna loining plant began operation in Majuro in October 1999, with an estimated annual through-put of 12 000 tonnes per year. Raw material is sourced from purse seiners transshipping in the Majuro lagoon. The semi-processed product is shipped to the canneries in American Samoa.

Demand

Fish and other marine organisms play an important part in the diet of most Marshallese, particularly those dwelling on outer atolls. The developed centres of Majuro and Kwajalein, where cash economies prevail, provide a ready market for fresh and salted/dried fish.

There have been several attempts to calculate fish consumption in the Marshall Islands. In recent years those estimates encompassing the whole country have ranged from 39 to 67 kg per person per year. It should be noted that there is considerable difference in consumption between the population centers of Majuro and Kwajalein, where 68 percent of the population resided in 1999 and the outer islands, where fish is relatively plentiful.

Economic Role

It has been recently estimated by the Asian Development Bank that in Marshall Islands the catches by subsistence fishing and coastal commercial in 1999 were worth US\$3.8 million, and US\$0.9 million, respectively. The same study also calculated that locally-based fishing in the country in 1999 was responsible for about 3.8 per cent of the country's GDP.

In the five year period 1996 to 2000 access fees for foreign fishing ranged from US\$1.6 million to US\$4.9 million.

With respect to employment, about 4 700 individual are employed in the subsistence fisheries in the Marshall Islands. Approximately 370 people are involved in various aspects of coastal commercial fishing. There are from 280 to 350 people employed at the new loining plant and the average wage is \$2 per hour. A Forum Fisheries Agency study estimated that 20 people serve as laborers for tuna transshipment operations.

According to the Office of Planning and Statistics, the fishery exports in 1999 were worth US\$473 000, which represented 6.2 per cent of all the exports from the country.

IV. DEVELOPMENT PROSPECTS

Despite considerable investment in the commercial development of coastal fisheries there is little evidence of their commercial viability. The Japanese Overseas Fishery Cooperation Foundation has assisted in developing small-scale commercial, lagoon, bottom and troll fishing at Arno and other sites. This project has involved considerable infrastructure development, but is yet to prove economically viable or self-sustaining, although many people have gained employment and income through the project.

The Marshall Islands Fisheries Policy, adopted by the government in 1997, indicates that the coastal fisheries is best utilized for food security and small-scale income earning opportunities, game fishing and tourism. Despite its apparent size, coastal resources cannot be the basis of a large viable commercial fishery.

In 1998 an assessment of the tuna resources of the Marshall Islands was made by the Secretariat of the Pacific Community. The report of the study concluded that:

- An increase in skipjack catch may be accommodated within the EEZ. A skipjack population model estimated the average Marshall Islands skipjack potential at 46 000 mt per year. This is considerably more than present landings.
- Catch levels of 6 250 tonnes (all species) may be obtainable from the longline fisheries on a sustainable basis. Since the longline catches by all fleets in the Marshall Islands EEZ ranged from 2 206 tonnes (1997) to 6 664 tonnes (1992) and averaged 4 220 during the decade, the longline fishery may be operating near the full potential of the resources.

The RMI government hopes that aquaculture will provide employment and income in the outer atolls. A clam hatchery is producing giant clams for the US aquarium market. There is presently much interest in the commercial production of black pearls at Majuro and other sites. Initiatives are also under way to investigate the commercial potential for the farming of seaweeds and sponges. Export oriented aquaculture will continue to face stiff competition from countries with low production costs and efficient transportation links to major markets.

V. INSTITUTIONAL ARRANGEMENTS

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 five-member 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. MIMRA has five divisions: Policy and Planning, Oceanic Fisheries, Coastal Fisheries, Corporate Services, and Training.

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/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.

Regulations have been issued under the act covering: (a) requirements of foreign fishing agreements, (b) requirements prior to entry of vessels for local government area activities, and (c) fish processing establishments.

VI. INTERNATIONAL ISSUES

MIMRA maintains direct contact on technical issues with regional and international organizations dealing in fisheries. Policy and other matters are managed in the first instance through designated contact points, most often the Department of Foreign Affairs. RMI is a member of the Secretariat of the Pacific Community (SPC), the South Pacific Forum Fisheries Agency (FFA) and the South Pacific Regional Environmental Programme (SPREP).

RMI is party to a number of treaties and agreements relating to the management of regional fisheries, including:

- the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America;
- the 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, and
- the FSM Arrangement for Regional Fisheries Access.

RMI is a signatory to the United Nations Convention on the Law of the Sea (UNCLOS) and 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. The Marshall Islands has recently signed the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean.

VII. RESEARCH AND TRAINING

Fisheries and aquaculture research in the Marshall Islands is the responsibility of MIMRA. However the organization does not have a strong research capability and much of the research that has taken place has been with the assistance of regional or international agencies. Research activities have included:

- monitoring, intended to allow ongoing assessment of the status of the main fisheries;
- surveys and resource assessments intended to provide snapshots or status reports on specific resources. In 2000 a marine resources survey was carried out on Jaluit;
- development-oriented research, aimed at identifying new grounds or techniques with commercial fishing or aquaculture potential. Activities have included deep reef slope fishing, and the mariculture of giant clams and pearl oysters.
- work on issues of major concern. In early 2000 the Secretariat of the Pacific Community assisted MIMRA with a survey of ciguatera fish poisoning at Ujae and Lae atolls.

A fisheries and marine training school has been established at Majuro that provides training in fishing techniques, seamanship, engine repair, and related skills for potential crew in the domestic longline fishery. Higher training is sought overseas.

VIII. AID

RMI receives aid and support for its fisheries sector from a wide range of sources. Major donors have included:

- Japan, through the Japan International Cooperation Agency and the Overseas Fisheries Cooperation Fund (Japanese aid totaled US\$1.5 million in 1996).
- The Asian Development Bank (US\$2.4 million was provided in 1996 for institutional strengthening, the establishment of a marine training school, and expansion of mariculture activities).
- Australia, through the Australian Agency for International Development.
- United States (provided US\$370 000 for patrol vessel support in 1996).
- United States (provided US\$370 000 for patrol vessel support per year as part of overall funding by the Compact of Free Association. In addition the National Oceanic and Atmospheric Administration/ National Marine Fisheries Service provided an average of \$80 000 per year for fisheries projects from 1992-1997).
- New Zealand (provided US\$48 000 to support marine training and contributed US\$70 000 for an ice plant on Jaluit).

- The Pacific Aquaculture Development Association.
- FAO provided a consultant in mid-2001 to assist in the development of a management plan dealing with sharks and birds in the longline fishery.
- In 2001 Japan funded a \$4 million atoll fishing project for Jaluit, with completion of construction expected in 2002.

Assistance is also obtained from the international organizations of which RMI 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 the Marshall Islands' fisheries sector.

IX. INTERNET LINKS

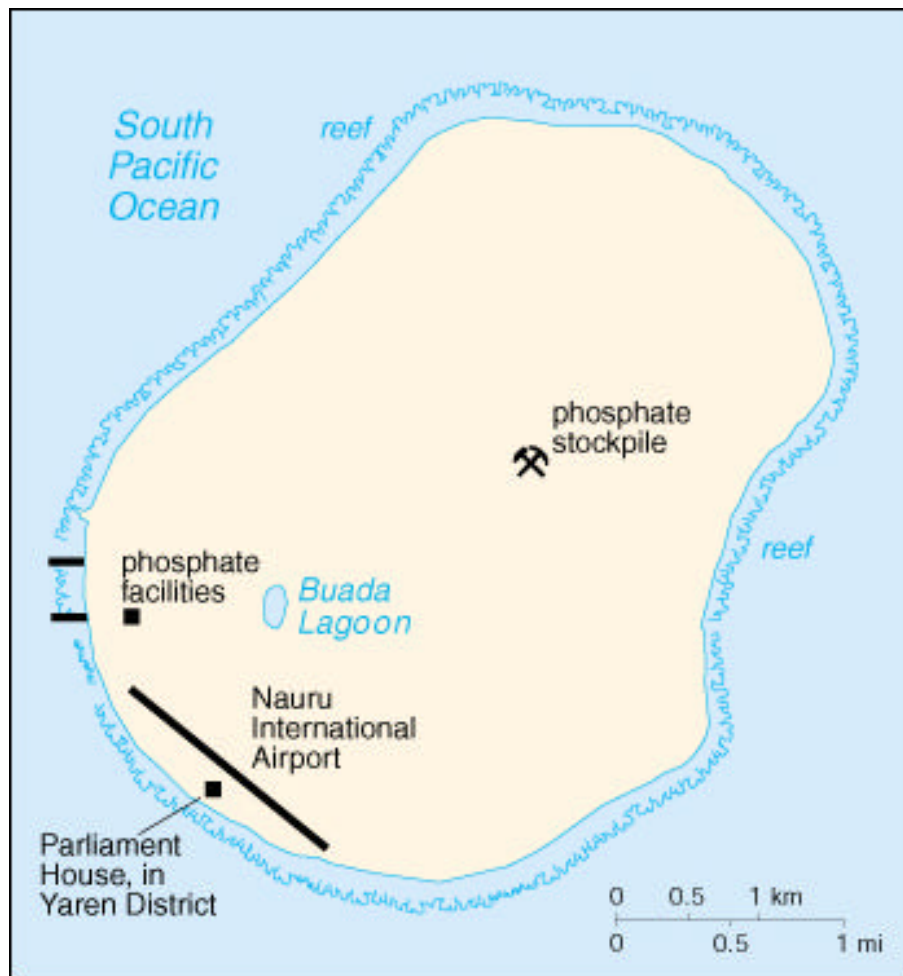
www.spc.org.nc/coastfish/Countries - Information on RMI fisheries, links to other sites concerning RMI, and some SPC reports on fisheries in RMI.

www.wri.org - WRI environment report on the Marshall Islands, including information on marine fisheries.

www.rmiembassyus.org - Republic of the Marshall Islands Online which gives facts about the Marshall Islands and its government

www.fishbase.org - Contains a list of Marshall Islands fishes

NAURU



NAURU

I. GENERAL ECONOMIC DATA⁵⁴

Land area ⁵⁵ :	21 sq. km.
Ocean area:	431 000 sq. km.
Length of coastline:	24 km
Population (1999) ⁵⁶ :	11 300
Gross Domestic Product (1999) ⁵⁷ :	US\$ 51.6 million
Fishing contribution to GDP:	US\$ 1.1 million
GDP per capita (1999):	US\$ 4 566

II. FISHERIES DATA

Commodity Balance (1999):

	Production ⁵⁸	Imports	Exports	Total supply	Per caput supply
Fish for direct human consumption ⁵⁹	475	22	0	497	44.0
Fish for animal feed and other purposes	0	0	0	0	

Estimated employment (1999):

(i) Primary sector:	50
(ii) Secondary sector:	0
(iii) Subsistence:	350

Gross value of Fisheries Output (1999)⁶⁰: US\$ 1.7 million

Trade (1996):	Value of imports	n/a
	Value of exports	0

⁵⁴ Average 1999 rate of exchange US\$ 1.00 = Australian dollar (A\$) \$1.5500; 1.7250 in 2000

⁵⁵ Source: South Pacific Commission Statistical Summary 2000.

⁵⁶ Source: South Pacific Commission 1999 mid-year estimate.

⁵⁷ Source for GDP data: Gillett and Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, Manila.

⁵⁸ Breakdown (tonnes): subsistence 110, coastal commercial 315, offshore locally-based vessels 50, total 475. Note: The above does not include the catch by offshore foreign-based vessels of 41 000 tonnes.

⁵⁹ Various government and non-government sources as given in Gillett and Lightfoot (2001).

⁶⁰ Breakdown: subsistence US\$332 000; coastal commercial US\$1 118 000; offshore locally-based vessels US\$250 000; total US\$1 700 000. Not included in this total is the value of the catches by foreign-based offshore vessels, about US\$37 million.

III. STRUCTURE AND CHARACTERISATION OF THE INDUSTRY

General

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 430,000 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 almost 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, Nauru's open ocean areas are frequented by an abundance of tuna and other pelagic species. Despite a relatively large per capita GDP derived from large-scale phosphate mining and significant food imports, Nauruans continue to favour fresh fish as a food product.

Marine Fisheries

The most important fishing activity is trolling for tuna from small outboard-powered boats. A study undertaken by the Forum Fisheries Agency in 1989 indicated that these boats catch an average of 70 kg of fish per day while trolling around Nauru.

The most important finfish species are the skipjack tuna *Katsuwonus pelamis*, yellowfin tuna *Thunnus albacares*, and rainbow runner *Elagatis bipinnulata*. These three species account for more than three-quarters of all finfish landings. The most important invertebrates are turban shells (*Turbo sp.*), lobsters, and several species of crabs.

Fishing craft are launched from two channels cut in the fringing reef, and this limits the size of vessel that can be used. One channel is located at the southwest of the island while the other faces due east, so that one or the other usually lies in the lee of prevailing winds. There is a small man-made boat harbour but its use is generally restricted to shore-based barges that are used to carry cargo ashore from ocean-going vessels that moor in deep water outside the reef using a system of anchored mooring buoys.

Both Nauruans and expatriate phosphate industry workers from Tuvalu and Kiribati engage in fishing. A 1992 survey recorded 130 powered skiffs owned by Nauruans, and a further 88 powered skiffs and 128 paddling canoes owned by expatriate workers. Much fishing is done on a part-time basis and the catch is used for home consumption or sold to supplement income. Under a system of fisherman registration initiated in the late 1990s in which registered fishers get a higher price in the market, there are 20 Nauruan and 60 other Pacific Islander fishermen registered. Recently Nauru fisheries officials have estimated that there are 100 half-time commercial fishermen, equivalent to 50 full-time fishermen.

Bottom fishing by hand-line is conducted along the outer reef slope targeting both shallow and deep demersal species. Shallow-water snappers dominate the catch from this fishery. Expatriate workers also conduct an active scoop-net fishery for flying fish.

Nauruans fish on the reef flats with cast nets and gill nets. A dive fishery using spear guns, commonly conducted with the aid of SCUBA, is also active, targeting snappers, groupers, squirrel fish, jacks, surgeonfish and soldier fish. Reef gleaning for octopus, turban shell, and other invertebrates is also common.

Recent declines in activity associated with phosphate mining, have resulted in a significant retrenchment of workers. Many of these people have increased their fishing activity, especially in inshore areas and declines in abundance of popular fish and invertebrates have been noted.

A series of fish aggregation device (FAD) deployments has been undertaken since the mid-1980s. The first units were based on the Philippines *payao* style of FAD, and were deployed to support domestic purse-seining in local waters. These FADs soon came to be used by local skiff fishers and proved to be effective in improving the productivity of troll and mid-water tuna fishing. With the cessation of local purse seining, Nauru adopted a regional FAD design developed by the South Pacific Commission and has maintained a programme of deployments to support local fishing effort. FAD deployments, assisted by SPC, took place in 1997 and in 2000.

Nauru has previously owned and operated two small purse seine vessels which fished in Nauru's EEZ briefly. One of these vessels sunk and the other later chartered to a Philippines-based fishing company.

The government-owned Nauru Fisheries Corporation operates an 18 metre catamaran longliner, the Victor Eoaeo II. The dual role of the vessel is to catch tuna for export to Japan and train Nauruan crews in longline fishing.

Inland Fisheries

Nauru has no freshwater streams or other bodies of freshwater, apart from one or two springs, and thus no freshwater fisheries.

Aquaculture

A brackish-water lagoon located near the centre of the island, and several other small brackish ponds, have been used for aquaculture purposes. Tilapia, which are not eaten by Nauruans, were introduced to these ponds in the mid-1960s. The tilapia have constrained attempts to culture other species, notably the highly valued milkfish. Starting in 1978 there have been several unsuccessful programmes to eradicate the tilapia.

There are presently some Taiwanese efforts to grow milkfish in four 10 m by 20 m concrete tanks. More of these tanks are planned.

According to officials of the Nauru Fisheries and Marine Resources Authority, there are plans to utilize rehabilitated mining areas for aquaculture purposes.

Utilization of the Catch

All fish landed by small-scale fishing are locally consumed. Much of the catch taken by Nauruans is shared along family lines, although catch in excess of immediate need is occasionally sold. Numerous Gilbertese and Tuvaluan expatriate phosphate workers fish

very actively, both for subsistence and for the express purpose of generating supplementary income. The market for fresh fish, including tunas, flying fish and demersal species is strong, underpinned by daily purchases by the operators of the many small restaurants on the island. These restaurants, in turn, are almost exclusively operated by expatriate phosphate industry workers from China. Sales are most often made directly from the fishing craft at the landing site.

The government-owned 18 metre longliner lands about 50 mt of fish annually. Some of this fish is sold locally, but the premium tuna are exported to Japan.

The large amount of tuna caught by foreign fishing vessels in the Nauru zone, about 41,000 mt in 1999, is all landed outside of Nauru. Sixty per cent of the fish in 1999 was taken by Taiwanese and Korean purse seiners and was transshipped to canneries in either Asia or American Samoa. The Japanese catch, about 15 percent, was landed in Japan while the US catch, 15 percent, was taken directly to American Samoa.

Demand

Fish and marine resources have traditionally been an important component of the Nauruan diet. Since the advent of phosphate mining the consumption of imported food has become widespread, but fresh fish remains extremely popular and per capita consumption figures based on local production alone exceeds 42 kg. The price of fresh fish varies with supply, but in 2001 ranged between US\$ 1.80 and \$4.00 per kg. The amount of imported fish is unknown, but thought to be significant. Frozen or smoked milkfish is regularly imported from Kiribati, but the scale of this trade is unknown.

Economic Role of the Fishing Industry

Nauru does not presently calculate its GDP. A recent ADB project estimated that the 1999 GDP was approximately US\$ 51.6 million and that the fishing contribution to GDP was about US\$1 million ,or about 2 percent of GDP.

The value of the catch of Nauru's domestic fisheries is about US\$1.7 million, nearly 60 percent of which is derived from coastal pelagic species.

Government revenue is derived through the licensing of foreign fishing vessels. Vessels from eight countries fished in the Nauru zone in 1999. Nauru received about US\$3.4 million in access fees during that year.

IV. DEVELOPMENT PROSPECTS

Nauru's national revenues are expected to decline substantially in the near future due to the depletion of the island's reserves of phosphate. In recognition of the economic potential of the nation's fisheries resources, the government is exploring these possibilities. Accordingly, the National Fisheries Development Strategy was formulated by the Nauru Fisheries and Marine Resources Authority. The Strategy is based on the concept that tuna is the main fisheries-related development opportunity. It proposes that the commercial exploitation be undertaken by the government and through joint venture operations with foreign fishing enterprises.

Although Nauru's tuna resources are considered to be abundant, increased domestic production is constrained by the restriction in the size of fishing craft that can be used due to the lack of a harbour. To address this problem the Government of Nauru is presently involved in widening and deepening the small boat channel on the east side of the island. It is hoped that improved ocean access will foster the development of a local tuna fishing fleet which will increase landings for both domestic consumption and export. Nauru's national airline, Air Nauru, could facilitate fish exports.

Other on-going and proposed work in the development of fisheries includes the deployment of fish aggregation devices and the establishment of a mechanical repair shop.

Considering the popularity of milkfish on Nauru and the Island's mining areas which could be rehabilitated into ponds, the culture of milkfish has development potential. The availability of milkfish fry in nearby Tarawa is an additional advantage, but these favorable factors must be balanced with the high domestic labor costs on Nauru.

V. INSTITUTIONAL ARRANGEMENTS

Fisheries development and management was previously the responsibility of the Department of Island Development and Industry, but in 1997 the Nauru Fisheries and Marine Resources Authority Act came into force. The Act established an Authority as an entity with the powers and functions to regulate and develop activities relating to Nauru's fisheries and marine resources.

In mid-2001 the Nauru Fisheries and Marine Resources Authority (NFMRA) had 56 permanent and 31 temporary employees. Most of the NFMRA's revenue comes from access fees paid by foreign fishing vessels.

In 1998 the Nauru Fisheries Corporation (NFC) was established as the commercial arm of the NFMRA. Its main activities are the operation of a domestic fish market and an 18 m tuna longliner.

In addition to the Nauru Fisheries and Marine Resources Authority Act, other fisheries-relevant legislation are:

- The Fisheries Act (1997), which regulates both foreign and domestic fishing activities;
- The Sea Boundaries Act (1997), which establishes Nauru's claim over a 12-mile territorial waters zone, a 24-mile contiguous zone, and a 200-mile EEZ; and
- The Fisheries Regulations (1998) which regulates foreign fishing vessels in Nauru's zone.

VI. INTERNATIONAL ISSUES

The NFMRA maintains direct contact on technical issues with regional and international organizations dealing in fisheries. Policy and other matters are managed in the first instance through designated contact points, most often the Department of Foreign Affairs. Nauru is a member of FFA and SPC as well as the South Pacific Regional

Environmental Programme (SPREP). Nauru is also party to a number of regional and international fisheries agreements, including:

- the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America (*Multilateral Treaty on Fisheries*);
- the Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific (*Wellington Convention*);
- the Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region (*Niue Treaty*);
- the Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Concern (*Nauru Agreement*);
- the Palau Arrangement for the Management of the Western Pacific Purse Seine Fishery (*Palau Arrangement*); and,
- the Federated States of Micronesia Arrangement for Regional Fisheries Access (*FSM Arrangement*).

Nauru is a signatory to (a) the United Nations Convention on the Law of the Sea (UNCLOS), (b) 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 (c) the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

VII. RESEARCH AND TRAINING

Nauru has little national fisheries research capability, but is able to enlist the assistance of the regional fisheries organizations, the South Pacific Commission (SPC) and the South Pacific Forum Fisheries Agency (FFA). In recent times the FAO South Pacific Regional Aquaculture Development Project has provided advice on rehabilitation of milkfish ponds, including options for dealing with the problem of unwanted tilapia. The University of the South Pacific has carried out some research on marine algae in Nauru.

Fisheries training in Nauru has largely been limited to that provided for government fisheries workers by FFA and SPC. Current development plans call for the training of the staff of NFMRA and NFC through in-country workshops and regional education institutions. There is some discussion of the establishment of a small maritime college to cater for training crew for both fishing and merchant vessels.

VIII. AID

Nauru has not historically sought direct fisheries development assistance from bilateral or multilateral donors, although some assistance of this type has been channeled through FFA, SPC and other regional organizations of which Nauru is a member. As the revenue from phosphate declines, the need to development relationships with donors has increased.

Japan's Overseas Fisheries Cooperation Foundation (OFCF) provided the first bilateral assistance to Nauru fisheries in 1996 with the provision of an ice machine, safety/rescue

vessels, and training in engine repair. Since then Australia has assisted with training and Taiwan has been involved with aquaculture.

Some of the proposed fisheries infrastructure development is based on the assistance of as yet unidentified donor countries and agencies.

IX. INTERNET LINKS

The following websites have information relevant to fisheries in Nauru:

www.spc.int/coastfish/Countries/nauru/nauru.htm - Information on Nauru fisheries and links to other sites concerning Nauru.

www.fishbase.org - has a list of the fishes found in Nauru.

<http://www.reefbase.org/Summaries/pdf/Nauru> - contains information on fisheries and other marine resources of Nauru.

www.spc.int/coastfish/News/Address_Book_2001/Address_book.htm - has the contact details for individuals, agencies, and companies involved with fisheries in Nauru.

NIUE



NIUE

I. GENERAL ECONOMIC DATA⁶¹

Land area ⁶² :	259 sq. km.
Ocean area:	390 000 sq. km.
Length of 200-m isobath:	98 km
Population (2000) ⁶³ :	1 900
Gross Domestic Product (2000) ⁶⁴ :	US\$ 6 455 706
Fishing contribution to GDP (2000):	US\$ 120 661
GDP per capita (2000):	US\$ 3 398

II. FISHERIES DATA

Commodity Balance (2000):

	Production	Imports	Exports	Total supply	Per caput supply
Fish for direct human consumption ⁶⁵	206 ⁶⁶	20	0	226	118.9
Fish for animal feed and other purposes	0	0	0	0	

Estimated employment (2000):

(i) Primary sector:	10
(ii) Secondary sector:	n/a
(iii) Subsistence/ part-time:	300

Gross value of Fisheries Output (2000)⁶⁷: US\$ 217 845

Trade (2000):	Value of imports	US\$ 40 000
	Value of exports	0

⁶¹ Average 2000 rate of exchange: US\$ 1.00 = NZ\$ 2.2012

⁶² Source: South Pacific Commission Statistical Summary 2000

⁶³ Source: South Pacific Commission 2000 mid-year estimate

⁶⁴ Source for GDP data: Gillett and Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, Manila.

⁶⁵ Source of information: Gillett and Lightfoot (2001)

⁶⁶ Production breakdown (tonnes): Subsistence 194; Coastal commercial 12; offshore locally-based 0; total 206. The total does not include the 2 tonnes caught by foreign-based offshore vessels.

⁶⁷ Value breakdown: Subsistence US\$167,041; coastal commercial US\$50 804; Offshore locally-based US\$0; total US\$217 845. Not included in the total is the value of the offshore catch by foreign based vessels, US\$4 234.

III. STRUCTURE AND CHARACTERISATION OF THE INDUSTRY

General

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 South Pacific Commission 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. 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 neighbors.

There are 14 coastal villages in Niue. Between 1985 and 2000 the population of the country decreased 20 per cent.

Niue became fully self-governing in free association with New Zealand in October 1974. New Zealand is presently responsible for the defense and aspects of the external affairs of Niue.

Marine Fisheries

Much of the fishing in Niue is undertaken from small boats outside the reef. The most common craft in use are lightweight, one-man outrigger canoes, which can be carried down cliff paths for launching. Small (3.7 to 4.4 m) aluminium skiffs, powered by outboard motors, are also commonly used, particularly for coastal trolling.

In recent times the largest fishing vessels in Niue have been several 8.5 m aluminium catamarans of the Samoan *alia* design. These vessels are stored on land at Niue's only wharf at Alofi, and when used are lifted into and out of the water by a small crane.

In June 2001 Niue had 62 registered boats and about 200 canoes. This suggests there was a minimum of at least 262 people who fish, either commercially or for subsistence from boats, plus those that dive and fish/gather from shore.

The major fishing technique is trolling for pelagic species. Bottom fishing is also important. Fishing for small pelagics is carried out from canoes close to shore in the evenings. Fishing from shore is done by hook/line, diving, traps, gill netting, and gleaning.

The major species caught offshore include skipjack, yellowfin, wahoo, barracuda, billfish, albacore, and bottomfish. From the shore, finfish are important but most of the catch is comprised of various species of invertebrates and aquatic plants. A recent survey in Niue by the Secretariat of the Pacific Community list 30 important species of echinoderms, seaweeds, molluscs, and crustaceans.

A 1989 agriculture census surveyed 522 households, indicated that 61 percent of the households performed some form of fishing activity. Of the 2 934 fishing trips made in

September 1989, 39 percent were from shore, 38 percent from canoes, 16 percent from outboard skiffs, with the remainder being diving trips and trips on the government catamaran.

During the work to compile the national accounts of Niue, a survey of 20 households (3.6 percent of all households on Niue) was carried out in June 2000. This indicated that the annual catch from the subsistence fisheries was 194 mt, worth NZ\$315 640.

Niue's Fisheries Division maintains an active fish aggregation device (FAD) deployment programme, with the intention of enhancing troll and mid-water tuna fishing. In early 2000 seven FADs were in the water with a further seven deployments planned for 2001. In August 2001 a New Zealand-sponsored FAD project commenced. Over a three-year period the project will develop a more cost-efficient FAD and conduct a study of the benefits.

In recent years there has been little foreign fishing activity in the Niue zone. During 1999 there was a multilateral arrangement allowing US purse seine vessel to fish and a bilateral agreement for Taiwanese longliners, but no catches were reported. In 2000 and 2001 only the US was licensed to fish, but no catches were made in the zone.

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.

Inland fisheries

There are no inland fisheries in Niue.

Aquaculture

Aquaculture of trochus, giant clams and pearl oysters has been considered in Niue as a possible means of income generation and natural resource enhancement. In 1994 a feasibility study of aquaculture was carried out by the Forum Fisheries Agency and ICLARM. The farming of freshwater prawns and crayfish and the establishment of a giant clam hatchery was investigated. It was concluded that these activities would be costly to set up and would not be economically viable.

Utilization of the catch

Most of Niue's fish catch is consumed at home. A 1990 survey indicated that 80 percent of reef fish catches were retained, 16 percent shared and 4 percent sold. Catches taken outside the reef were similarly used, with 64 percent being retained, 25 percent shared and 11 percent sold. During the work to compile the national accounts of Niue in 2000, it was estimated that 94 percent of all landings in Niue was retained or shared.

There is currently no commercial export of fishery products from Niue; the only fishery exports are those carried by traveling Niueans as baggage. A study by the SPC in the early 1990s indicated that 5 mt of fish and 2 mt of crabs were exported annually during periods when there was direct air service to New Zealand.

Demand

Fish consumption in Niue has been estimated using both nutrition and fish production/trade methods:

- In the early 1990s the Secretariat of the Pacific Community, using a 1987 SPC nutrition study, indicated that the annual per capita consumption was about 49 kg whole fish weight (note this does not include consumption of imported fish, about 9 kg per year).
- Considering (a) the Niue population of 1900 people in 2000, (b) the subsistence fisheries production of 194 mt, (c) the commercial production of 12 mt, and (d) imports of 20 mt, the annual per capita consumption of fishery products on Niue appears to be about 118.9 kg.

Economic Role of the Fishing Industry

A recent study by the Asian Development Bank estimated that in 2000 fishing contributed about US\$120 066 to the US\$6 455 706 GDP of Niue, or about 1.9 per cent.

In 1999 (the latest year for which data is available) access fees paid to Niue by foreign fishing vessels amounted to US\$151 793. This is equivalent to about 2 per cent of Niue's GDP.

IV. DEVELOPMENT PROSPECTS

The further development of domestic fisheries is constrained by the lack of any harbour in which anything but small fishing craft can shelter. It is likely that some further expansion of commercial fishing at the current scale is possible, given the relatively high local prices and low cost of entering the fishery. At the same time, the number of fishers who might profitably engage in commercial fishing is small because a significant increase in landings could quickly result in oversupply.

The difficulties of exporting fishery products from the island suggest that the local market (residents, tourists) will be the basis of any future commercial development. Commercial sportfishing is likely to become an important activity.

Although Beveridge Reef appears to have considerable coastal fishery resources, the distance from Niue Island, the cost of travel, and the large vessel required, largely negates the fisheries value of the reef.

The current focus of the Fisheries Division's activities is (a) safeguarding inshore resources against over-exploitation, and (b) attempting to gain more benefits from the offshore tuna resources. As for the latter, cooperation between Niue and its neighbors in licensing foreign fishing vessels is likely to be the most effective mechanism to obtain the benefits.

V. INSTITUTIONAL ARRANGEMENTS

Fisheries in Niue are regulated by the Domestic Fishing Act 1995, Domestic Fishing Regulations 1996, and the Territorial Sea and Exclusive Economic Zone Act 1997.

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 1997 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.

Responsibility for fisheries and marine resource matters is vested in the Department of Agriculture, Forests and Fisheries. The Department has a number of Divisions, one of which is the Fisheries Division. A recent review proposed that the Fisheries Division be partitioned into two sections: (1) Fisheries Research, and (2) Monitoring, Control, and Surveillance.

VI. INTERNATIONAL ISSUES

The Fisheries Division maintains direct contact on technical issues with regional and international organizations dealing in fisheries. Policy and other matters are managed in the first instance through the Department of Foreign Affairs.

Niue is a member of the South Pacific Commission (SPC), the South Pacific Forum Fisheries Agency (FFA) and the South Pacific Regional Environmental Programme (SPREP).

Niue is party to a number of treaties and agreements relating to the management of regional fisheries, including:

- the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America;
- the Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific, and;
- the Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region.

Niue is a signatory 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

VII. RESEARCH AND TRAINING

Fisheries and aquaculture research in Niue is the responsibility of the Fisheries Division. The Division does not have a strong research capability, but has collaborated with regional fisheries organizations. SPC has carried out five research projects in Niue in the past decade: coastal fishing activity, women's fishing activity, state of coastal resources, household fishery survey, and a reef invertebrate fishery. FFA and ICLARM have jointly done research on aquaculture potential. FAO has sponsored studies on *decapterus*, coconut crab, and development potential.

Niue has no fisheries training institutions. Fisheries Division staff make use of fisheries education and training opportunities overseas, or those provided by regional fisheries organizations.

VIII. AID

New Zealand is the largest donor of development assistance to Niue. A total of about US\$25,000 has been allocated for 2001/2002 to "assist with development of appropriate programmes for Niue 's agricultural and fisheries industries".

Assistance to the fisheries sector has also flowed from other sources, including FAO, UNDP, UNCDF, NZODA, FFA, SPC, and ICLARM. A significant amount of assistance is related to rehabilitation of infrastructure after cyclones.

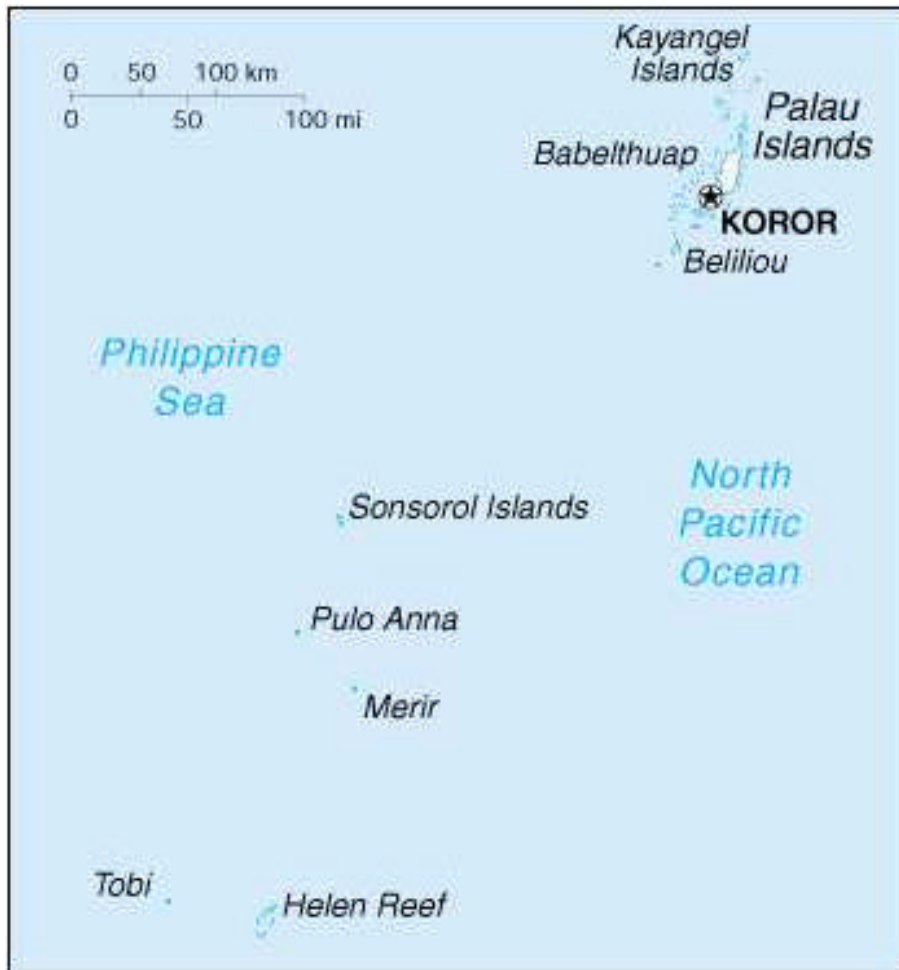
XI. INTERNET LINKS

www.spc.int/coastfish/Countries/Niue - has information on Niue fisheries and links to other sites dealing with the Niue.

www.mft.govt.nz/nzoda/programmes2001/pacific/niue - has general information on Niue, including fisheries-related aid from New Zealand.

www.niueisland.com - has general information on Niue, including a fishing report.

PALAU



PALAU

I. GENERAL ECONOMIC DATA⁶⁸

Land area:	488 sq km
Ocean area:	629 000 sq km
Length of 200-m isobath:	430 km
Population (1998) ⁶⁹ :	18 500
Gross Domestic Product (1998) ⁷⁰ :	US\$137 143 250
Fishing contribution to GDP:	US\$11 027 250
GDP per capita (1998):	US\$7 413

II. FISHERIES DATA

Commodity Balance (1999):

	Production	Imports	Exports	Total supply	Per caput supply
Fish for direct human consumption ⁷¹	4 615 ⁷²	610	2 900 ⁷³	2 325	124 ⁷⁴
Fish for animal feed and other purposes	-	-	-	-	

Estimated employment (1999):

(i) Primary sector (full and part-time):	200
(ii) Secondary sector:	n/a
(iii) Subsistence fisheries:	1 100
Gross value of Fisheries Output (1999) ⁷⁵ :	US\$ 17 595 000
Trade: Value of imports (1999) ⁷⁶	US\$ 1 830 000
Value of exports (1996)	US\$ 2 213 419

⁶⁸ The currency used in Palau is the US dollar.

⁶⁹ Source: Secretariat of the Pacific Community 1998 mid-year estimate.

⁷⁰ Source for GDP data: Gillett and Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, Manila.

⁷¹ Sources: various government and non-government sources as given in Gillett and Lightfoot (2001).

⁷² Breakdown: subsistence 1 250 t, coastal commercial 865 t, offshore locally-based 2 500, total 4 615. Not included in the total is 124 t caught by foreign-based offshore vessels.

⁷³ Breakdown: 2 500 t locally-based offshore fishery exports; 400 t coastal fishery exports.

⁷⁴ This per caput supply does not take into consideration the large number of visitors to Palau

⁷⁵ Breakdown:

Coastal commercial fisheries:	US\$	2 595 000
Subsistence fisheries:	US\$	2 500 000
Locally-based offshore fishery:	US\$	12 500 000
Total	US\$	17 595 000

⁷⁶ Source: Palau Conservation Society.

III. STRUCTURE AND CHARACTERISTICS OF THE INDUSTRY

General

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 center and capital), Babelthuap (the largest island in terms of land mass, making up 78 percent of Palau's land area and the second largest island in Micronesia after Guam), 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. The westernmost islands of Palau are closer to Indonesia than they are to Koror, which comprises only 4 percent of the land area but is home to more than 70 percent of the population. Politically, the country consists of 16 states vested with inshore fishery management responsibilities and a national government with offshore responsibilities.

The major marine habits 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

Marine Fisheries

Exploitation of Palau's living marine resources is diverse. Most fishing is done within the lagoons and on the outer reef slopes and is commonly conducted on a subsistence or semi-subsistence level, with a portion of catches finding their way to markets in the capital, Koror. Techniques used for subsistence and small-scale commercial fishing range from 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 fishing activities involve the use of small fishing craft, typically from 4.8-7.6 m in length and powered by outboard motors. At least 25 percent of households own fishing boats and through the extended family system, most fishers have access to a powered craft of this type.

The most important resources are reef finfish, pelagic fish, mangrove crab, lobster, trochus (for both shells and meat), giant clam, beche-de-mer, and other invertebrates.

In the ten-year period 1989 to 1998 an annual average of 2 115 t of fish and invertebrates was produced by Palau's coastal and inshore fisheries. By weight, about 60 percent of the landings were from the subsistence fisheries. The value⁷⁷ of the subsistence and commercial fisheries was about US\$5 million. In a typical year of the last decade, about 1 300 fishers (1 100 subsistence, 200 commercial) using 800 boats participated in the Palau's inshore fisheries.

⁷⁷ Market value for the commercial catch; "farmgate" prices for the subsistence catch, as given in Gillett and Lightfoot (2001).

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. Improvements in shipping and air communications in the past decade have allowed development of profitable fish export activities. In the mid-1990s as a conservation measure, export restrictions were placed on a number of marine species.

Fishing for the shellfish trochus is periodically a significant source of revenue for many fishers. In the 1990s regulation of the trochus industry increased and harvests occurred in only five years: 1992, 1993, 1995, 1996, and 1999 when between 26 t and 389 t was exported annually.

Private-sector interests commenced the collection and export of ornamental species for the aquarium trade in 1991. Marine dive tourism is very important in Palau and sport fishing is growing in importance.

The offshore fishery for pelagic species, particularly tuna, is conducted primarily by locally-based foreign vessels. From 1964 to 1983 Van Camp Seafood Company operated a shore base and freezing facilities at Malakal near Koror, supplied by a locally-based pole-and-line fleet which produced from 3,000 to 8 000 t of tuna per year. The base, made redundant by the successful introduction of purse-seining into the region, was sold in 1986.

The next wave of tuna-related fishing activity was purse seining. Some experimental purse seining was carried out in the 1970s in the Palau zone, first by the Japanese and then by the Americans. Commercial tuna seining became important in the early 1980s. Catches increased in the Palau zone, reaching nearly 30 000 t in 1991. Catches have since declined, mainly because increasing familiarity with the region indicated higher catch purse seine catch rates to the east of the Palau zone. Tuna catches by purse seine gear in the 1998 were almost zero, while that of 1999 were only a few hundred tonnes.

From the mid-1980s to the early 1990s the locally-based longline fishery expanded rapidly. Nearly 4 000 t of tuna was landed in 1992, after which catches tapered off. During subsequent years about 2 500 t of longline tuna was caught and exported annually. The three major longline companies used predominantly vessels from China, with the fleet size fluctuating from 100 to 300 longliners in the latter part of the decade. Much smaller amounts of tuna were caught in the Palau zone by Japan-base longliners.

Tuna catches in 1999 were made by vessels from mainland China (995 t), Japan (46 t), Kiribati (65 t), Papua New Guinea (13 t), and Taiwan China (1 229 t), for a total of 2 368 t. Access fees and other government charges for foreign fishing averaged about \$2 290 000 in the period 1993 to 1997.

Inland fisheries

There are no significant inland or freshwater fisheries in Palau. Lake Ngardok in Melekeok State, the largest natural body of freshwater in Micronesia, was made a nature reserve in 1997.

Aquaculture

The Micronesian Mariculture Demonstration Center 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 Center (PMDC) the facility also serves as a regional mariculture training centre and a marine science research laboratory. PMDC's primary activities have focused on: giant clam hatchery operation, re-seeding, export, training and research; hawksbill turtle head-starting, research and conservation; trochus resource assessment and management; research into soft coral culture; and a visiting scientist programme.

PMDC has carried out culture of giant clams, soft corals and other organisms as a means of financing it's own research activities. It has also supported a handful of giant clam grow-out sites around Palau.

Species which have been trialed in Palau include seaweed, corals, giant clams, crocodiles, milkfish, mollies, mullet, oysters, shrimp, rabbitfish, sponge, trochus, and turtles.

There are presently few, if any, commercial aquaculture operations in Palau. In the past much of the private sector aquaculture activity was associated with various aid projects or government promotion schemes.

Utilization of the catch

Studies sponsored by the Palau Conservation Society indicate that, of the 2 115 t produced annually by the inshore fisheries, 715 t goes to the seven retailers, 2 t goes to the 26 local restaurants, and 1 378 t goes directly to residents.

The fishers, retailers, and residents together export about 400 t, or 19 percent of the inshore catch. Government records show that about 32 percent of the exports were by air cargo, with the remainder as baggage by travelers. Guam and Saipan to the northeast of Palau together received about 86 percent of the inshore fishery exports.

The distribution channel for trochus is quite different, with the meat being consumed locally and the shell going to button factories in Asia and Europe. Most of the aquarium fish exports are for the market in the United States.

The Palau Division of Marine Resources indicates that during the past few years about 12 percent of the tuna exports were for canning, while 88 percent was for the sashimi market, primarily in Japan. Much of the tuna is exported in aircraft dedicated to the fish trade.

Demand

Fish and other marine organisms play an important part in the diet of most Palauans, including those living in urban areas. The market for fresh fish and other seafood in Koror is strong, supported by local consumption, a large tourist industry, and by demand from exporters shipping fish to Guam and Saipan.

In the past two decades numerous estimates of fish consumption in Palau have been made. Most of the estimates have been in the range of 84 to 135 kg per capita per year⁷⁸. A recent study by the Palau Conservation Society estimated (a) local coastal fisheries production of 2 115 t, (b) fishery product imports of 610 t, (c) fishery product export of 400 t, (d) a mean resident population in Palau in the 1990s of 16 600, (e) visitors to Palau (full-time resident equivalents) of 500. This equates to annual per capita fishery product consumption of 135 kg in the 1990s.

Economic role of the Fishing Industry

In 1998 fishing contributed about 8 percent to the GDP of Palau. Although this is substantial, it has declined dramatically in the past decade, partly due to a decline in the locally-based longline fishery and to strong growth in other sectors of Palau's economy, especially tourism. It also should be noted that the methods used to calculate Palau's GDP have changed since the early 1990s when the nominal contribution of fishing to GDP was reported as 25 percent.

The value of the 2 500 t of tuna shipped out of Palau annually by locally-based companies in the 1990s is estimated to be about US\$ 12.5 million. This together with the inshore fishery exports account for the vast majority of Palau's commodity exports.

Other economic benefits of fisheries include:

- Food to 1 100 subsistence fishers and employment to 200 commercial fishers
- Access fees and other government charges for foreign fishing of about \$2 290 000 annually in the 1990s
- A substantial portion of the protein supply for local residents
- Recreation for both Palau residents and visitors

IV. DEVELOPMENT PROSPECTS

Given the resource limitations that apply to tropical reef and lagoon fisheries, Palau's main development prospect is the offshore fishery for tuna and allied species. The EEZ is estimated to have a throughput of skipjack tuna amounting to 14,000 t/month. No recent estimates have been made of the local abundance of yellowfin and bigeye tuna, but industrial fishing activity and catches indicate that these fish also form a substantial resource. Palau's geographic position makes it easier, and cheaper, for offshore fishing companies to access markets in Japan and elsewhere in Asia, a particularly important factor in the fresh tuna fishery targeting sashimi markets. Palau is thus well placed to benefit from further development in the offshore fishery.

V. INSTITUTIONAL ARRANGEMENTS

Several national government agencies and one local NGO are concerned with marine resource exploitation, development and management in Palau.

⁷⁸ Whole fish weight equivalent

- The Ministry of Resources and Development includes the Bureau of Natural Resources and Development, which directs the activities of the Marine Resources Division (MRD). The functions of MRD include marine research and development, resource management, technology transfer, technical advisory and extension services, statistical monitoring and recommending legislation. In addition, MRD is responsible for the operation of the PMDC which is charged with developing and promoting the commercialization of certain species through mariculture.
- Within the Bureau of Natural Resources and Development the Palau Maritime Agency has responsibilities in the management of tuna fisheries, including maintaining the data collection system for recording catches and exports of fish by locally-based foreign fishing.
- Within the Ministry of State the Bureau of Foreign Affairs handles trade negotiations, and the Division of Foreign Relations oversees matters relating to international boundaries.
- Surveillance and enforcement are the responsibility of the Ministry of Justice, where both Attorney General's Office and the Division of Marine Law Enforcement have important functions.
- The Environmental Quality Protection Board monitors and enforces legislation dealing with the environment.
- The Palau Federation of Fishing Associations is a cooperative established in 1975 to provide shoreside facilities and services to local fishers. PFFA suffered financial losses and was declared insolvent in 1982. In 1983 it was taken over by the national government and is currently managed as a quasi-government agency by PFA.
- The Palau Conservation Society⁷⁹ (PCS) is an NGO with major involvement in marine resources. Past initiatives have included a study of the costs and benefits of tuna fishing to Palau, an inshore fisheries resource profile, promotion of marine reserves, conducting reef surveys, promotion of sport fishing as a management tool, and assessing the effects of tourism on reef ecosystems.

Article I, Section 2 of Palau's Constitution confers on the country's 16 states the ownership of all marine resources found within 12 nautical miles of the state boundaries. Article IX, Section 5 (12) states that marine resource conservation in the national interest falls within the purview of the national government. State governments thus have primary responsibility for management of inshore fisheries, while national government takes the lead role with respect to offshore fisheries.

Palau's main fisheries law is Title 27 of the Palau National Code, under which there are regulations for both foreign and domestic fishing. Other relevant legislation is contained in Title 24, which relates to environmental protection. The Marine Protection Act (1994, amended 1995) which imposes a variety of restrictions on the harvest and trade of some food fishes, on aquarium fish and on aquacultured organisms, has been incorporated into Title 27.

⁷⁹ Several PCS reports were useful in compiling this fishery profile of Palau.

VI. INTERNATIONAL ISSUES

The MRD maintains direct contact with regional and international organizations on technical issues dealing in fisheries. Policy and other matters are managed in the first instance through designated contact points, most often the Bureau of Foreign Affairs. Palau is a member of the Secretariat of the Pacific Community (SPC), the South Pacific Forum Fisheries Agency (FFA) and the South Pacific Regional Environmental Programme (SPREP).

Palau is also party to a number of treaties and agreements relating to the management of regional fisheries, including:

- The Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America;
- The 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

Palau is a signatory to the following international agreements:

- 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.

VII. RESEARCH AND TRAINING

Fisheries and aquaculture research in Palau is the responsibility of MRD, whose primary responsibilities and activities include:

- Resource assessment and evaluation of the commercial potentials of reef, pelagic deep water and bait fish, mollusks, turtles and crustaceans from catch records, censuses and field surveys;
- Development and recommendation of regulations for the scientific management of these resources on a sustainable yield basis;
- Recommendation of regulatory measures such as size limits, fishing seasons and sanctuary areas, where appropriate;

- Advising and informing the public of any measures and other important matters concerning marine conservation;
- Maintenance of the PMDC as a site for research on Palau's marine resources;
- Hatchery rearing and mass production of commercially important marine organisms, including giant clams and trochus; and
- Turtle research for conservation and management.

MRD is also undertaking data gathering in support of management, including aerial mapping of habitats to assist in determining optimum yields, a programme of rapid ecological assessment for areas of key concern, a marine and terrestrial survey of resources in the Southwest islands, a household survey of subsistence fishing activities and production, a comprehensive monitoring and re-seeding programme for trochus, and the collection of data on commercial landings in market centres.

The PMDC serves as an education and training centre for Palauan students in principles of marine biology, conservation and mariculture. The centre provides intensive summer education programmes for local students as well as educational tours for schools at all grade levels.

MRD staff and others seeking more advanced training mostly rely on overseas opportunities provided by bi-lateral and multi-lateral donors as well as by regional and international fisheries organizations.

The MRD maintains direct contact on technical issues with regional and international organizations dealing in fisheries. Policy and other matters are managed in the first instance through designated contact points, most often the Bureau of Foreign Affairs. Palau is a member of the South Pacific Commission (SPC), the South Pacific Forum Fisheries Agency (FFA) and the South Pacific Regional Environmental Programme (SPREP).

Other training and research agencies relevant to Palau are:

- Palau Conservation Society has carried out numerous studies relevant to the fisheries of Palau (see Institutions section above).
- Center for Tropical and Subtropical Agriculture operates in Palau and other US-affiliated Pacific Islands. CTSA's activities involve providing technical assistance, management support and training in aquaculture.
- Marine Resources Pacific Consortium (MAREPAC) attempts to adapt traditional management principles and practices to modern resource management challenges. MAREPAC membership comprises Palau and other US-affiliated Pacific Islands.
- Palau International Coral Reef Center (PICRC), opened in January 2001. The PICRC is a research centre directed by a board of eminent regional scientists that undertakes research on coral reefs and participates in regional coral reef monitoring activities.

- Palau Community College has a Cooperative Research and Extension Program involved in aquaculture research and monitoring of marine protected areas.
- The Nature Conservancy has provided substantial support for fisheries-related research.

VIII. AID

Palau has enjoyed fisheries sector assistance from a range of multi-lateral and bi-lateral donors. Support has included the funding of expatriate staff positions within MRD, 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 Japanese Government (through the Japan International Cooperation Agency and Overseas Fishery Cooperation Foundation) and the Pacific Aquaculture Association. Other donors have included UNDP, NZODA, AusAID, ACIAR, FFA, SPC, ICOD, and CIDA.

Much of the fisheries sector assistance in the past has been channeled through the Marine Resources Division. 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 Foundations that are based in the United States, and the Keidanren Foundation in Japan.

IX. INTERNET LINKS

The site <http://www.spc.int/coastfish/countries/palau/palau> has information on Palau fisheries and links to other sites dealing with Palau.

PAPUA NEW GUINEA



PAPUA NEW GUINEA

I. GENERAL ECONOMIC DATA⁸⁰

Land area ⁸¹ :	462 243 sq. km.
Ocean area:	3 120 000 sq. km.
Length of coastline:	17 000 km
Population (1999) ⁸² :	4 687 900
Gross Domestic Product (1999) ⁸³ :	US\$ 3 445 189 046
Fishing contribution to GDP (1999):	US\$ 48 775 478
GDP per capita (1999):	US\$ 735

II. FISHERIES DATA⁸⁴

Commodity Balance (1999):

	Production	Imports	Exports	Total supply	Per caput supply
Fish for direct human consumption	95 500 ⁸⁵	35 539 ⁸⁶	39 386	91 653	19.6
Fish for animal feed and other purposes	3 000	-	2 000	1 000	-

Estimated employment (1996):

(i) Primary sector:	1 500
(ii) Secondary sector:	5 000
(iii) Subsistence fisheries:	250 000-500 000

Gross value of Fisheries Output (1999)⁸⁷: US\$ 98 500,000

Trade:	Value of imports (1996)	US\$ 43 607 000
	Value of exports (1999)	US\$ 49 000 000

⁸⁰ Average 1999 rate of exchange US\$ 1.00 = Kina (K) 2.5708

⁸¹ Source: South Pacific Commission Statistical Summary 2000.

⁸² Source: South Pacific Commission 1999 mid-year estimate.

⁸³ Source for GDP data: Gillett and Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, Manila.

⁸⁴ Sources: Various government and non-government sources as given in Gillett and Lightfoot (2001).

⁸⁵ Breakdown (tonnes):

Coastal commercial:	5 500	
Coastal subsistence:	26 000	
Offshore local-based:	50 500	
Inland fisheries	13 500	(Coates, 1995)
Total	95 500	

85 000 t caught by foreign-based vessels is not included in the total.

⁸⁶ Amount is for 1996.

⁸⁷ Breakdown: Coastal subsistence: US\$20 000 000; Inland subsistence: US\$13 500 000; Coastal commercial US\$21 000 000; locally-based offshore: US\$44 000 000; total US\$98 500 000.

III. STRUCTURE AND CHARACTERISATION OF THE INDUSTRY

General

Papua New Guinea (PNG) comprises the eastern half of the world's largest tropical island plus an archipelago of a further 600 islands lying between approximately 1° to 12°S and 141° to 157°E in the western Pacific Ocean. PNG has a total land area of 462 243 sq. km. and an EEZ variously estimated to cover 2 437 480 sq. km., 2.3 million sq. km. or 3 120 000 sq. km.

The coastline and offshore archipelagos present a great diversity of coastal types and marine environments. The Gulf of Papua is characterized by large delta areas, mud flats and mangrove swamps, while the north coast and high island coasts are typified by fringing coral reefs and narrow lagoons. Some of the smaller island clusters lie adjacent to extensive submerged reef systems or broad shallows. PNG's total coastline length of approximately 17 000 km. includes about 4 250 km. (25 percent) of deltaic flood plain/lagoon systems, while some 4,180 km. (24 percent) of the coastline occurs around islands and atolls. PNG also has fast- and slow-flowing rivers, over 5 000 lakes, and an extensive system of marshes.

In addition to its national government, PNG has a decentralised system of semi-autonomous Governments in each of its 19 Provinces. Five of the Provinces are landlocked, while the remainder are coastal or maritime in nature, although some of the coastal Provinces also have extensive fresh water systems. Provincial Governments have considerable autonomy in regard to fisheries development and management.

Marine Fisheries

PNG's small-scale fisheries 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 the larger 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 (beche-de-mer as well as trochus and other shells) and for subsistence purposes is extensive, and may exceed finfish harvesting. Commercial prawn-trawling operations take place in the Papuan Gulf and other parts of southern PNG, and a small-scale tuna longline fishery has been established. A handful of vessels are now successfully catching sashimi-grade tuna and exporting them to overseas markets by air.

Subsistence harvesting is the most important component of PNG's domestic fishery in terms of both volume and value, but is poorly known. Some of the subsistence catch is sold, traded, bartered or forms the subject of customary exchange. Estimates of subsistence production vary but 26 000 t is a commonly-cited figure. Anecdotal information suggests that this may be an underestimate. A large number of people, estimated at somewhere between 250 000 and 500 000, participate in the coastal subsistence fishery, although the number is thought to have decreased at an annual rate of 1.5 percent between 1980 and 1990. It is estimated that 30 percent of the marine subsistence catch comprises coastal bay, lagoon and reef fish, 10 percent pelagic fish, and the rest invertebrates and seaweeds. Subsistence fishery production has been

valued at about US\$ 20 million based on a typical price to consumers of about US\$.77/ kg.

The major species landed in PNG's domestic commercial fisheries are, in order of commercial value in 1999, prawns, beche-de-mer, sashimi-grade tunas, lobster, trochus and other shells, sharks, lagoon and reef fish, and coastal pelagic fish. A substantial fishery for barramundi, producing 200 to 400 t/ yr., operated for several years until it collapsed in the early 1990s.

The prawn fishery is the most valuable coastal commercial fishery, accounting for exports of 808 t (tail weight) worth about US\$ 5.9 million in 1999 . The fishery takes place mainly in the Gulf of Papua, adjacent to Gulf Province, as well as in smaller fishing grounds elsewhere. Five prawn species are routinely taken but the catch is dominated by the banana prawn, *Penaeus merguensis*, which makes up about 60 percent of landings. Total PNG prawn production has in the past exceeded 1 300 t tail weight. Catch reductions are mainly a result of limitations in the number of fishing vessels imposed by the government in an attempt to maintain the fishery at sustainable levels.

Small amounts of lobster are caught throughout PNG's coastal waters but the only concentrated fishery is in the Gulf of Papua and Torres Strait. This is essentially a village-based fishery with catches being purchased, processed and exported by commercial operators. Trawling for lobster was permitted in this area until 1985, since which time all lobster in PNG have been caught by diving. Annual landings have ranged recently from 75 t to 103 t, and are dominated by the ornate spiny lobster, *Panulirus ornatus*. 1999 exports were 92 t valued at US\$ 2.08 million.

The shell fishery for trochus (*Trochus niloticus*), pearl shell (three *Pinctada* species, the most abundant of which is the black-lip pearl shell, *P. margaritifera*) and green snail (*Turbo marmoratus*), PNG's third largest export fishery, is also essentially village-based. Shell is collected by coastal villagers for on-sale to middlemen and eventual export or local processing. Total harvests of this group of products in PNG have typically been between 350 to 550 t/yr., although exports in 1999 were only 256 t worth about US\$ 1.9 million. The apparent decline in landings is thought to be due to localized over-harvesting.

The above figures for shells do not include button blanks or finished buttons made from shells. One button factory was operating in PNG in the late 1990s, but its present status and output is unknown.

PNG's beche-de-mer production averaged only 5.5 t/yr. in the period 1960-1984 but began increasing as of 1985 and peaked in 1991 with exports of almost 700 t dried weight (equivalent to at least 7,000 t green weight). Harvests in the last few years have begun to decline, and 1999 exports were only 370 t valued at US\$ 3.9 million. The decline is probably a result of localized over-exploitation, or at least removal of virgin biomass. The Government is currently putting in place management arrangements for some of the more heavily exploited areas and species. In 2001 the beche-de-mer fisheries were closed in Western/Torres Strait, Milne Bay, Manus, and New Ireland Provinces. It has been estimated that total yields of 1 000 t/ yr. could be obtained from a properly managed, geographically distributed beche-de-mer fishery in PNG.

Lagoon, reef and coastal pelagic fish are taken by small-scale commercial fishers using nets, lines and a wide variety of sometimes highly specialised fishing methods. Domestic commercial production of reef fish and large pelagics (excluding longline-caught tuna) is estimated to be around 3 300 t, worth at least US\$ 3.3 million and possibly more. In addition, about 40 percent of the marine subsistence fishery, or 10 400 t, is fin-fish. Total landings of coastal fish species from commercial and subsistence fisheries combined is therefore about 13 700 t.

Coastal fin-fish in rural or remote areas of PNG are considered to be under-exploited, and the government has in the past attempted to promote commercial development of these fisheries through the creation of infrastructure and by providing various forms of operating subsidy. In particular, a major programme established in the late 1970s and only now winding down, attempted to establish up to 20 coastal fishery stations, equipped with ice machines and cold stores and serviced by a fish collection system, throughout the country. Despite sustained efforts and high costs the stations, as well as many other small-scale fishery development projects, failed due to insurmountable economic, social and technical barriers. As a result coastal fisheries in most parts of PNG are still under-developed.

Exploitation of sharks has taken place in PNG since 1976, initially through a gill-net fishery which ran from 1976-1982, and then via a longline fishery which first targeted deep-water sharks for their oil and then, more recently, whaler sharks for their fins and meat. Shark fins also continue to be taken and sold as dry products by small-scale fishermen on an occasional basis. The total value for shark fin exports (dried and frozen) in 1999 was US\$1.2 million.

By far the biggest fishery resource in PNG is that of tuna and allied species. This resource is estimated to have an MSY potential of 300 000-400 000 t/yr. with a first landed value of at least US\$ 380 million.

Most tuna fishing in PNG has historically been carried out by foreign fishing vessels (FFVs). In 1999 78 FFVs from the Philippines, Taiwan China, Korea, Federated States of Micronesia, Kiribati, and Vanuatu were licensed to fish in PNG's DFZ under bilateral access arrangements. In addition, 50 US purse seiners were licensed to fish in PNG under the terms of the US Tuna Treaty, a regional access agreement involving several Pacific Island countries. These various FFVs in 1999 collectively took 85,000 t of catch worth an estimated US\$ 75 million. Most of the catch was transhipped onto reefer vessels in the PNG ports of Wewak, Manus, Kavieng, Rabaul, Lae and Madang, for shipment to canneries in Thailand, Philippines and American Samoa.

After many years of foreign domination, PNG is promoting more direct participation in the tuna fishery by local companies and individuals. In line with this policy, the Government ceased issuing foreign longlining licenses in mid-1995, in an attempt to promote development of a domestic tuna longline industry. Subsequently, after a number of longliners began operating under local charter arrangements, this too was regulated against, so that the fishery was closed to all but bona fide domestic entrants. . This is now being reconsidered due to slow growth of the fishery, and consequent loss of government revenue. The fishery may be re-opened to foreign chartered longliners until there are sufficient domestic vessels to take up all available licenses.

By late 2001 about 40 local longliners were operating in the fishery. 1999 landings were an estimated 500 t of yellowfin, bigeye and other large pelagic species, worth about US\$ 2.5 million. The prime-quality part of the catch is exported in fresh chilled form to Japan by air while lower-quality fish may be air-freighted to Australia or sold on the domestic market. Individual longline vessels are estimated to spend an average of more than \$590 000 each on wages, supplies and services annually. Of this, airfreight is the single largest cost component at around 25 percent of the total.

A locally-based purse-seine fishery has also begun to develop, although this is operated largely through the charter of foreign vessels by local companies. Three vessels operated in 1995, landing a total of 15 056 t of tuna. Some of this catch was transshipped in PNG to canneries in the Philippines, while a part was unloaded in Micronesia. By 1999 the catch of locally-based purse seiners had grown to 50 000 t, worth US\$ 42 million.

There is some sportfishing in PNG. There are between 50 and 60 private sportfishing vessels larger than 7.5 metres and commercial charter boats operate out of Port Moresby, Madang, Lae, and Rabaul. World records have been taken in PNG for *Scomberomorus*, *Caranx*, and *Gymnosarda*.

Inland Fisheries

PNG's inland water bodies are exploited by small-scale fishers for subsistence and commercial purposes. Estimates of production from inland waters vary but a figure of 13,500 t has recently been proposed. At a price to the consumer of US\$ 1.00/ kg this production has a nominal value of some US\$ 13.5 million.

Two major river systems, the Sepki/ Ramu and the Fly/ Purari, are quite extensive and provide most of the freshwater fish harvest. People involved in freshwater fishing (those who do some fishing at least once per week) number somewhat less than 125 000. Except for the barramundi fishery, there has been little commercial development of freshwater fishery resources.

Most of the present landings from the Sepik/Ramu consist of two introduced species. Because of the very limited fish bio-diversity, 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, including Java carp, rainbow trout, and at least seven other types. An inventory of small-scale aquaculture is now underway.

Aquaculture

Both freshwater and marine aquaculture are practised to a limited extent, though neither is of economic importance at present.

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 carp and 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. It is reported that the annual production in the late 1990s was 60 t of carp and 10 t of trout.

Marine aquaculture has included farming of seaweed, giant clams, crocodile, milkfish, mullet, mussels, oysters, and prawns. There is currently one pearl oyster farm, located in Milne Bay with another being established in New Ireland. In the late 1990s there was cage culture of groupers at Manus Island, but the viability was hampered by a nationwide moratorium on the export of live reef food fish. A barramundi farm operates outside of Madang.

Utilization of the Catch

Most of PNG's domestic fish catch is taken in the subsistence fishery and is used for home consumption or distribution within families and communities. It has been estimated that small-scale fisheries provide 35 percent of the protein intake of at least some parts of PNG's population.

The amount of the subsistence catch which enters into commercial trade is unknown, but is estimated to be at least 15 percent, or 1,600 t. When added to estimated commercial landings of about 3,300 t, this gives a figure for the commercial finfish trade in PNG of about 4 900 t/yr.

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.

There are two fish canneries in PNG. One is based in Lae, and packs imported frozen mackerel, mainly for the domestic market, although some export of this product occurs. The other is in Madang, and packs tuna. This cannery is supplied by its own fleet of purse seiners, as well as by purchasing fish from other tuna-fishing vessels. The cannery has increased throughput to its target of 80 tonnes per day of raw material, operating two shifts 11 days per fortnight. The cannery is anticipated to expand its throughput to 100 tonnes per day during 2002. Exports of canned tuna to the USA, Philippines and Europe from the facility amounted to 5 587 tonnes in 1999. The closure of tuna canneries in Solomon Islands and Fiji has stimulated canned tuna exports within the region, helped by tariff reduction under the Melanesian Spearhead Group arrangement.

According to the National Fisheries Authority, PNG exported 39 896 t of fishery products in 1999 (worth US\$48 million) and 41 555 t in 2000 (worth US\$54 million).

Demand

A recent review of the literature of fish consumption in PNG shows that most nation-wide studies indicate an annual per capita intake of between 18.2 and 24.9 kg.

Demand for fisheries products in PNG greatly exceeds supply, resulting in fishery product imports which are greater than domestic landings. It has been estimated that

there is a demand for at least an additional 2 000 t/ year of fresh, smoked and frozen fish in Port Moresby, the country's biggest commercial seafood market, alone. Anecdotal information also supports the view that general demand for fish exceeds supply, and that certain niche markets in particular are unsatisfied. As in most Pacific Island countries cost is a major factor, since the buying power of most residents, even in urban areas, is very limited.

Most of PNG's imported fish (about 95 percent by weight) is canned fish, principally mackerel. The remainder is frozen fish, including low-cost barracouta fillets from New Zealand which are mainly used in the domestic fast food business, and whole mackerel imported to supply the cannery in Lae.

Economic Role of the Fishing Industry

The official contribution of fishing to GDP was US\$19 176 909, or .56 percent of GDP. A recent ADB study estimated the contribution to be US\$48 776 000, or 1.4 percent of GDP. This difference is mainly attributable to the absence of the contribution of subsistence fishing in the official estimates.

The US\$48 million of exports of fishery products in 1999 represent about 1.8 percent of the value of all commodity exports of the country.

For 2000 access arrangements resulted in the payment of US\$10 534 495 in fees plus US\$706 125 for training levies, observer fees, and technical assistance. This US\$11.2 million represents about 2 percent of all government revenue or 33 percent of non tax revenue.

Recent analysis of the value to PNG of the tuna fishery indicates that foreign purse seine vessels entering the fishery generate an initial contribution of \$500 in taxes and charges and a further \$53 000 to \$70 000 in taxes and government charges annually (the amounts for taxes include that on fuel). Domestic based purse seine vessels, in contrast, are estimated to generate contributions of from \$463 000 to \$595 000 in taxes and charges on entering the fishery and a further \$237 000 to \$301 000 in taxes and charges annually.

Information on fisheries-related employment in PNG is largely unavailable. An ADB study, focusing on the tuna sub-sector, estimated that the total number of PNG nationals directly employed in tuna catching, processing, and exporting is about 3 000. This represents about 1.5 percent of the total formal employment in the country

The latest national census for which data is available (1990) shows that out of 130 963 rural households, about 23 percent were engaged in catching fish. About 60 percent caught fish for own consumption only and 40 percent caught fish for both own consumption and for selling.

Although detailed data is not available, it appears that small-scale fish production from coastal areas has declined further in the past five years. A more than 300 percent increase in the price of fuel and a progressive decline in the relative value of the Kina have combined to greatly increase the costs of materials and supplies needed for fishing. The devaluation of the Kina makes fishing for export increasingly attractive, but domestic prices for seafood products have not increased accordingly. As a result the

economics of small-scale fisheries that supply domestic demand are deteriorating in coastal areas, affecting rural incomes.

IV. DEVELOPMENT PROSPECTS

There is scope for expansion of both offshore and coastal fisheries in PNG, as well as for the development of local markets through improved distribution, better use of by-catch (especially from tuna fishing) and value-added processing. It may also be possible to develop more 'exotic' resources, such as aquarium fish, specimen shells and game fishing.

As regards to offshore tuna fisheries, the government has placed priority on domestication of the industry and is promoting the development of domestic fleets as well as canneries, longline bases and other processing activities. Potential exists both for increases in current tuna landings, and, if necessary, for the replacement of FFVs by domestic vessels. So far, however, the offshore fishery continues to be dominated by foreign interests. Constraints to domestication include lack of entrepreneurial capital and skills, and the fact that the government has not yet carried out the fiscal and policy reforms needed to attract private operators into the fishery.

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 commercialisation 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.

V. INSTITUTIONAL ARRANGEMENTS

The Fisheries Management Act 1998 (FMA) 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.

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.

The Fisheries Act provides for the establishment of the National Fisheries Authority (NFA) to replace the former Department of Fisheries and Marine Resources (DFMR). The NFA, which has a more commercial orientation than its predecessor, began operating in 1995. A restructuring of NFA has recently occurred in which NFA assumed the status of a non-commercial statutory authority. The number of staff was reduced from 168 to 48 and many responsibilities were devolved to provincial governments.

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. It seems likely that, now the FIA is well-established, it will continue to provide a voice for the interests of the fishing industry.

VI. INTERNATIONAL ISSUES

The National Fisheries Authority maintains direct contact on technical issues with regional and international organizations dealing in fisheries. Policy and other matters are managed in the first instance through designated contact points, most often the Department of Foreign Affairs. Papua New Guinea is a member of the South Pacific Commission (SPC), the South Pacific Forum Fisheries Agency (FFA) and the South Pacific Regional Environmental Programme (SPREP).

PNG is party to a number of regional agreements that control or manage the tuna fishery in the Western Central Pacific Ocean. These include the Nauru Agreement, the Palau Arrangement for the Management of the Western Pacific Purse-Seine Fishery, the Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement for the South Pacific Region, the Wellington Convention for the Prohibition of Fishing with Long Drift Nets in the South Pacific, and the FSM Agreement.

PNG is party to a number of regional agreements that control or manage the tuna fishery in the Western and Central Pacific Ocean. These include the Nauru Agreement Concerning Cooperation in Management of Fisheries of Common Interest, the Palau Arrangement for the Management of the Western Pacific Purse-Seine Fishery, the Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement for the South Pacific Region, the Wellington Convention for the Prohibition of Fishing with Long Drift Nets in the South Pacific, and the Federated States of Micronesia Arrangement for Regional Fisheries Access.

By virtue of its membership of FAO, PNG subscribes to the 1995 FAO Code of Conduct for Responsible Fisheries. PNG is also a signatory to the Washington Convention on International Trade in Endangered Species (CITES), which regulates exports of some fishery products.

The Torres Strait Treaty between Australia and PNG provides for the management of the Torres Strait Protected Zone (TSPZ) that lies between the two countries. The Treaty covers a wide range of issues, including immigration, customs and defence, as well as fisheries and marine resources. Fisheries within the zone are jointly managed by the two countries, with arrangements for joint determination of management measures, catch-sharing and cross-licensing of vessels to operate in both country's waters. To give effect to the provisions of the treaty, the PNG Government enacted the Fisheries (Torres Strait Protected Zone) Act in 1984. This was included in the recent review of the Fisheries Management Act, with the intention of bringing all of PNG's fishery law into one legislative instrument.

VII. RESEARCH AND TRAINING

Fisheries research in PNG has traditionally been carried out by the NFA or its predecessor organizations, and has a long history. Major research programmes on tuna, baitfish, prawns, barramundi, lobsters and various reef fish and other key fishery species were originally initiated in the 1960s. Originally these were instrumental in the development of management arrangements for PNG's fisheries, but after the 1980s research activities became less focused. Since the restructuring of NFA a new strategy for research is being developed, which will focus primarily on obtaining information needed to refine fishery management plans. The new strategy involves making greater use of partnerships with local and overseas research agencies, NGOs, private institutions and funding donors.

There are a number of institutions in PNG which offer training relevant to the fisheries sector:

- the Kavieng-based National Fisheries College (NFC), which is now a Branch of NFA, offers a range of seafood and fisheries courses including new qualifications for fishing vessel crew and captains authorised under the Merchant Shipping Act;
- the PNG Marine School, in Madang, offers 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; and
- the PNG Institute of Public Administration offers accountancy, management and other training programmes relevant to the fisheries sector.

VIII. AID

Fisheries development in PNG has been heavily dependent on external economic and technical assistance. Most of the development initiatives have been donor supported, though many have included a PNG government contribution.

Bilateral aid for fisheries in PNG has been received from Australia (PNG's largest international donor), New Zealand, and a number of other governments, while multilateral assistance has been provided by FAO, IFAD, UNDP, EU, ADB and the

World Bank. 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, as well as several UN agencies (UNDP, ESCAP) have also been active in supporting PNG's fisheries sector.

At present the major aid-sponsored fishery projects are:

- The Fisheries Development Project funded by an Asian Development Bank loan for restructuring of the National Fisheries Authority and the construction of two fishing wharves.
- The National Fisheries College Strengthening and Training Project, funded by AusAID for turning the College into an efficient provider of short, modular courses, designed to meet the needs of all stakeholders in fisheries.
- The Community Coastal and Marine Conservation Project supported by the Global Environment Facility, executed by UNDP and implemented by Conservation International. It aims to promote conservation of marine biodiversity mainly through developing community-based management of marine resources in Milne Bay Province.

Several major new projects are planned for 2002. These include the EU funded Rural Coastal Fisheries Development Project, the ADB loan-funded Coastal Fisheries Management and Development Project, and the INFOFISH-supported Alternative Tuna Products Development Project

IX. INTERNET LINKS

The following websites have information relevant to fisheries in PNG:

- www.spc.int/coastfish/Countries/PNG/png.htm - Information on PNG fisheries and links to other sites concerning PNG
- www.niugini.com - General information on PNG and descriptions of the country's economic sectors, including fisheries
- www.png.net/govt.html - Contact addresses for government departments and trade associations

SAMOA



SAMOA

I. GENERAL ECONOMIC DATA⁸⁸

Land area ⁸⁹ :	2 935 sq. km.
Shelf area (to 200m):	4 500 sq. km.
Ocean area:	120 000 sq. km.
Length of coastline:	447 km.
Population (1999) ⁹⁰ :	168 000
Gross Domestic Product (1999) ⁹¹ :	US\$ 230.1 million
Fishing contribution to GDP:	US\$ 15.3 million
GDP per capita (1999):	US\$ 1 370

II. FISHERIES DATA

Commodity Balance (1999):

	Production ⁹²	Imports	Exports	Total supply	Per caput supply
Fish for direct human consumption ⁹³	12 535	2 450	4 657	10 328	61.5
Fish for animal feed and other purposes	0	0	0	0	

Estimated employment (1999):

(i) Primary sector:	900
(ii) Secondary sector ⁹⁴ :	80
(iii) Subsistence:	7 500

Gross value of fisheries output (1999)⁹⁵: US\$ 23.6 million

Trade (1999) ⁹⁶ :	Value of imports	US\$ 4.9 million
	Value of exports	US\$ 10.8 million

88 Average 1999 rate of exchange: US\$ 1.00 = Samoan dollar (S\$) \$3.0231; 2000 – 3.2864

89 Source: South Pacific Commission Statistical Summary 2000.

90 Source: South Pacific Commission 1999 mid-year estimate.

91 Source for GDP data: Gillett and Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, Manila.

92 Production breakdown (tonnes): Subsistence 4 293; Coastal commercial 3 086; offshore locally-based 5 156; total 12 535. The total does not include the 100 tonnes caught by foreign-based offshore vessels.

93 Source: government and non-government data in Gillett and Lightfoot (2001).

94 A further 3 000 people from Samoa are employed at the two tuna canneries in American Samoa.

95 Value breakdown: Subsistence US\$7 143 000; coastal commercial US\$6 583 000; Offshore locally-based US\$9 840 000; total US\$23 566 000. Not included in the total is the value of the offshore catch by foreign based vessels, US\$99 000.

96 Source for output value and trade: Government and non-government data in Gillett and Lightfoot (2001).

III. STRUCTURE AND CHARACTERISATION OF THE INDUSTRY

General

Samoa consists of two main islands, Upolu and Savaii, seven smaller islands (two of which are inhabited), and several islets and rock outcrops. The total land area is 2 935 sq. km. The 1999 population of about 168 000 reside in 326 villages, of which 68 percent are on the island of Upolu. About 230 villages are considered to be coastal villages.

Barrier reefs enclosing narrow lagoons encircle much of the coastline except for the north coast of Upolu, the main island, where there is an extensive shelf area which extends up to 14 miles offshore. There are few freshwater bodies of any significance and thus no important inland fisheries, although a number of aquaculture projects are under way. Marine fisheries are predominant, but due to the proximity of neighbouring countries (American Samoa, Wallis and Futuna, Tokelau and Tonga) Samoa's EEZ does not extend to 200 nautical miles offshore in any direction, and at 120 000 sq. km. the EEZ area is the smallest in the Pacific Islands region.

Two large tuna canneries located in nearby American Samoa have major implications for Samoa. They provide jobs to about 3 000 Samoans as well as a ready market for tuna catches by Samoa's longline fleet.

Marine Fisheries

Nearshore fishing is undertaken by villagers operating in shallow lagoon waters adjacent to their lands. 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. Fishing is for both subsistence and commercial purposes, with a significant overlap between the two. The subsistence fishery was estimated to have landed about 4 293 t of fish and invertebrates in 1999. Small-scale commercial fishing was responsible for an additional 3 000 t. The most important resources for Samoa's small-scale fisheries are: finfish (especially surgeonfish, grouper, mullet, carangids, rabbit fish), octopus, giant clams, beche de mer, turbo, and crab.

Commercial fishing is carried out outside the reefs and offshore by a large fleet of catamarans, typically 9 to 10 m in length and powered by 40 hp outboard motors. Since the introduction of this FAO craft design, the *alia*, in the mid-1970s, more than 320 have been locally built. The first 120 craft were constructed in plywood and, later 200 more were built from welded aluminium. In the early to mid 1980s the *alia* fleet numbered some 200 craft. Initially much of the fleet engaged in bottom fishing along the southern shelf area and reef slopes, landing high-value deep-water snappers for air-export to Hawaii. However as the deep-bottom resource became more heavily exploited, fishing effort began to be re-directed offshore, with fishermen targeting skipjack and small yellowfin tunas by trolling around fish aggregation devices (FADs). This fishery has in the past produced a catch of around 2 000 t/ yr.

Despite an active FAD deployment programme run by the Government, continued FAD losses and a number of other factors contributed to a decline in the fleet to around 100 vessels by the late 1980s. The fleet was reduced still further, to only 40 vessels, as a

result of the destruction caused by two severe cyclones which struck Samoa in 1991, and the catch from the fleet fell to around 200 t annually.

A vessel reconstruction programme and the introduction of effective small-scale longline fishing techniques and gear in the early 1990s saw the number of *alia* grow rapidly during the decade. The development in the mid-1990s of an export market for albacore and other tuna resulted in further expansion in the fishery. By 1999 the catches by locally-based longline vessels were about 5 000 tonnes worth US\$10 million. The status of the tuna fleet in 2000 was:

- Conventional 9 to 10 m *alia*: about 119 vessels operating; 63 percent based in the Apia urban area;
- 10 to 12.5 m catamarans and monohull longliners: about 20 operating; 89 percent based in the Apia urban area;
- 12 to 15 m catamarans and monohull longliners: 9 operating; 100 percent based in the Apia urban area; and
- Monohull longliners greater than 15 m: 6 operating; 100 percent based in the Apia urban area.

The catch made by the tuna longliners in recent years is comprised of 71 percent albacore, 12 percent yellowfin, 5 percent bigeye, and 12 percent other species.

According to the Fisheries Division, 41 *alia* fishermen have lost their lives at sea since 1996. Many of the safety problems appear related to the use of small catamarans at considerable distance from land. In 2001 Samoan fishermen drifted as far away as Papua New Guinea.

There is relatively little foreign fishing activity in the Samoa zone. This is due to both the small size of the Samoa zone and the fact that the productive areas for purse seine fishing and longline fishing are located to the north and south, respectively. The foreign tuna catch in recent years is mainly from US purse seiners transiting the zone between their base in nearby American Samoa and the fishing grounds to the northwest.

Inland Fisheries

Samoa has limited freshwater resources and consequently there are only a small number of freshwater fish species and no significant fisheries. A study of Afulilo basin in the early 1990s revealed only freshwater eel (*Anguilla* sp.), pipefish (*Dorichthys* sp.), jungle perch (*Kuhlia rupestris*), and two species of goby (*Sicyopterus micrurus* and *Stiphon elegans*).

Aquaculture

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: *euchema Kappaphycus alvarezii* and *Euchema denticulatum*.

In the past few years the Fisheries Division has focused on three areas of aquaculture development: stocking tilapia, restocking inshore areas with giant clam, and the release of green snail on suitable reefs.

The most significant undertaking in recent times is the tilapia demonstration farm established in 1993. Despite early problems of management and feed quality, several farms were subsequently established. By late 2000, there were 19 tilapia farms in Samoa: 11 on Upolu and 8 on Savaii. Between October 1999 and May 2000 about 4 000 tilapia were stocked in 9 ponds. According to the Fisheries Division, the tilapia grow to harvestable size within 6 months provided they are cared for properly.

Hatchery-reared young giant clams have been introduced to village fishing reserves established under a community fisheries management project. Monitoring of growth rates suggests that these clams will reach reproductive age within 3-5 years from introduction. About 1 700 young clams were provided to villages in 1999 - 2000.

A recently-completed fisheries project sponsored by Australia contained an aquaculture component in which the potential for aquaculture in Samoa was assessed. The results of that study concluded that (a) further assessment trials be undertaken with triploid Pacific oyster, (b) culture trials be undertaken with green mussel should a source of spat become available, and (c) trochus should be introduced into the country.

Utilization of the Catch

Marine organisms are an important protein source in the diet of many of Samoa's coastal communities and also provide the primary source of income for some individuals and households. Fishery products are now Samoa's largest export.

With respect to distribution of the 1999 catch, 34 percent was for own-use home consumption, 25 percent for local sales, and 41 percent for export.

The 1999 Agriculture census indicated:

- 70 percent of the 6 699 fishing households did not sell any of the catch.
- Of the households that did sell some of their catch, about 31 percent sold half of their catch, 29 percent sold about one-quarter, 24 percent sold about three-quarters, and 20 percent sold all their catch.

Four export companies purchase tuna from the fishermen to export either frozen to the two canneries in American Samoa or fresh chilled to Hawaii, the United States mainland, Australia and New Zealand.

Demand

A recent fish consumption study using dietary recall indicated that in Samoa the average consumption of local seafood per capita is 57 kg per annum, made up of 44 kg of fish, and 13 kg of invertebrates and seaweed. In addition, canned fish consumption per capita is 14 kg per annum. The total (local plus imports) consumption is therefore 71 kg per capita per year.

Alternatively, data on fishery production, import, and export, suggest that the annual per capita consumption of fishery products in Samoa was 61.5 kg in 1999.

Economic Role of the Fishing Industry

The 1999 Agriculture census indicated that one-third of the total number of households in Samoa were engaged in some form of fishing during the week prior to the census. The total number of people engaged in some form of fishing during the week prior to the census was 10,142. In addition, 1 percent of households had members who were formally employed in fishing.

The total value of the fisheries of Samoa was about US\$23.6 million, made up of:

- Subsistence, US\$7 143 000;
- Coastal commercial, US\$6 583 000; and
- Offshore locally-based, US\$9 840 000

Tuna is now the most important export of the country. According to the Samoa Treasury Department, 71.8 percent of all Samoa exports in 1999 were fish. The Fisheries Division indicates that 82 percent of all fish exports were tuna or fish caught while fishing for tuna. Tuna alone was therefore responsible for about 60 percent of all exports from the country in 1999.

A recent ADB examined the contribution of fishing to the economy of Samoa. It concluded that fishing was responsible for about 6.6 percent of the GDP of the country.

IV. DEVELOPMENT PROSPECTS

Heavy exploitation of coastal waters coupled with the deleterious effects of destructive fishing methods, coastal development and occasional severe cyclones have led to important declines in inshore fishery productivity in many areas around Samoa. A recently completed six-year project encouraged the establishment of community-based inshore fishery management arrangements to address the restoration of these fisheries. As a result, thirty percent of Samoa's approximately 230 coastal villages now have village fishery management plans. Marine reserves, a major tool of management at these villages, have been established at approximately 60 locations. The effectiveness of these management systems in arresting resource declines should be apparent in a few years.

The shelf area around Samoa's two main islands has been variously estimated as holding deep-water bottom-fish stocks sufficient to support a maximum sustainable yield of 20 to 60 t and 88 to 118 t, sufficient to support only about 14 *alia* fishing craft operating on a full-time basis. It is known that other areas of banks and reefs lie within Samoa's EEZ, but the potential productivity and ultimate profitability of fishing these areas is not known. Fishing of these stocks is currently at a low level.

The development of the small-scale tuna longline fishery has resulted in dramatic increases in overall fisheries production in recent years. Commercial production is now about 5,000 t annually from about 154 vessels. The fishing effort has increased more than the number of vessels would suggest, due to both larger vessels and more hooks being set by each vessel. Recent studies suggest a decrease in longline catch rates during the 1990s. It is thought that this reduction is from gear interaction in the Samoa zone, rather than any impact of fishing on the region-wide resources of albacore and yellowfin. Fisheries officials in Samoa have concluded that without some form of effort restriction, the profitability of the Samoa tuna fishery will continue to decrease. For this reason, the government placed restrictions on the numbers of longline vessels. As of January 2001 there has been a limit of 55 longliners over 10 m.

With respect to aquaculture, any assessment of the potential in Samoa should be viewed in the context of past aquaculture experience. The most recent assessment of aquaculture in Samoa suggested that the culture of Pacific oysters and green mussels, and the introduction of trochus offer the most promise.

V. INSTITUTIONAL ARRANGEMENTS

The main legislative instrument relating to fisheries in Western Samoa is the Fisheries Act of 1988. This 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.

Fisheries Fishing Licence Regulations 2001 were approved in August 2001. These regulations deal with applying for a fishing license, the number of fishing licenses available, special considerations for local/foreign license applications, transferability of licenses, offenses, and penalties.

Other legislation relevant to fisheries includes the Territorial Sea Act of 1971, the Exclusive Economic Zone Act of 1988, the Fisheries Regulations 1996, and the Fisheries Amendment Act 1999. The latter deals mainly with the licensing requirements for local/foreign vessels, aquaculture operations, and fish processing establishments.

Responsibility for fisheries and marine resource matters is vested in the Fisheries Division of the Department of Agriculture, Forests, Fisheries and Meteorology (MAFFM). The Division, which is based in the capital of Apia on the island of Upolu, is headed by an Assistant Director (Fisheries) and employs about 35 staff organised into three main sections: Fisheries Assessment and Management Support, Community Fisheries Support, and Commercial Fisheries Support.

VI. INTERNATIONAL ISSUES

The Fisheries Division maintains direct contact on technical issues with regional and international organizations dealing in fisheries. Policy and other matters are managed in the first instance through the Department of Foreign Affairs. Samoa is a member of the South Pacific Commission (SPC), the South Pacific Forum Fisheries Agency (FFA) and the South Pacific Regional Environmental Programme (SPREP), which is headquartered in Apia. Samoa is also party to a number of treaties and agreements relating to the management of regional fisheries, including:

- the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America;
- the Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific; and
- the Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region.

Samoa is a signatory 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.

VII. RESEARCH AND TRAINING

Primary responsibility for research activity lies with the Fisheries Assessment and Management Support Section of the Fisheries Division. In the past the Division's research was largely focused on supporting development projects under implementation or consideration. In recent years there has been a re-orientation to research in support of fisheries management, especially providing information for village-level management. This has recently included the identification of areas suitable for fish reserves under the Village Fisheries Extension Programme and providing assistance in monitoring the effects of the reserves.

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 SPC in New Caledonia.

Other work has included the monitoring of tilapia ponds to determine growth rates and other parameters, aquaculture trials with *Macrobrachium* prawns and green mussels (*Perna viridis*), exploratory fishing trials, and experimental post-harvest product development work. Trochus shells (*Trochus niloticus*) have been introduced in small

numbers (batches of 40 and 78 shells, both in 1990) in an attempt to support the ultimate development of a new small-scale fishery for this species. Surveys have been conducted to identify suitable reef habitats prior to the introduction of green snail (*Turbo marmoratus*).

Fisheries Division staff attended about 50 local workshops and training sessions in 1999/2000. In addition the Division benefits from overseas training opportunities provided by regional organizations or bilateral and multilateral donors. During 1999/00 Division staff attended training courses fisheries extension, aquaculture, seaweed farming, marine conservation, women in fisheries management, and coastal fisheries management. This training was variously provided by SPC, FAO, FFA, the Government of Korea, and the Government of Japan.

VIII. 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.

Bilateral programmes of technical cooperation, collaboration and assistance have been provided by the Governments of Japan, Australia, New Zealand, United Kingdom, and USA, and by multilateral donors including UNDP, FAO and UNCDF. Samoa also enjoys technical assistance or the channeling of multilateral donor assistance from various regional agencies including, FFA, SPC, and SOPAC.

There have been a number of other fisheries technical assistance projects in Samoa. The major past efforts have included the following:

- DANIDA financed the FAO/DANIDA Village Fisheries Development Project and provided a naval architect for the design of the original alia catamaran.
- FAO/ UNDP through a regional project provided support for FAD projects, baitfish culture trials, and other support.
- Japanese aid supplied a fisheries centre, fish markets and wharf.
- USAID provided a 20 m research vessel in 1988.
- FAO has assisted the development of mussel and tilapia farming.

The major aid-funded fisheries project in the near future will be the fisheries wharf complex funded by China. Construction is expected to begin in November 2002.

IX. INTERNET LINKS

The following websites have information relevant to fisheries in Samoa:

- www.spc.int/coastfish/Countries/Samoa - Information on Samoa fisheries and links to other sites concerning Samoa.
- www.fishing.ws - Information about fishing in Samoa.
- www.visitsamoa.ws - General information about Samoa.
- www.divesamoa.ws - Information about diving and fishing in Samoa.

SOLOMON ISLANDS



SOLOMON ISLANDS

I. GENERAL ECONOMIC DATA⁹⁷

Land area ⁹⁸ :	28 370 sq km
Ocean area:	1 340 000 sq km
Length of coastline:	4 270 km
Length of 200 m isobath:	4 600 km
Population (1999) ⁹⁹ :	436 100
Gross Domestic Product (1999) ¹⁰⁰ :	US\$ 279.5 million
Fishing contribution to GDP ¹⁰¹ :	US\$ 35.8 million
GDP per capita (1999):	US\$ 1 965

II. FISHERIES DATA

Commodity Balance (1999):

	Production	Imports	Exports	Total supply	Per caput supply
Fish for direct human consumption ¹⁰²	89 528 ¹⁰³	81	68 000	21 447	49.2
Fish for animal feed and other purposes ¹⁰⁴	2 980	0	980	2 000	-

Estimated employment (1999)¹⁰⁵

(i) Primary sector:	3 367
(ii) Secondary sector:	1 500
(iii) Subsistence fisheries:	5 506

Gross value of fisheries output (1999)¹⁰⁶: US\$ 79 204 647

Trade (1999):

Value of imports ¹⁰⁷	US\$ 237 000
Value of exports ¹⁰⁸	US\$ 35 472 033

⁹⁷ Average 1999 rate of exchange US\$1.00 = Solomon Island dollar (SI\$) 4.8381

⁹⁸ Source: South Pacific Commission Statistical Summary 2000

⁹⁹ Source: South Pacific Commission 2000 mid-year estimate.

¹⁰⁰ Source for GDP data: Gillett and Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, Manila.

¹⁰¹ The contribution consists of three components: locally-based offshore fishing, coastal commercial fishing, and subsistence fishing.

¹⁰² Sources: Production – Gillett and Lightfoot (2001); Imports - FAO Food Balance Sheets; Exports - Estimated as official figures are inaccurate

¹⁰³ Breakdown (tonnes): Coastal subsistence – 13 000, Coastal commercial - 3 200, Offshore locally-based – 73 328; This does not include an estimated 948 mt from foreign-based offshore vessels caught in the Solomon zone.

¹⁰⁴ Breakdown (tonnes): Industrial fish meal – 980 ; Industrial baitfish 2 000 (Ministry of Fisheries and Marine Resources)

¹⁰⁵ Preliminary data from the 1999 national census shows that 3,367 people had "paid work" in fishing and 5 506 people had "unpaid work" in fishing. Employment in fish processing is not included in these figures. It is estimated that in early 1999 about 1 500 people were employed at the tuna cannery and in the processing/export of chilled fish.

¹⁰⁶ Comprised of subsistence - \$8 061 016; small-scale commercial - \$1 901 573, and locally based offshore fishing \$69 242 058; Source Gillett and Lightfoot (2001).

¹⁰⁷ Source: FAO Fishery Statistics Yearbook (Commodities) 1999 and FAO Food Balance Sheets 1999.

III. STRUCTURE AND CHARACTERISTICS OF THE INDUSTRY

General

The Solomon Islands lie in the southwest Pacific, to the east and south of Papua New Guinea. The country consists of two roughly parallel island chains with six major high island groups. In total there are some 992 islands distributed over 1 340 000 sq km of sea. The Solomon Islands is the third largest archipelago in the South Pacific. The main islands vary in length from 140 to 200 km and in width from 30 to 50 km, and in types from high islands to raised atolls and low lying islands, sand cays and rock outcrops. Guadalcanal is the largest island (5 340 sq km), while the others scale down from that to a size of less than 1 ha. The Solomon Islands, being in the west of the Pacific Islands region, has relatively high biological diversity. The most distinguishing feature of the coastal area of the Solomon Islands as compared to most other countries in the Pacific Islands region is the size of its major islands. The larger islands tend to have a greater rainfall, more rivers/streams, and consequently more nutrient run-off.

The islands are divided administratively into nine provinces, which have considerable autonomy in matters of self-government, including fisheries.

Recent civil disturbances have had a major effect on the fisheries situation in the country. Severe ethnic tensions have occurred, mainly between the original inhabitants of Guadalcanal people and people from Malaita Island who have re-settled on Guadalcanal. In 1999 the situation degenerated into sporadic violence. In 2000 many fishing enterprises closed, air service to the country was suspended, institutions were plundered, and fishery exports declined substantially.

Marine Fisheries

The fisheries situation of the country is characterized by:

- The large importance of both subsistence fisheries and of the offshore industrial fisheries for tuna
- Lesser important small-scale commercial fisheries near the urban centers

About 90 percent of the Solomon Islands population is living in rural areas, so subsistence and artisanal fishing activities are widespread and of great importance. These fisheries are concentrated on coastal and nearshore reefs and lagoons. The target resources are reef associated finfish, beche de mer, trochus, giant clam, lobster, and turbo. About 180 species of reef finfish fish, from 30 families, are caught by the small-scale rural fisheries. The catch is comprised, mostly, of Lutjanids (snappers), Serranids (groupers and rock cods), Lethrinids (emperors), Scombrids (mackerels) and Carangids (trevallies).

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. These fisheries are oriented to providing primarily finfish to wage-earning residents. The other common form of small-scale commercial fishing is that for non-perishable fishery products for export. The most important of these items are

¹⁰⁸ Source: (Ministry of Fisheries and Marine Resources).

trochus shells, beche-de-mer, and shark fins. These commodities are an important source of cash for Solomon Islanders, especially in the isolated villages since the demise of the copra industry. With an average production of about 400 t per year of trochus, the Solomon Islands is the largest producer in the Pacific Islands region.

Numerous programmes have been carried out by government to promote the improvement and commercialization of rural fisheries, most often with the assistance of external donors. Under these programmes fisheries centres, generally equipped with ice-making and/ or cold storage plants, were established in a number of rural areas in the late 1980s and early 1990s. The centres were intended to serve as market outlets for fish caught by rural fishermen, sell fishing gear and provide training in new fishing techniques and improved catch handling. Although about 25 of these centers were established, by mid-2001 less than a dozen were functioning. This is thought to be due to the unfavourable economics of commercial fisheries in rural areas and the civil unrest which has plagued the country since the late 1990s.

A significant small-scale fishery targeting deep water bottom fish for domestic and export marketing has developed in recent years. This fishery has been promoted by the EU-sponsored Rural Fishing Enterprises Project, which supports rural fishers in both production and marketing. The project has fostered the establishment of fishing groups based at new or existing fisheries centres, some of which it has rehabilitated and re-equipped, and has provided training in catch handling and specialised fishing skills, as well as marketing assistance. As a result of project activities, deep-bottom fish landings have risen from negligible quantities in the late 1980s to over 170 mt in 1996 and 1997. As with many other aspects of fisheries in the Solomon Islands, the civil unrest negatively affected this fishery and landings decreased sharply in the period 1999 to 2001.

Since 1994 various companies have operated in the Solomon Islands collecting live reef food fish. Although the fishery is relatively small in size, it has attracted much local and overseas attention due to concern over issues related to sustainability. The important target species in Solomon Islands are the square-tailed coral trout (*Plectropomus areolatus*), camouflage grouper (*Epinephelus polyphkadion*) and the flowery grouper (*E. fuscoguttatus*). Some aquarium fish collecting is also undertaken, with one company active in mid-2001.

Solomon Islands coastal and offshore waters are rich tuna grounds and have traditionally been exploited by distant-water fishing fleets. Japanese longliners have fished in the zone since at least 1962 and annual catches have ranged up to 9 500 t (1978), but have been around 3 000 – 4 000 t in the late 1990s. Catches are dominated by yellowfin tuna (typically 60 percent) with albacore and bigeye making up the balance. Effort is directed to more northern and western areas where the proportion of bigeye in the catch is higher. Catch rates have shown no clear trend over the period, other than an increase in bigeye catch rates in recent years.

Domestically-based fishing operations commenced in 1971 with the formation of Solomon Taiyo Ltd (STL), a joint venture between the Solomon Islands Government (SIG) and the Taiyo Gyogio Fishing Company of Japan. STL has since established a new fishing base and cannery in Noro, Western Province. A second tuna fishing company, National Fisheries Development Limited (NFD) was later established in a joint-venture arrangement between the Government and STL. After accumulating substantial

losses, NFD was sold to a Canadian company, BC Packers, in 1990. About a decade later the company was again sold, this time to Trimarine Corporation.

The domestic pole-and-line fleet has operated since 1971 with catches approaching 40 000 t in 1986, a peak year. Effort is concentrated around the Main Group Archipelago where baitfish supplies are most readily available. The fishery shows strong cyclical variation, with peaks every three or four years, a feature which seems to be linked to El Niño events.

Initially the domestic tuna fishery was primarily a pole-and-line fishery, but group seining was commenced by STL in 1984 and later single-seining was undertaken by both STL and NFD using two government-owned vessels as well as vessels chartered from Australia, Taiwan China and Japan. In the late 1990s the purse seine fishery was basically comprised of three domestic vessels which caught around 11 000 t per year. Operations are concentrated around the Main Group Archipelago.

Other vessels have been licensed in recent years, but little information on their activities is available. US purse seine vessels also have access to a small part of the zone under the Multi-lateral Treaty, but in recent years the US fleet has fished to the east of the Solomon Island zone.

Since 1995 several joint-venture tuna longlining enterprises have operated from shore-bases in the Solomon Islands. Foreign longliners chartered to five local fishing companies began operating in 1995. Over 30 vessels were nominally operational in the following year, a mix of ice vessels and larger conventional freezer longliners which together caught 5,540 t. Catches are either air freighted to sashimi markets in fresh-chilled form or frozen and shipped by sea.

The total catch of tunas in the Solomon Islands EEZ in 1999 was 73 493 t. The local industrial tuna fleet in that year consisted of 20 longliners, 5 purse seiners, and 30 pole/line boats. The catches by country in the Solomon zone in 1999 were:

Fishing Nation	Fiji	FSM	Japan	Kiribati	Korea	PNG	Solomon	Taiwan China	USA	TOTAL
	1	49	4	85	909	18	69 092	2 228	1 107	73 493 mt

Units: metric tonnes, Source: SPC Catch and Effort Logsheet Database with adjustments.

Since 1999 the tuna fishing situation has deteriorate due to the social unrest. Solomon Taiyo's Japanese joint venture partner formally severed ties to the company in February 2001. In mid-2001 Solomon Taiyo's fleet consisted of 10 operating pole/line vessels. Tuna catches in 2000 have been estimated to be less than half of the 1999 level.

Inland fisheries

Despite the presence of numerous rivers and streams in Solomon Islands, inland waters contribute little to fisheries production. Some occasional sale of wild-caught freshwater prawns (*Macrobrachium lar*) and eels occurs (*Angillua* sp.) occurs. Otherwise the small amounts of freshwater production are used for subsistence purposes.

Aquaculture

Aquaculture currently contributes little to fisheries production in Solomon Islands. A private project attempting to culture freshwater prawns (*Macrobrachium rosenbergii*) commenced in 1984 but achieved production of only 500 kg/year before it was terminated in 1987.

Subsequently, a single *Penaeus monodon* shrimp farming operation was established in 1987 by a private operator. Production has increased steadily, reaching 12.6 t in 1994, but the farm closed during 2000 during the civil unrest.

The Coastal Aquaculture Centre (CAC), was a joint project between SIG and the International Centre for Living Aquatic Resource Management (ICLARM) 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 sell their production to exporters. Survival rates and ex-farm prices (US\$ 3.00-4.50 per shell) have been favorable to date. In the late 1990s efforts were made to explore giant clam sashimi markets in Taiwan and Hong Kong. CAC also initiated a black-lipped pearl oyster collection programme with a view to investigating pearl culture, experimental culture of sea cucumbers (beche-de-mer), and a project to investigate green snail and trochus resources, the latter with Japanese assistance. CAC ceased operation in early 2000 due to violence associated with the civil unrest.

In 2001 aquaculture operations in the Solomon Islands were limited to an experimental pearl farm near Gizo and a limited amount of seaweed farming in Malaita and in the Western Province.

Utilization of the catch

Of the 73 493 mt of tuna landed in 1999, the vast majority was exported. According the Central Bank of the Solomon Islands, about 71 percent was exported frozen, 22 percent canned, 5 percent chilled, and 2 percent smoked (arabushi). Thailand received most of the frozen tuna, the UK took the majority of the canned product, the chilled fish was sent by air freight to Australia for forwarding to mainly Japan, and all of the smoked tuna was for Japan.

In 2001 the tuna marketing situation was very different from that of the 1990s due to the social unrest. Because of the reduced amount of fishing, most of the production was for local processing (canning and smoking), with much less frozen exports. Chilled exports suffered from additional problems associated with air freighting.

In the mid-1990s landings from the deep slope fishery gradually increased to over 170 t, of which 25-30 percent was exported. Due to the social unrest, the exports of deep bottom fish were almost negligible in 1999 and 2000.

It is estimated that 16 200 t of reef and lagoon fish are taken annually by subsistence and artisanal fisheries and that around 80 percent of this catch (13 000 t) is used for subsistence consumption. Some 75 percent of the fresh fish marketed in Honiara is reported to be provided by small-scale fishers in Isabel and Malaita Provinces.

Demand

Although there are no reliable statistics collected on the landings of the small-scale fisheries in the Solomon Islands, there have been several attempts to estimate per capita fish consumption. During the last two decades most of these estimates indicated an annual per capita consumption of between 32 and 40 kg for the entire country. However a 1992 survey of household consumption which was restricted to the Honiara area reported an estimated annual per capita consumption of seafood of 45.5 kg, of which 36.7 percent was fresh fish, 31.0 percent frozen fish, and 32.3 percent canned fish. The survey found that 31 percent of households consumed fish daily and 82 percent of meals containing animal protein were based on fish.

Economic role of the Fishing Industry

A recent study by the Asian Development Bank showed that the contribution of the fishing sector to GDP in the Solomon Islands was about 12.8 percent in 1999.

The Solomon Islands labor market survey of 1998 contains information on fisheries-related employment. It shows that 1 412 people were employed in fishing out of a total of 34,061 people formally employed. Another study focused on the country's tuna industry indicated the following types of jobs and numbers of people employed: Local pole/line vessels: 750; Local purse seine vessels: 135; Local longliners: 240; Cannery: 1 450; Sashimi handling/processing: 40; Artisanal fishing vessels: 100; Crew on foreign fishing vessels: 138. It was stated that these 2853 people employed in activities related to tuna represent about 10.8 percent of all employed people in the Solomon Islands.

It has been estimated that the annual value of the production from the fisheries in the Solomon Islands was about US\$80 million in the late 1990s. This is comprised of subsistence fishing (US\$8 million), coastal commercial fishing (US\$2 million), locally-based offshore fishing (US\$69 million), and foreign based offshore fishing (US\$1 million).

There are multiple estimates of the value of fishery exports from the Solomon Islands. According to the Central Bank of the Solomon Islands, in 1997 fishery exports were worth US\$35.5 million, which is about 20 percent of the value of all exports from the country.

More than 90 percent of marine product exports have usually comprised tuna and tuna-related products, primarily in frozen or canned form. Non-tuna exports have been dominated by beche-de-mer, trochus products (including semi-processed buttons), black-lipped pearl oyster and shark fins.

Solomon Islands has derived significant national revenue through the licensing of foreign fishing vessels to fish in its EEZ. In the early 1990s over a hundred vessels were licensed to fish in the zone, which resulted in some US\$2 million in fees per year. At the end of the decade the number of foreign vessels fishing was reduced due to various reasons, including more local basing and (for purse seiners) a shift to the east in the fishing grounds. In 1999 the Solomon Islands received about US\$ 273 000 in access fees. This amount represents about .1 percent of the GDP of the Solomon Islands.

Since June 1993 there has been a ban on tuna transshipments at sea by all vessels operating under licensed fishing access agreements with South Pacific Forum member countries. Solomon Islands has benefited from this arrangement through taxes on transshipments made at the ports it has designated for this purpose, i.e. Honiara, Tulagi and Noro, and through additional commercial activity. A recent study showed that a purse seine vessel port call results in payments of about US\$3 000 to \$4 000 for government services and government levies. In addition, payments to the private sector during transshipment port calls are around \$4,000 per visit. Honiara is one of the more popular ports in the Pacific Islands for transshipping, with between 65 and 120 purse seine calls per year in the late 1990s. The civil unrest after 1999 had a large negative effect on the number of transshipments.

IV. DEVELOPMENT PROSPECTS

Much of the Solomon Island's EEZ is productive for tunas, and productive all-year round for surface fisheries at least, although there is significant year-to-year variation. Although the EEZ is of moderate size by regional comparatives its high productivity means that the Solomon Islands has access to a moderately large national tuna resource which is thought to be able to withstand increased catches. SPC has projected that longline catches could probably be doubled to, say, 12 500 t/ yr. provided that fishing effort is dispersed more widely throughout the EEZ. SPC has also projected that if surface catches of skipjack were to be increased from present levels (50 000 t) to 100 000 t, the catch per unit effort would fall by 28 percent.

These projections of course assume that exploitation levels in neighbouring countries do not also increase. Since the tuna resource is a shared one, fishery development and management needs to take place in a regional context.

The potential for increasing production or revenues from inshore fisheries appears much more limited, with certain exceptions. Many inshore resources, including beche-de-mer and trochus, are thought to be over-exploited and sustainable management should involve a reduction in harvesting levels. Deep bottom fish and reef fish are moderately exploited in some areas and under-exploited in others: there may be some scope to increase production, as well to increase economic returns from value-added processing. Aquaculture may have development potential but is currently only in its early stages in Solomon Islands.

The civil unrest since 1999 is a threat to most development prospects. In addition to the damaging effects of violence, a breakdown in government services and infrastructure has created a very unfavourable environment for economic development, as well as major difficulties for resource management interventions.

V. INSTITUTIONAL ARRANGEMENTS

The main fisheries law in the Solomon Islands is the Fisheries Act of 1998, and the various fishery regulations promulgated under the Act, which establish rules for both domestic and foreign fishing of all kinds. Other relevant legislation includes the Fishery Limits Act (1997) and the Delimitation of Marine Waters Act (1988) under which Solomon Islands lays claim to a 200-mile EEZ and defines the various fishery zones included therein.

The Ministry of Fisheries and Marine Resources is responsible for ensuring the sustainable development and management of Solomon Island's living marine resources. The Ministry is structured in five sections:

- The Research and Resources Management Section provides technical and scientific advice to government on all aspects of subsistence, artisanal and commercial fisheries development and management, and has responsibility in these matters for both domestic and foreign fishing. The Section undertakes resource assessment surveys relevant to the monitoring of exploited stocks.
- The Licensing, Surveillance and Enforcement Section is responsible for the licensing of fishing vessels and fish processing establishments. In the case of vessels with foreign interests, licenses can only be issued by the Section following approval of the proposed arrangement by the Foreign Investment Board. Such vessels must also be registered in the Regional Register maintained by the South Pacific Forum Fisheries Agency.
- The Provincial Development and Extension Services Section manages the development and management of rural fisheries, mostly through the maintenance of fisheries centres. A number of externally-funded projects come under the Section's responsibility. In recent times such projects have included the OFCF-sponsored Coastal Bottom Fish Fishery Development Project, the EU-sponsored Rural Fishing Enterprises Project, a Canadian-sponsored project to establish rural fishing cooperatives, a USAID-funded Rural Fishing and Marketing Project, and a Japan International Cooperation Association-funded project aimed at improving national fish marketing.
- The Aquaculture Section carries out research in aquaculture and promotes aquaculture-related development.
- The Statistics and Information Section compiles information to support management and other functions of the Ministry.

The various Provincial Governments also have their own Fisheries Departments or Officers, who are variously engaged in fishery extension, development, research and monitoring work in conjunction with the national Ministry of Fisheries and Marine Resources.

VI. INTERNATIONAL ISSUES

The MMN of Fisheries and Marine Resources maintains direct contact on technical issues with regional and international organizations dealing in fisheries. Policy and other matters are managed in the first instance through designated contact points, most often the Department of Foreign Affairs. Solomon Islands is a member of the South Pacific Commission (SPC), the South Pacific 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 agreements 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 signatory 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.

VII. RESEARCH AND TRAINING

Solomon Islands Ministry of Fisheries and Marine Resources undertakes a range of fishery research projects, often in association with external organizations or donor agencies. In recent years these have included:

- resource assessments of deep-bottom fish;
- studies on distribution, abundance and biology of tuna baitfish;
- monitoring of tuna transshipments;
- biological sampling of landings from tuna vessels;
- studies on distribution of pearl oysters;
- studies of the subsistence fishery;
- studies of the live reef food fish fishery;
- assessment of the effectiveness of coastal resource management;
- examination of the trochus industry and trade;
- participation in a regional project to develop visual assessment methods for reef fish stocks; and
- fish consumption and market studies in Honiara.

Prior to its closure in early 2000, the Coastal Aquaculture Centre (CAC) carried out a number of applied research projects, usually in collaboration with SIFD. These have included:

- development of village-based farming methods for giant clams. The operation of a giant clam hatchery at the CAC provides juvenile clams both for commercial grow-out and for the possible restoration of areas depleted of natural stocks;
- a large-scale sampling programme to collect black-lipped pearl oyster spat at five lagoon areas. The aim of this work is to investigate the potential for pearl culture;
- experimental culture of sea cucumbers (beche-de-mer) to establish hatchery and husbandry techniques for these animals; and
- a post-larval fish project.

The Arnarvon Islands located between Isabel and Choisel Islands are host to a number of marine research projects, including that sponsored by The Nature Conservancy, Biodiversity Conservation Network, Australian Centre for International Agriculture Research, International Center for Living Aquatic Resource Management, South Pacific Regional Environment Programme, and the Great Barrier Reef Marine Park Authority. Many of the projects involve biodiversity conservation, turtle protection, and the effects of a marine reserve on species abundance.

Research into green snail and trochus has also been conducted with the assistance of Japan's Overseas Fisheries Cooperation Foundation, concentrating on areas in the Russell Islands and Central Province.

Vocational training for the fisheries sector is delivered through the Solomon Islands national Marine and Fisheries Training School, which runs various levels of officer and deckhand training for the industrial fishery. The school also provides training for selected rural fishers through courses in practical fishing, catch handling and quality control, basic marketing and fisheries resource management.

Higher-level training related to fisheries is generally sought overseas, primarily at the University of the South Pacific (USP) in Fiji. Through its School of Marine Studies in Honiara, USP maintains a presence in the Solomons.

Other fisheries-related training for Solomon Islanders is carried out through courses and attachments sponsored by the South Pacific Commission and the Forum Fisheries Agency.

VIII. AID

Fisheries development in the Solomon Islands has been heavily dependent on external economic and technical assistance. Virtually all development initiatives have been donor supported, though most have included a SIG contribution.

Bilateral aid for fisheries has been received from Australia, New Zealand, UK, Taiwan, China, and Japan, while multilateral assistance from FAO, UNDP, EU, ADB, and Japan's Overseas Fisheries Cooperation Foundation. 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, as well as several UN agencies (UNDP, ESCAP) have also been active in supporting Solomon Islands' fisheries sector.

Because of the civil unrest many of the fisheries-related aid programmes have been suspended. In mid-2001 the EU-sponsored Rural Fishing Enterprises Project was the only major initiative in operation.

IX. INTERNET LINKS

www.spc.int/coastfish/Countries/solomons/solomons.htm has information on Solomon Island fisheries and links to other sites dealing with the Solomon Islands.

TONGA



TONGA

I. GENERAL ECONOMIC DATA¹⁰⁹

Land area ¹¹⁰ :	747 sq. km
Ocean area ¹¹¹ :	700 000 sq. km
Length of coastline:	419 km
Population (1999) ¹¹² :	100 200
Gross Domestic Product (1999) ¹¹³ :	US\$ 157.0 million
Fishing contribution to GDP (1999):	US\$ 11.6 million
GDP per capita (1999):	US\$ 1 567

II. FISHERIES DATA

Commodity Balance (1999):

	Production	Imports	Exports	Total supply	Per caput supply
Fish for direct human consumption ¹¹⁴	7 836 ¹¹⁵	712 ¹¹⁶	715 ¹¹⁷	7 833	78
Fish for animal feed and other purposes	-	-	-	-	

Estimated employment (1996)¹¹⁸:

(i) Primary sector:	1,067
(ii) Secondary sector:	n/a
(iii) Subsistence fisheries:	Est. 7 500

Gross value of fisheries output (1999)¹¹⁹: US\$ 18.5 million

Trade (1999):	Value of imports ¹²⁰	US\$ 870 416
	Value of exports ¹²¹	US\$ 2 639 687

¹⁰⁹ Average 1999 rate of exchange US\$ 1.00 = Tongan dollar (Pa'anga) \$1.

¹¹⁰ Source: South Pacific Commission Statistical Summary 2000.

¹¹¹ See text for discussion of Tonga's area of maritime jurisdiction.

¹¹² Source: South Pacific Commission 2000 mid-year estimate.

¹¹³ Source for GDP data: Gillett and Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, Manila.

¹¹⁴ Sources: Various industry and government data as reported in Gillett and Lightfoot 2001.

¹¹⁵ Breakdown: a) Locally-based offshore fishing: 800 mt
 b) Coastal commercial fishing: 4 173 mt
 c) Subsistence fishing: 2 863

The total does not include an estimates 45 mt caught by foreign- based offshore fishing

¹¹⁶ Source: Tonga Foreign Trade Report 1999

¹¹⁷ The 715 mt reported in the Foreign Trade Report 1999 is considered by the Tonga Fish Exporters Association to be considerably less than the actual exported amounts. This discrepancy affects the per caput supply figure reported above.

¹¹⁸ Source: Population Census 1996

¹¹⁹ Breakdown: a) Locally-based offshore fishing: US\$ 3 676 379
 b) Coastal commercial fishing: US\$ 10 855 633
 c) Subsistence fishing: US\$ 3 992 122

¹²⁰ Source: Foreign Trade Report 1999.

¹²¹ Source: Foreign Trade Report 1999. The Tonga Fish Exporters Association estimate of fish exports in 2000 is T\$9 million (US\$5.6 million).

III. STRUCTURE AND CHARACTERISTICS OF THE INDUSTRY

General

Tonga is an archipelagic nation comprising 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.

The islands of Tonga rise from two parallel ridges. The limestone islands rise from the Tonga Ridge, and the volcanic islands from the Tofua Ridge. Tongatapu, and most of Ha'apai and Vava'u islands are limestone. The dominantly volcanic islands are mostly in the west: 'Ata, Tofua, Late, Fonualei, Niuatoputapu and Niuafu'ou.

Tonga's sea area is determined by the Royal Proclamation of 1887, which declared Tonga's jurisdiction over an area or box of some 350,000 sq. km. of ocean. Because of the sensitivities of overturning a declaration by a former monarch, this continues to be the legal definition of Tonga's sea area under Tongan law, even though it has been overtaken by more recent international legal arrangements under which countries have declared 200-mile Exclusive Economic Zones. Tonga has not formally declared such a zone, but most international arrangements to which it is a party function as if it had. The sea area covered by Tonga's 'de facto EEZ' is around 700 000 sq. km., or about twice as much as the area covered by the Royal Proclamation box.

Marine Fisheries

Fish and marine animals (including whales, whose capture is now prohibited) have traditionally been an important source of food in Tonga. Up to the early 1960s domestic demand 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 beche-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.

Offshore pelagic resources, on the other hand, are relatively under-exploited. It is thought that the current landings of about 1 000 t of tuna and tuna-like species could be increased to at least 4 000 t without negative consequences for the resource. However Tonga's offshore pelagic resources form part of the larger tuna stock of the Western Central Pacific Ocean, so development and management decisions need to be coordinated with those of other Pacific Island countries.

Most tuna landings are presently made by longline gear. In the late 1970's and early 1980s, there were two locally-based pole/line tuna boats and there has been a small amount of US purse seine activity in the north of the Tonga zone. Some tuna is caught by small-scale trolling, sometimes around fish aggregation devices, and by sport fishing.

In mid-2001 the locally-based longline tuna fleet consisted of about 16 vessels, all of which were based in Tongatapu. Although most of the air-freighted fish in the 1990s were deep-water snappers, tuna longline activity has increased considerably and fresh tuna is now responsible for most of the fishery exports by air. The development of the tuna fishery was first attempted by a government-run tuna fishing company, but it appears that the recent substantial development of the tuna fishery appears has more to do to creating better business conditions, including the removal of most of the taxes on fuel used in tuna fishing and clarifying government policies and management intentions.

Deep-water snappers, although declining in importance relative to tuna, is a major export of the country. Fish are caught by a fleet of about 16 vessels which range in size from 28 to 40 feet. Two species of deep water snapper, the longtailed red snapper (*Etelis coruscans*) and the pink snapper (*Pristopomoides filamentosus*) are especially valuable and are exported to Hawaii and Japan.

Tonga's deep water snapper fishery has its origins in exploratory fishing in 1970s by the FAO and the South Pacific Commission which was followed up by a comprehensive fisheries development programme undertaken with UNCDF and UNDP. The development assistance for the snapper fishery included designing boats appropriate for Tonga's fishermen, teaching boat building, training fishermen in snapper fishing techniques, and commencing a biological research programme to ensure conservation of the fish stocks.

Small-scale fishing vessels are numerous throughout the Tongan islands. The fishing methods they use include night spear-fishing (very widespread, but largely unstudied), gill-netting, hand-line fishing and the use of fish fences. Small boats of various types service the needs of these fisheries. In 1989 it was estimated that the country's fishing fleet consisted of about 350 canoes, 440 outboard-powered dinghies and 40 inboard-motor vessels. No more recent estimates have since been made.

The Ministry of Fisheries' Inshore Fishery statistics programme lists the major reef-fish species landed at the domestic markets. 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).

There was an important commercial fishery for beche-de-mer in the 1980s and 1990s, but this ceased due to over-exploitation and a subsequent ban on exports in 1997. The ban was declared initially for ten years, with provision for a review after five years. An export ban on giant clams to assure the local availability of this important traditional food has been in effect for about a decade.

There are about four charter sportfishing vessels in Tongatapu and ten in Vava'u. A number of sportfishing tournaments are held, mostly in the period June to December.

Inland fisheries

Tonga has no significant inland fisheries. One or two of the country's handful of lakes have been stocked with tilapia or mullet from time to time but production from these areas is limited to subsistence harvesting for local consumption.

Aquaculture

Aquaculture research has been carried out in Tonga for over 40 years, mostly by the Ministry of Fisheries (or its predecessor, 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, particularly in pearl farming, production of giant clams for the aquarium market, and seaweed culture. A few private sector black-lipped pearl oyster (*Pinctada margaritifera*) farms have been recently established in Vava'u. The Ministry of Fisheries is presently re-focusing its aquaculture programme in a greater drive towards more tangible economic results.

Some of the Ministry's aquaculture research has been in support of 'reef re-seeding' or juvenile release programmes, which may contribute to re-establishment of some over-exploited stocks (giant clams in particular) provided that improved management of these stocks can also be developed.

Gastropods have not been the focus of much aquaculture attention in Tonga *per se*, but a few species have been introduced in an attempt to establish new capture fisheries:

- *Trochus niloticus* were introduced from Fiji in 1992 (Vava'u), 1994 (Tongatapu), and 1995 (Ha'apai)
- 50 green snail (*Turbo marmoratus*) were introduced from Vanuatu in 1993, with half being released into the wild and the remainder kept for spawning experiments at the Mariculture Centre. Subsequently, other types of green snail (*Turbo* spp.) were introduced from Okinawa. Juveniles are being held in the Mariculture Centre and in sea cages in both Tongatapu and Vava'u.

Utilization of the catch

Much domestically landed fish is transported to Nuku'alofa and sold fresh or, less commonly, frozen. Freezing is generally not needed because demand mainly outstrips supply. Fish prices average about US\$ 2.45/ kg, and are effectively restricted by the price of competing protein sources, especially imported mutton flaps, which currently sell for US\$ 2.37 to 2.75 per kg. The value of mutton flap imports to Tonga exceeded US\$ 2 million in 1999. It is thought that increased landings of more affordable fish, such as by-catch from tuna longliners, could compete effectively with these imports.

Fish marketing on the main island of Tongatapu is dominated by the government Tuimatamoana fish market and the nearby informal fish market on the footpath

alongside a main street. Also important is the local fish distribution carried out to restaurants and hotels by a fish catching/exporting company. Fish marketing is much less structured in the other island groups of Tonga, however plans have been made for public fish markets in Vava'u (EU funding) and Ha'apai (Australia funding).

Fishery exports are dominated by tuna and deep-water snappers, which are air-freighted fresh, mainly to Hawaii. Lack of air cargo space has in the past been a constraint on the development of both the snapper and tuna fisheries. Changing airline schedules/routes and aircraft types represent significant threats to further development. Frozen tuna exports to the canneries in Pago Pago were quite important in the 1990s, but may decline in importance, depending on the future activities of the government tuna fishing company and of the Ministry of Fisheries' longliner, which together produce almost all of the frozen tuna exports.

Other exports include aquarium fish and invertebrates (including aquaculture-produced giant clams) which are destined mainly for the US market, frozen angel-hair seaweed to Japan, and small quantities of reef fish, clams and other inshore fishery products which are exported to New Zealand, often as the personal consignments of passengers visiting relatives. Beche-de-mer, which was been dried and shipped to Hong Kong and Singapore, became an important fishery during the early 1990s but overfishing has led the Ministry to impose a ban on beche-de-mer exports.

Demand

Fish and marine resources have traditionally been an important component of the Tongan diet. There have been few recent studies on demand or consumption of fishery products in Tonga. The 1998 FAO/AusAID Fishery Sector Study stated:

“It is difficult to make an accurate assessment of the present level of fish intake in Tonga. Although there was a national nutrition survey in 1986, there have been no national food consumption surveys from which average fish consumption could be derived. The figures published for per capita consumption of fish range from a low of 14 kg/year to a high of 102 kg (implying a production of 10 000 mt). Assuming that all the production from inshore fisheries is eaten domestically, and that the best estimate of this in 1995 was 2 362 mt, then this would provide a supply of 24.2 kg/year for the 1996 population of 97 500. Integrating the 575 mt of imported canned fish gives an overall availability of 30 kg/year.”

A recent re-assessment of fishery production in Tonga (see footnote 7) indicates a production level that would equate to almost a doubling of per capita availability from that given in the Sector Study.

There has been a trend in the last two decades towards cheaper imported protein sources as local fish supplies became increasingly unable to meet the domestic demand at prices within the buying power of most Tongans. Imported mutton flaps, first introduced as emergency food after a cyclone in the early 1980s, have become very popular in Tonga.

Economic role

The contribution of fishing to GDP in Tonga for the financial year 1999/2000 is estimated to be US\$11.6 million, which is about 7 percent of the GDP of the country.

According to the 1996 census, the fisheries sector was responsible for 1 067 paid jobs, or about 8 percent of all paid employment in the Tongan economy. A recent study showed that 215 people are employed in the export-oriented fisheries.

Estimates of the value of fish exports in recent years range from US\$ 2.6 million (Foreign Trade Report 1999) to US 5.6 million (Tonga Fish Exporters Association 2000). The Foreign Trade figure of fish exports equates to 23.8 percent of all exports from the country.

Fisheries makes a large contribution to the nutrition of the country. This contribution is especially important in the isolated islands where communities are quite vulnerable to changes in food supplies.

IV. DEVELOPMENT PROSPECTS

Rapid development of the tuna longline fishing industry has occurred recently. By the mid-1990s only the subsidized vessels of the government fishing company were operating. In mid-2001 sixteen private sector longliners were in service. The Tonga government has recently articulated constraints to further development:

- The short history of exploitation of tunas means there is a lack of available expertise;
- The operation of unsuitable vessels in the early stages of the fishery's development resulted in some negative perceptions of profitability;
- A lack of infrastructure, particularly wharf and on-shore facilities creates additional problems; and
- The 'high cost' operating environment, including high fuel prices and air freight charges, affects viability.

According to the Ministry, the further development of tuna fisheries will be guided by the Tonga National Tuna Management and Development Plan. The Tuna Plan initially establishes a total allowable catch/harvest target per annum for the longline fishery, in conjunction with a limit on the number of vessels participating in the fishery. This is set at 4,000 tonnes of the main tuna species (albacore, yellowfin and bigeye) per annum, with an initial vessel limit of 25 longline vessels over 13 metres in length.

Fisheries which appear capable of supporting additional fishing effort include that for aquarium fish (especially in Ha'apai and Vava'u), flying fish, and sport fishing. There is a growing realization in Tonga that most of other fisheries do not have potential for expansion of catches and that any increase in benefits will be from improved management of the fisheries. Included in this category are the fisheries for deep-water snappers and many of the inshore fisheries (mullet, lobster, giant clams).

Improved management has the potential to increase small-scale fishery production through the restoration of some inshore resources which are severely over-exploited.

The Ministry is currently investigating co-management arrangements as a means of achieving this. Resource enhancement through release of juveniles from the Ministry's hatcheries may also contribute to accelerating the recovery of selected species if done within a framework of effective management.

Pearl farming appears to have potential for commercial development, and may be particularly suited to more rural areas. Previous research has demonstrated the technical feasibility of producing half-pearls from a locally available shell species (*Pteria penguin*) which was introduced in the 1970s, although techniques still need to be improved. The black-lipped pearl oyster (*Pinctada margaritifera*) farms recently established in Vava'u show some promise.

V. INSTITUTIONAL ARRANGEMENTS

The main legal basis for fishery management in Tonga is the Fisheries Act (1989) and subsequent amendments and subsidiary legislation. Unlike other Pacific Island countries, Tonga no longer recognises customary marine tenure and instead practices a system of free and open access to marine resources by all Tongans. These arrangements are thought to have contributed to overfishing of inshore resources. Consequently the possibility of instituting co-management, under which some of the responsibilities and benefits of managing inshore resources are transferred to coastal communities, is currently being investigated by an Australian-sponsored project.

Tonga's Ministry of Fisheries is the Authority responsible for developing and managing the nation's marine resources. The Ministry was established in 1991; previously fisheries were the responsibility of a Fisheries Division established within the Ministry of Agriculture, Forestry and Fisheries.

In mid-2001 the Ministry of Fisheries had a staff of 125 positions, of which 12 were vacant. The total expenditure estimate for the financial year 2000/2001 was US\$ 1.8 million.

The Ministry operates a number of vessels, of which the 39.5 m tuna longliner Takuo is the largest. The Ministry also manages an aquaculture centre, a range of services (extension, training, research, monitoring, enforcement) and fishery out-stations in various islands.

VI. INTERNATIONAL ISSUES

The Ministry of Fisheries maintains direct contact on technical issues with regional and international organizations dealing in fisheries. Policy and other matters are managed in the first instance through designated contact points, most often the Department of Foreign Affairs.

Tonga is a member of the Secretariat of the Pacific Community (SPC), the South Pacific Regional Environmental Programme (SPREP), the South Pacific Forum Fisheries Agency (FFA), the South Pacific Applied Geoscience Commission, and the Food and Agriculture Organization of the United Nations.

Tonga is also party to a number of treaties and agreements relating to the management of regional fisheries, including:

- Harmonised Minimum Terms And Conditions for Foreign Fishing Vessel Access;
- Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America; and
- Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region.

Internationally, Tonga is a signatory to the United Nations Convention on the Law of the Sea (UNCLOS) and 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 .

VII. RESEARCH AND TRAINING

Fisheries and aquaculture research has been undertaken in Tonga for over 40 years, much of it at the instigation of the Ministry of Fisheries and its predecessor the Fisheries Division, and usually with support from foreign aid donors or organizations. The research that has taken place has followed three main avenues:

- Monitoring, intended to allow ongoing assessment of the status of the main fisheries. Currently monitoring of the deep-water snapper and tuna longline fisheries are done on a routine basis;
- Surveys and resource assessments intended to provide snapshots or status reports on specific resources. Lobsters, green snail, seaweeds, beche-de-mer, giant clams, and corals, have been the subjects of the most recent surveys;
- Development-oriented research, aimed at identifying new grounds or techniques with commercial fishing or aquaculture potential. This area has absorbed the greatest amount of research funding and human resources. As well as all the aquaculture research that has taken place, it includes experimental bait fishing, longlining, flying-fish capture and studies of other fishing techniques.

Tonga's programme of fishery research has been beneficial for fishery development and management purposes, but there are areas where important knowledge gaps still exist (for instance, the subsistence fishery and the commercial night spear fishery are the most important inshore fisheries, but are virtually unstudied). In addition, much development research, whether in aquaculture or fisheries, has yet to be translated into commercial or economic activity. The Ministry of Fisheries is currently examining mechanisms which will give further focus to its research programme.

The only institution offering formal training relevant to the fisheries sector is the Tonga Marine School, which provides vocational training for seafarers. There are no academically-oriented programmes, and such training is generally obtained at overseas institutions, often supported by Government or donor-funded scholarships or grants for in-service training.

The Ministry of Fisheries undertakes a range of extension training for members of the fishing industry, in various areas which have included aquaculture, practical fishing methods, sea safety, fish processing and, recently, familiarisation with new Hazard

Analysis at Critical Control Points (HACCP) food safety regulations being introduced in the US and other export markets for Tongan seafoods.

VIII. AID

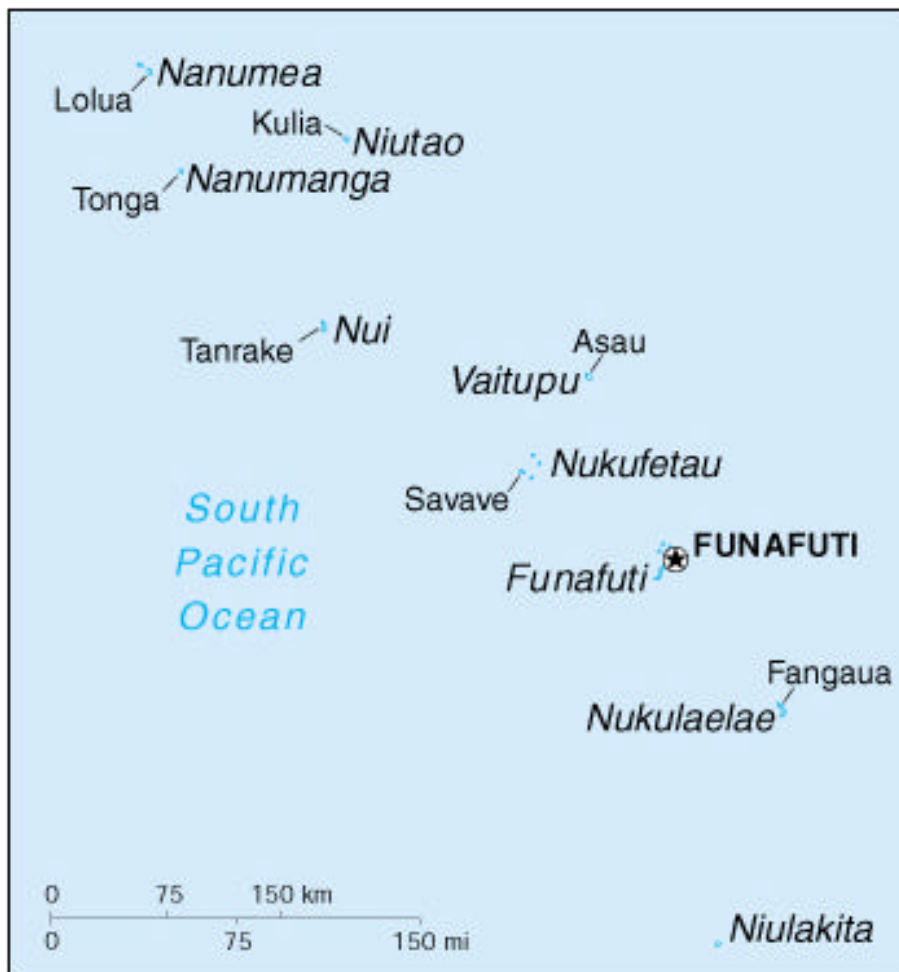
Tonga has received substantial assistance with fisheries development programmes from a wide variety of sources, including FAO, UNDP, UNCDF, EU, USAID, JICA, NZODA, AUSAID, ACIAR, FFA, SPC, ICOD, CIDA and UKODA. Projects have variously been concerned with the provision of shore-based plant and equipment (buildings, ice plant, aquaculture centre, fisheries stations), fishing vessel construction, research, fisheries harbours, marketing and training.

Presently the largest aid-supported fisheries project is the Australian Tonga Fisheries Project. The project will cost about US\$ 2.6 million over a four year period and focuses on inshore fisheries management, development of offshore tuna fishing, small-scale fisheries development, and strengthening of the Ministry of Fisheries.

IX. INTERNET LINKS

The site www.spc.int/coastfish/Countries/Tonga/tonga has information on Tonga fisheries and links to other sites dealing with Tonga.

TUVALU



Tuvalu

I. GENERAL ECONOMIC DATA¹²²

Land area ¹²³ :	26 sq. km.
Ocean area:	900,000 sq. km.
Length of coastline:	590 km
Population (1998) ¹²⁴ :	11 000
Gross Domestic Product (1998) ¹²⁵ :	US\$ 13.9 million
Fishing contribution to GDP (1998):	US\$.98 million
GDP per capita (1998):	US\$ 1 263

II. FISHERIES DATA

Commodity Balance (1995):

	Production	Imports	Exports	Total supply	Per caput supply
Fish for direct human consumption ¹²⁶	1 100 ¹²⁷	11	1	1 090	100.9
Fish for animal feed and other purposes	-	-	-	-	

Estimated employment (1999):¹²⁸

(i) Primary sector:	94
(ii) Secondary sector:	312
(iii) Subsistence fisheries:	1118

Gross value of fisheries output (1999)¹²⁹: US\$ 1.2 million

Trade:	Value of imports	n/a
	Value of exports (1999)	US\$ 4 232

¹²² Average 1998 rate of exchange US\$ 1.00 = Australian dollar (A\$) \$1.5918; 1999 - 1.5500

¹²³ Source: South Pacific Commission Statistical Summary 2000.

¹²⁴ Source: South Pacific Commission 1998 mid-year estimate.

¹²⁵ Source for GDP data: Gillett and Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, Manila.

¹²⁶ Various government and non-government sources as given in Gillett and Lightfoot (2001).

¹²⁷ Breakdown (tonnes): subsistence 880, coastal commercial 220, offshore locally-based 0, total 1100. Not included in the total is an estimated 40 532 tonnes caught by offshore foreign-based vessels in the Tuvalu zone.

¹²⁸ Source: 1991 Population and Housing Survey, extrapolated to 1998.

¹²⁹ Breakdown: subsistence US\$.93 million, coastal commercial US\$.28 million. Not included in the total is an estimated US\$38 million of fish caught by offshore foreign-based vessels in the Tuvalu zone.

III. STRUCTURE AND CHARACTERISATION OF THE INDUSTRY

General

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. The country became an independent state on October 1978 After 62 years of British colonial rule. In 1986 Tuvalu acquired Least Developed Country (LDC) status.

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.

Because of the low topography of all of the Tuvalu islands, sea level rise is of major concern to the country. Tuvalu is becoming increasingly vocal in international meetings on this vulnerability.

Marine Fisheries

Subsistence activities dominate Tuvalu's fisheries sector. A wide variety of techniques are used throughout the group to collect fish, crabs and shellfish 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.

About 75 percent of the fish landings in Tuvalu are ocean species, predominantly two species of tuna – skipjack and yellowfin. The remainder is made of reef and lagoon species, with smaller amounts of bottom fish from deep slope areas. From census data it has been determined that 74 percent of households in Tuvalu participate in reef fishing and 63 percent in ocean fishing.

Flying fish are quite important in Tuvalu. Of the 40 species of flying fish are found in the central Pacific, *Cheilopogon* and *Cypselurus* are probably the most common genera in Tuvalu. They are mainly captured at night using lights and scoop nets.

Tilapia and trochus were introduced to Tuvalu in attempts to create new resources and small-scale fisheries based on them. The introduction of tilapia into borrow pits on Funafuti and elsewhere resulted in long-term negative ecological impact and no local benefit as tilapia is not favoured as a food fish by Tuvaluans. Trochus were introduced to six islands (Funafuti, Nukufetau, Nukulaelae, Nanumea, and Nui) from Fiji and the Cook Islands in four separate introductions carried out between 1985 and 1989. By 2001 there were occasional reports of trochus sightings, especially on Funafuti, but the shellfish is not yet common.

The fisheries resources of the open ocean are substantial, however the reef and lagoon resources are much more limited. Increasing fishing pressure in inshore areas, especially on Funafuti where about a third the population resides, is cause for concern.

With the assistance of UNDP and the South Pacific Regional Environmental Programme, Tuvalu has recently established its first marine park within the Funafuti lagoon in 1996. This marine reserve covers an area of 40 sq. km. and includes six islets and adjoining reefs and waters. The goal of this initiative is the preservation of marine and terrestrial biodiversity.

Fishing trials and surveys conducted on Tuvalu's deep reef slopes between 1991 and 1994 indicated that stocks of deep-water snappers could sustain a catch of 100 t/year. Although government has promoted wider development of the export snapper fishery, there has been little private participation. This is due to a range of factors including the relatively high cost of entering the fishery, the local difficulty in raising capital, and the poor handling, distribution and export infrastructure that exists in Tuvalu.

The National Fishing Company of Tuvalu (NAFICOT) has carried out commercial fishing using two of six GRP launches provided to Tuvalu in 1991 under Japanese grant-aid. The company sells its catch through a small fish retail outlet in Funafuti, makes occasional exports of deep bottom snappers, and participates in the operation of the outer island fishery centers.

NAFICOT previously operated a pole-and-line vessel, *Te Tautai*, also provided under Japanese aid. The vessel produced reasonable catches during the 1980s, with a peak catch of 1,091 t in 1988. However the operation suffered from a poor local supply of baitfish and *Te Tautai* was frequently obliged to fish in Fiji and the Solomon Islands under a licensing agreement. The vessel was later chartered to the South Pacific Commission between 1991-1993 for regional tuna tagging work, subsequent to which it sank in Funafuti lagoon.

Fish aggregation devices (FADs) were deployed around Funafuti during the early 1990s, and at all outer islands in 1993, to enhance subsistence and artisanal tuna fishing. Associated with the FAD programme was the development of mid-water fishing techniques suited to small fishing craft.

An Australian-sponsored fish drying project operated at Nukufetau during the latter part of the 1990s. It focused on both salt fish and tuna jerky for the Funafuti and overseas markets. The major constraint to the sustainability of the activity involved export logistics.

In recent years there has been an increasing amount of foreign fishing activity in the Tuvalu. In 1999 about 40 532 tonnes of fish were caught by vessels registered in six countries. Vessels from the USA and Japan accounted for more than 99 percent of the catch. Skipjack and yellowfin make up the vast majority of the catch. In general, when there are El Niño conditions in the Pacific Ocean, the tuna purse seine fishery shifts from the zones of Papua New Guinea and the Federated States of Micronesia, eastward to Kiribati and Tuvalu.

Inland fisheries

There are no inland fisheries in Tuvalu.

Aquaculture

In the past tilapia have been introduced into borrow pits in Funafuti and other locations, but this was not considered a success. The construction of Tuvalu's first purpose-built aquaculture pond, for milkfish, was completed on the island of Vaitupu in 1996. It is intended that operation of the Vaitupu pond will provide a model for subsistence aquaculture activity elsewhere in Tuvalu.

Aquaculture research projects involving giant clams and introduced *Eucheuma* seaweed have been carried out, the former as a possible means of re-stocking wild populations, and the latter for commercial production. Neither has so far led to any kind of commercial development.

Other species trialed for aquaculture in Tuvalu include land crabs and turtles.

Utilization of the catch

Fish is the most common protein source in Tuvalu. Fresh fish is preferred, but salted, dried fish is also consumed. Dried fish is most often the product of excess subsistence catches taken in the outer islands. It has been estimated that 15 percent of fish landings in Tuvalu are dried for later use.

Artisanal fishermen on Funafuti sometimes sell their catch directly from handcarts. NAFICOT operates a small fish retail outlet near the main Funafuti wharf, and occasionally makes export shipments of deep bottom snapper.

Attempts to provide access to wider markets for outer islands fishers have been constrained through inadequate shipping services, and lack of cold storage and other processing facilities at the landing sites. There has been substantial work on the production and export sale of dried fish and of tuna jerky produced by solar-drying at outer island centres but so far these have not led to commercial development.

In recent years fishery exports have been primarily finfish and beche de mer. Ministry of Finance data indicate that fishery exports were US\$ 4 232 in 1999 and zero in 2000.

Demand

Studies of fish consumption in Tuvalu in the past decade have resulted in estimates in fish annual per capita consumption of between 85 to 146 kg. Current fishery production data indicate that per capita fish consumption in Tuvalu is of the order of 100kg/ yr. This may be an underestimate as an unknown amount of canned fish is imported into Tuvalu and this is not accounted for in the above estimate. The per capita consumption of fish is much higher in the outer islands than it is in Funafuti, where more alternative types of protein are available.

Economic role of the Fishing Industry

It has been recently estimated by ADB that the catches of Tuvalu's subsistence and coastal commercial fisheries are worth US\$.93 million and US\$.28 million, respectively. This domestic catch value is dwarfed by that of the offshore foreign-based vessels operating in the Tuvalu zone, about US\$38 million in recent years.

Subsistence and commercial fishing is responsible for about 7 per cent of Tuvalu's GDP.

With respect to employment, census data shows that fisheries accounts for about 5 percent of all formal cash employment and about 20 percent of subsistence activities.

It is estimated that in 1999 Tuvalu obtained about US\$5.9 million in access fees from foreign fishing vessels. About 83 percent of this came from the US purse seine fleet. Access fee are about 43 percent of the GDP of Tuvalu and more than a third of Tuvalu government income.

IV. DEVELOPMENT PROSPECTS

Tuvalu's 1995-1998 Development Plan is the latest articulation of official development policy. The Plan recognises the potential economic importance of the living marine resources within Tuvalu's EEZ and gives priority to their development and rational exploitation. The plan calls for: improved local production to satisfy subsistence needs and to enhance engagement in the cash economy; the identification of resources with potential for commercialisation; maximisation of the benefits derived from the licensing of foreign fishing ventures and operation of the local fleet; and the imposition of management measures for the protection of Tuvalu's marine resources.

In 1997, acknowledging that only a little progress had been made towards achieving these plans, the government identified key constraints as; lack of capital, no domestic investors; poor transportation facilities; lack of supporting facilities; and lack of manpower in both technology and management. Other identified constraints include the poor supply of spare parts and equipment and the high cost of fuel.

A review of the Tuvalu economy by ADB in 1998 concluded that marine resources represent the sole opportunity for substantial export development. The review recommended:

- Improving the reliability and frequency of inter-island transport;
- Identifying of a foreign joint-venture partner to exploit snapper resources on seamounts; and
- Strengthening the extension and research capacity of the Fisheries Department.

Although attempts to develop domestic fisheries in Tuvalu beyond the subsistence level have met with only limited success so far, these efforts continue. Three community fishing centres have recently been established in the outer islands under the Community Fishing Project. Australia provided funding for centres on Nukufetau and Nanumea and Japan assisted with establishment of a centre at Vaitupu, along with construction of a boat harbour and market. The centres serve as marketing points where fishers can have their catch processed by salting and drying for the domestic market. Government has

managed operation of the centres to date, but it is intended that they will eventually be taken over by local communities. Another four centers are planned.

A new multi-purpose inter-island ship is being constructed in Japan for Tuvalu and is expected to begin operation in 2002. An important function of the ship will be to transport fish from the outer island fishing centers to Funafuti.

In December 2000 the Government of Tuvalu concluded a deal to secure controlling interest in Air Fiji, the only airline servicing Tuvalu. One of the objectives of this deal was to increase opportunities for exporting perishable fishery products.

Tuvalu faces great difficulties in establishing larger-scale, domestic fisheries. Tuna fishery development in particular is constrained by: the high investment cost of suitable vessels; the high capital and recurrent costs of shore-based and/ or transport facilities; the lack of slipping and docking facilities; meagre water supply; limited air transport and services; and the difficulty in attracting foreign investment in competition with other countries in the region.

V. INSTITUTIONAL ARRANGEMENTS

The basic fisheries law in Tuvalu is the Fisheries Ordinance of 1978, which is incorporated into the 1990 revision of the laws of Tuvalu. The Ordinance provides for the Minister responsible for fisheries to take such measures as he sees fit to promote the development of fisheries and to ensure that fishery resources are exploited to the full for the benefit of Tuvalu. Other relevant legislation includes the Marine Zones (Declaration) Act of 1993 and the National Fishing Corporation of Tuvalu Act of 1980, revised in 1982.

Responsibility for fisheries and marine resource matters is vested in two agencies, the Fisheries Department and the National Fishing Corporation of Tuvalu (NAFICOT), both of which are divisions of the Ministry of Natural Resources. The Department of Fisheries is responsible for the control, management and development of fisheries while NAFICOT is responsible for commercial fisheries development.

VI. INTERNATIONAL ISSUES

The Department of Fisheries maintains direct contact on technical issues with regional and international organizations dealing in fisheries. Policy and other matters are managed in the first instance through the Department of Foreign Affairs. Tuvalu is a member of the South Pacific Commission (SPC), the South Pacific Forum Fisheries Agency (FFA) and the South Pacific Regional Environmental Programme (SPREP). Tuvalu is also party to a number of treaties and agreements relating to the management of regional fisheries, including:

- the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America;
- the 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; and
- the Palau Arrangement for the Management of the Western Pacific Purse Seine Fishery.

Tuvalu is a signatory 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.

VII. RESEARCH AND TRAINING

The Fisheries Department, often with the participation or support of external agencies, has undertaken fisheries research in Tuvalu. The research that has taken place has followed three main avenues:

- monitoring, intended to allow ongoing assessment of the status of the main fisheries. A major activity has been the Ciguatera Monitoring Project which was established with in response to a severe outbreak of this form of fish poisoning on Nuie island in 1988;
- surveys and resource assessments intended to provide snapshots or status reports on specific resources. Bottom fish, bait fish, pearl oysters, beche-de-mer, trochus, tuna and giant clam have been the foci of such surveys; and
- development-oriented research, aimed at identifying new grounds or techniques with commercial fishing or aquaculture potential. The major activity undertaken in this area has been research into deep-slope bottom fish resources which commenced in 1991, as well as the later development of a management plan for this fishery.

The Fisheries Department maintains an extension service which focuses on providing training for fishers in outboard motor maintenance, fishing techniques, fish processing and safety at sea. A marine training school on Funafuti provides courses for merchant seamen, most of whom subsequently serve on overseas cargo or fishing vessels. Higher-level training is usually sought overseas, often at the University of the South Pacific in Fiji.

The National Coordinating Centre monitors foreign fishing vessel activity within Tuvalu's EEZ. The Centre provides the main contact point between the foreign fleets and the Fisheries Department.

VIII. AID

Tuvalu has six major bilateral donors: Australia, France, Japan, New Zealand and Taiwan 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.

IX. INTERNET LINKS

The following websites have information relevant to fisheries in Tuvalu:

- www.spc.int/coastfish/Countries/Tuvalu - Information on Tuvalu fisheries and links to other sites concerning Tuvalu.
- www.Tuvalu.F2S.com - general information on Tuvalu and links to other relevant sites.
- www.spc.int/coastfish/News/Address_Book_2001 - has the contact details for individuals, agencies, and companies involved with fisheries in Tuvalu.

VANUATU



VANUATU

I. GENERAL ECONOMIC DATA¹³⁰

Land area ¹³¹ :	12 190 sq. km.
Ocean area:	680 000 sq. km.
Length of coastline:	1 920 km
Length of 200-m isobath:	2 593 km
Population (1999) ¹³² :	193 219
Gross Domestic Product (1999) ¹³³ :	US\$ 229.3 million
Fishing contribution to GDP: (1999):	US\$ 5.1 million
GDP per capita (1999):	US\$ 1 187

II. FISHERIES DATA

Commodity Balance (2000):

	Production	Imports	Exports	Total supply	Per caput supply
Fish for direct human consumption ¹³⁴	2 930 ¹³⁵	1 316	113	4 133	20.7
Fish for animal feed and other purposes ¹³⁶	100	-	100	-	-

Estimated employment (1999):

(i) Primary sector ¹³⁷ :	250
(ii) Secondary sector:	25
(iii) Subsistence fisheries:	10 000

Gross value of Fisheries Output (2000) ¹³⁸ :	US\$ 4 554 424
Trade (2000) ¹³⁹ : Value of imports	US\$ 1 185 000
Value of exports	US\$ 1 086 700

¹³⁰ Average 1999 rate of exchange US\$1.00 = Vatu (VT) 129.07; 2000 – 137.64

¹³¹ Source: South Pacific Commission Statistical Summary 2000.

¹³² Source: South Pacific Commission 2000 mid-year estimate.

¹³³ Source for GDP data: Gillett and Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, Manila.

¹³⁴ Sources: various government and non-government sources in Gillett and Lightfoot (2001).

¹³⁵ Breakdown (tonnes): subsistence 2 700; coastal commercial 230; offshore locally-based 0; total 2 930. The total does not include the 118 tonnes caught by foreign-based offshore vessels.

¹³⁶ Mostly trochus.

¹³⁷ Does not include about 120 crew on foreign fishing vessels operating outside of Vanuatu.

¹³⁸ Value breakdown: subsistence US\$3 974 587; coastal commercial US\$681 801; offshore locally-based US\$0; total US\$4 656 388. Not included in the total is the value of the offshore catch by foreign-based vessels, US\$253 087.

¹³⁹ Source: Vanuatu government documents and Gillett and Lightfoot (2001).

III. STRUCTURE AND CHARACTERISATION OF THE INDUSTRY

General

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.

In addition to the national government, which has overall responsibility for fisheries development and management, Vanuatu's six provinces are administered by local governments which have considerable autonomy in fisheries matters.

Vanuatu shares maritime borders with New Caledonia, Vanuatu, and Fiji. The undisputed portion on Vanuatu's exclusive economic zone covers 680 000 sq km. The Mathew and Hunter area, disputed with New Caledonia, is about 190 00 sq km.

Marine Fisheries

Vanuatu's fisheries resources are exploited at the subsistence, artisanal and industrial levels.

Subsistence activities include coastal line and net fishing targeting demersal and small pelagic reef and lagoon fish, as well as reef gleaning and collection of shellfish and other invertebrates. Most of the catch is for home consumption or family distribution, but where markets or handling and distribution facilities exist some part may be sold. The subsistence fishery is becoming increasingly cash-oriented around urban areas, with varying portions of the catch being sold.

Trochus and beche-de-mer are also collected in a low-technology, labour-intensive manner characteristic of subsistence fishing. However these species are sold and form a valuable portion Vanuatu's of marine export products. About 100 tonnes of trochus are harvested annually, most of which is processed into button blanks in the nation's capital, Port Vila.

Artisanal fishing with bottom hand lines primarily targets deep-water snappers and groupers, while hand-lining and gill-netting target shallow reef fish species. Annual production of deep-bottom, reef and lagoon fish was about 110 to 140 tonnes in the 1990s. Exports of trochus (raw and processed) in the 1990s ranged from 25.4 t in 1994 to 84.3 t in 1996.

The deep-bottom fishery was established as a result of government initiatives following a series of fishing surveys of deep reef slope resources in the 1970s which indicated the presence of commercially significant stocks of deep-water snappers and groupers. In 1982 the Village Fisheries Development Project (VFDP) was established to encourage rural fishers to enter this fishery. Under the project rural fishing groups were provided with subsidised fishing craft, equipment and fuel, soft loans, training, and technical and

marketing assistance. Typical craft used in the fishery were small (5-8 m) wooden skiffs powered by 15-25 hp outboard motors. Collection and distribution systems were established to transport catches to Port Vila, the capital, and other urban centres for sale. The main method of transportation was by air, since inter-island shipping in Vanuatu is inadequate for the purpose of fish marketing.

During the 1980s and early 1990s the fishery produced an average of about 50 t/ year, with a peak of 82.5 t in 1985. The fishery became a significant source of rural income in certain islands, but this was only achieved at a significant cost to government, which used technical assistance funds to subsidize many aspects of the fishery for over 15 years. Eventually donor support expired and most of the rural fishing centres were closed down. The fishery has continued to operate in the islands of Efate, Espiritu Santo and Malekula where fish transportation and other operational costs permit the fishery to be commercially viable. In the mid-1990s the total production from the fishery in these areas was about 50 t. According to the Fisheries Department, about 20 t of deep-bottom fish was landed in 1999, of which about one tonne was exported.

Other approaches have been used to attempt to improve the economics of small-scale fishing operations in Vanuatu. Principal among these has been the deployment of fish aggregation devices (FADs) in coastal waters close to both rural and urban areas to increase the catchability of tunas and allied species. FADs were originally deployed to improve the availability of bait for bottom-fishing operations as well as to generate increased catches. However they have only proved to be a viable fisheries development tool in areas close to urban centres, since the economic constraints of high fish transport costs apply even more to FAD-caught fish, which tend to be low-value, than to bottom fish. Thus the only locations where FAD deployment can be considered cost-effective are around the towns of Port Vila and Luganville. In these areas small troll fisheries for FAD-associated fish are active. It was the intention of the Fisheries Department to commence a 3-year FAD project in 1999 using UNDP funds, but the donor did not approve the project.

In Port Vila, the FADs are heavily used by sport-fishing operators targeting billfish, tunas and other large coastal pelagic species. Eight sport-fishing charter vessels ranging in size from 6-12 m operate from Port Vila. The sport-fishing industry relies on tourism for its customer base.

A small fishery and export operation for aquarium species is based on Efate, and involves four companies. Ornamental fish and 'live rock' (coral fragments coated with micro-organisms, used to condition marine aquaria) are collected around Efate and air-freighted to overseas markets. According to the Fisheries Department, the value of aquarium fish exported in 1999 and 2000 was about US\$38 000 and US\$15 000, respectively.

A fledgling domestic tuna longline fishery operated sporadically in the 1990s. The fishery involved small (10-15 m) vessels which were either locally-owned or operate under charter arrangement with local or joint-venture companies. One vessel operated in 1995, landing an estimated 24 t of catch, and two more vessels became operative in 1996. In 1999 no locally-based longliners were operating.

Industrial tuna fishing by Japanese, Taiwanese and Korean fleets has taken place in Vanuatu's waters since the mid-1950s, mostly targeting albacore tuna. A Japanese

company, Mitsui, established the South Pacific Fishing Company (SPFC) at a base at Palekula on Espiritu Santo in 1957. By 1983 20 Taiwanese longliners were based at Palekula targeting albacore in the Tasman Sea between April and August and fishing in Vanuatu waters from September to March. However in 1977 these vessels changed their bases of operation to Fiji and American Samoa as a result of fishery developments in those areas.

Between 1974 and 1979 Japanese pole-and-line vessels also fished in Vanuatu and landed catches at the SPFC base. Fishing was concentrated in the area to the north and west of Espiritu Santo and catches in the order of 300 – 1 600 t/year are recorded, with an average of 5 to 8 t per vessel-day.

In 1989 Taiwanese vessel operators reached agreement with the Government of Vanuatu to recommence fishing in Vanuatu waters in return for a fixed annual fishing access fee of US\$5 000/vessel. According to the Fisheries Department, in 1999 there were 65 vessels licensed under bilateral arrangements to fish in Vanuatu waters. For this, the Vanuatu government received US\$70 000 in fees.

Under the terms of the US multilateral tuna treaty, which provides for access by US purse seine vessels to the EEZs of those island states party to the agreement, US purse seine vessels may fish in Vanuatu's EEZ. In reality, however, purse-seining conditions in Vanuatu's EEZ are generally poor and fishing effort by this fleet has been slight, with no catches being reported in recent years. Despite the lack of catch, Vanuatu still receives fee payments, which in 1999 amounted to about US\$148 000.

It is estimated that in 1999 the combined longline and purse seine tuna catch in Vanuatu waters was about 118 tonnes.

Vanuatu's Maritime Act establishes Vanuatu as an open registry nation for ships. The Vanuatu International Shipping Registry as of September 2001 had 524 vessels of which 99 (18.9 percent) were fishing vessels. Very few of these vessels have ever fished in Vanuatu. A number of Taiwanese and US seiners are registered in Vanuatu, fish in the Pacific Islands region, but are based elsewhere. The 1999 tuna catches in the Pacific Islands region by these Vanuatu-flagged seiners was 26 000 tonnes, of which almost 60 percent was caught in the waters of Kiribati.

The employment of Vanuatu crew on foreign fishing vessels was quite important a decade ago but has declined recently. In 1990 over 400 Vanuatu men worked on Taiwanese and Korean vessels, but by the late 1990s only about 120 were so employed. Competition with crews of other nationalities (mainly Asian) is thought to be a major factor in this decline.

Inland Fisheries

Inland fisheries in Vanuatu are limited and essentially carried out for subsistence purposes. They involve the occasional capture of small quantities of freshwater prawns and eels in Vanuatu's few rivers and streams. They are of little commercial significance.

Aquaculture

There is little commercial or private-sector aquaculture in Vanuatu. The Fisheries Department operates a small hatchery for trochus shell (*Trochus niloticus*), producing juveniles which are used in experiments to study the impact and potential of reef re-seeding as a means of enhancement the wild trochus fishery. Similar experimental work on green snail (*Turbo marmoratus*) is also carried out.

Past aquaculture efforts in Vanuatu have included attempts at raising the oyster *Crassostrea gigas* and *C.echinata*, rabbitfish, macrobrachium shrimp, and tilapia.

In mid-1999 the Fisheries Department carried out some spawning trials of three species of giant clams. In the same year the Department brought seaweed (*Kappaphycus alvarezii*) from Fiji for some experimental culture.

According to Fisheries Department records, 275 pieces of "cultured coral" valued at US\$1 165 was exported from Vanuatu in 2000.

Utilization of the Catch

The majority of Vanuatu's catch is taken by the subsistence fishery, and is landed and locally consumed throughout the archipelago. In those areas served by domestic air freight services, by one of the two private fish collection vessels currently operating out of Port Vila, or within road access of Port Vila or Luganville, a proportion of the subsistence catch may be sold.

Most commercially-sold fish ultimately finds its way to fish trading and retail outlets in Port Vila. Consumers of the product are private households and the numerous hotels and restaurants catering to Vanuatu's busy tourist trade. The preference is for fresh or frozen product and apart from filleting and packing there is little locally-based value-added processing. Some exports of deep bottom snappers and tuna are made to Hawaii, Sydney and New Zealand, but local demand and prices for deep bottom snapper are high and local marketing is almost as profitable as the export trade.

The trochus shells are processed into button blanks at two small factories in Port Vila. The larger factory produced 22 t of button blanks in 1999 with an export value of about US\$500 000. The blanks are exported to button factories in Asia and Europe.

The locally-based offshore fishing vessels which occasionally are based in Vanuatu export fish to Australia and Japan as well as sell product to local restaurants and hotels. Catches by foreign-based vessels are rarely landed in Vanuatu. The fish, almost entirely taken by longline gear, is mostly delivered to canneries in Levuka, Fiji and Pago Pago, American Samoa.

Demand

There have been several attempts to calculate fish consumption in Vanuatu in recent years. These estimates have ranged from 15.9 to 25.7 kg per person per year. This is lower than in many other Pacific Island countries, mainly because of Vanuatu's relatively large land area and the consequent greater availability of agricultural food products, but nevertheless higher than the world average of about 13 kg/ yr.

Many Vanuatu residents in urban areas, where the cash economy rather than the subsistence lifestyle prevails, prefer fish and would eat more of it if it were available at a price competitive with other protein foods such as imported chicken or domestically-produced beef. However the high costs of marketing of fish, coupled with a strong market based on the affluent tourist hotel and restaurant trade, has resulted in locally-produced fish being priced out of reach of many consumers in Vanuatu. This has been compensated for to some extent by growing imports of low-cost canned and frozen fish, as well as by the consumption of alternative forms of protein.

Economic Role of the Fishing Industry

It has been recently estimated by the Asian Development Bank that the catches of Vanuatu's subsistence and coastal commercial fisheries are worth US\$3 974 587 and US\$681 801, respectively. It has also been calculated that subsistence and commercial fishing is responsible for about 2.2 per cent of Vanuatu's GDP.

The 1993 National Agriculture Census includes the following fisheries-relevant employment information:

- 35 percent of the 22 000 rural households in Vanuatu were engaged in fishing during the seven day period prior to the census;
- Of the fishing households above, 40 percent reporting selling fish for some form of income; and
- 19 percent of rural households collect trochus shell.

Marine resources are of minor importance in terms of export earnings. The value of marine product exports in 2000 was reported to be US\$400 000. During the 1990s the annual value averaged about \$525 000.

The Vanuatu Government receives payments for foreign fishing in the Vanuatu zone. In 1999 these access fees totaled about US\$218 000.

Vanuatu also benefits from providing crew to foreign fishing vessels. According to a 1997 study by the Forum Fisheries Agency, work on foreign fishing vessels presently constitutes about 0.7 percent of all formal employment in Vanuatu.

IV. DEVELOPMENT PROSPECTS

The considerable effort and resources devoted to the promotion of a small-scale deep bottom fishery initially resulted in success, at least in areas with access to urban markets, but the fishery has effectively collapsed in more remote areas owing to high production and distribution costs and the unwillingness of the government to continue subsidizing marginal or unprofitable fishing activities. The entry of larger-scale, private-sector operators into the fishery has revitalized it to a certain degree, but care will need to be taken not to allow catches to exceed MSY or catch rates to fall below profitable levels. MSY for the fishery is estimated to be, at most, 300 t/ yr., but catches will probably need to be kept below this level if the fishery is to remain economic.

An urban-based sport-fishing charter industry has grown in tandem with the expansion of tourism and is thought to have potential for further growth. This fishery is an important provider of fresh fish to the Port Vila area.

The fact that several neighboring countries have established viable tuna longline fisheries, suggest that Vanuatu could do the same. The government wishes to increase onshore foreign investment in this sector, but progress is hesitant. Various schemes to reactivate the moribund fishing base at Palekula on Espiritu Santo have been undertaken over the past two decades but have not come to fruition. The recently-formulated Tuna Management Plan, envisages increased economic and social benefits from Vanuatu's tuna resources. The Plan proposes a number of measures to obtain these benefits:

- A development programme which is funded from fees and penalties;
- Development of an FAD programme;
- Expansion and clarification of duty exemptions for tuna-related development ;
- Information and support for tuna fishery development;
- Legislation to facilitate fish exports;
- Vanuatu crew requirements in license terms and conditions; and
- Crew support and training programmes.

A major factor in realizing the potential of the tuna resources is the degree of government support to these initiatives.

Subsistence fishing is second only to agriculture as a food source for villagers living in Vanuatu's rural areas. Traditional management practices have been used in the past to conserve fishery stocks, but with advances in fishing techniques and equipment, and increasing pressure for financial reward from fishing, customary fishing practices have declined in some areas. The resulting pressure on inshore resources and numerous examples of localized resource depletion has heightened awareness of the need for better management of inshore fishing activities. Renewed interest in the potential of customary marine tenure to conserve inshore resources is now being shown both by government and by resource users.

Any progress in development of aquaculture in Vanuatu is likely to be from private sector investment rather than the government attempting to initiate commercial activities by direct involvement.

V. INSTITUTIONAL ARRANGEMENTS

The main legislation dealing with the management of fisheries in Vanuatu is the Fisheries Act (1982). The Act contains provisions concerning:

- Fisheries management and development plans
- Fishery access arrangement
- Foreign fishing licenses
- Stowage of fishing gear by foreign vessels

- Minister's power to enter into agreements or arrangements on harmonisation of licensing and enforcement
- Regional register of foreign fishing vessels
- Foreign investment in fisheries
- Local fishing vessel licenses
- Minister's power to authorize scientific research operations
- Applications for fishing licenses
- Minister's power to refuse to issue or renew fishing licenses
- Conditions of fishing licenses
- Fees, royalties and other charges
- Period of validity of fishing licenses
- Suspension and cancellation of fishing licenses
- Appeals against refusal to issue or renew, suspension and cancellation of fishing licenses
- Fishing for marine mammals prohibited in Vanuatu waters
- Prohibition of use of explosives and poisons for fishing
- Marine reserves
- Licensing of fish export processing establishments

The Act was amended in 1989. Changes include certain definitions (e.g. definition of a local fishing vessel), powers of the Minister to enter into foreign fishing agreements, and observers.

Other relevant instruments include the Decentralization and Local Government Regions Act (1994), laws relating to the issue of Business Licenses (CAP 173), the Maritime Zones Act (1981) and various Land laws. There is no single document that brings together in one place all the various legislative provisions relating to fisheries.

Responsibility for the development and management of Vanuatu's fisheries is vested in the Fisheries Department of the Ministry of Agriculture, Livestock, Forestry and Fisheries. The Department is headed by the Director of Fisheries and has three main sections: (1) Resource Assessment, Management, and Computer Information; (2) Administration and Finance; and (3) Rural Fisheries Development Programme. In the mid-1990s a total of 29 staff were employed in the Fisheries Department. In 1999 the figure dropped to 15 permanent officers as a result of the government's Comprehensive Reform Programme.

VI. INTERNATIONAL ISSUES

The Department of Fisheries maintains direct contact on technical issues with regional and international organizations dealing in fisheries. Policy and other matters are managed in the first instance through the Department of Foreign Affairs. Vanuatu is a

member of the South Pacific Commission (SPC), the South Pacific Forum Fisheries Agency (FFA) and the South Pacific Regional Environmental Programme (SPREP). Vanuatu is also party to a number of treaties and agreements relating to the management of regional fisheries, including:

- the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America;
- the Convention for the Prohibition of Fishing with Long Driftnets in the South Pacific; and
- the Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region.

Vanuatu is a signatory 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. Vanuatu is also party to the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

VII. RESEARCH AND TRAINING

Fishery research in Vanuatu is the responsibility of the Department of Fisheries. A wide range of applied research activities have been carried out, often supported by regional or international agencies, in particular the French research organization ORSTOM¹⁴⁰ which until 1997 maintained a field centre in Vanuatu. Research projects carried out have included:

- biological studies on deep-bottom fish;
- studies on the distribution and yield potential of tuna baitfish species;
- resource assessments of trochus, green snail and beche-de-mer;
- biological and population dynamics studies on coconut crab;
- experimental hatchery rearing of trochus and green snail; and
- juvenile release experiments with trochus, and subsequent population monitoring

Presently the three most important research projects of the Fisheries Department are:

- Trochus re-seeding experiments;
- Stock assessment of beche de mer, coconut crab, lobster, and giant clams ; and
- Seaweed farming trials

Fisheries-related training is delivered through the National Fisheries School in Luganville, where vocational courses for fishermen are run at a purpose-built centre. The Marine Training School in Port Vila also provides basic training in seamanship for the

¹⁴⁰ Now known as IRD – Institute de recherché pour le development.

fishing and shipping industries. The Fisheries School is operated by the Fisheries Department, while the Marine School is based at the Fisheries Department headquarters. Higher-level or academic training in fishery-related subjects is generally sought overseas.

VIII. AID

Vanuatu has enjoyed fisheries sector assistance from a range of multi-lateral and bi-lateral donors. Support has 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.

IX. INTERNET LINKS

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.unescap.org/dpad/vc/conference/ex_vu - Information on the Vanuatu trochus management programme.

www.nla.gov.au/lap/libs/vanuatudfl.html - Information on the library at the Vanuatu Fisheries Department.

REFERENCES

- Adams, T. (1997). The interface between traditional and modern methods of fishery management in the Pacific Islands. Draft paper for: Ocean and Coastal Management, South Pacific Commission, Noumea, New Caledonia.
- ADB (2001). Economic Benefits from Pacific Island Fisheries: contributions to GDP, employment, nutrition, and exports. Asian Development Bank, Manila.
- Bettencourt, S., and R. Gillett (2001). Learning from Communities: Coastal Resource Management in the Pacific Islands. *In: Proceedings of the International Coral Reef Symposium, Bali, Indonesia, October 2000.*
- Campbell, H. (2000). Managing Tuna Fisheries: a new strategy for the Western and Central Pacific Ocean. *Marine Policy* 24 (2000):159-163.
- Carleton, C. (1983). Guideline for the Establishment and Management of Collection, Handling, Processing, and Marketing Facilities for the Artisanal Fisheries Sector in the South Pacific Commission Area. 15th Regional Technical Meeting on Fisheries, Working Paper 6, South Pacific Commission, Noumea, New Caledonia.
- Clark, L. (1983). A Study on Fees and other economic Benefits from Foreign Fishing Access to the Fishery or Exclusive Economic Zones of the States Participating in the South Pacific Forum Fisheries Agency. FFA, Honiara, Report 1983/2,.
- Crossland, J., and R. Grandperrin (1979). Fisheries Directory of the South Pacific Commission region. South Pacific Commission, Noumea, New Caledonia.
- Dalzell, P., T. Adams and N. Polunin (1996). Coastal Fisheries in the Pacific Islands. *Oceanography and Marine Biology: an Annual Review*. Volume 34. UCL Press.
- FAO (2001). Status of Fishery Statistics in the South Pacific. Sub-Regional Office for the Pacific Islands, Food And Agriculture Organization of the United Nations, Apia, Western Samoa.
- FFA (1995). Director's Report 1994 - 1995. Forum Fisheries Agency, Honiara.
- FFA (1996). Director's Report 1995 - 1996 . Forum Fisheries Agency, Honiara.
- 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. 95 p.
- Gillett, R.D., and C. Lightfoot (2001). The Contribution of Fisheries to the Economies of Pacific Island Countries. Asian Development Bank, The World Bank, Forum Fisheries Agency, and the Secretariat of the Pacific Community, Manila.

- Hampton, J., T. Lawson, P. Williams and J. Sibert (1995). Case study of fishery interaction in a Pacific Island country: Kiribati. Second FAO Expert Consultation on Interactions of Pacific Island Fisheries. Shimizu, Japan, 23-31 January 1995. Food and Agriculture Organization of the United Nations, Rome, Italy.
- Johannes, R. (1998). The case for dataless management of marine resources: examples from tropical nearshore fisheries. *Trends in Ecology and Evolution*, 13(6), 1998.
- Lehody, P., M. Bertignac, J. Hampton, A. Lewis and J. Picaut (1997). El Niño Southern oscillation and tuna in the western Pacific. *Nature*, 389: 715-718.
- Longhurst, A. (1995). Seasonal cycles of pelagic production and consumption. *Progress in Oceanography*, 36(2):77-167.
- McCoy, M. (1991). Survey of Safety at Sea Issues in Pacific Island Artisanal Fisheries. FAO/UNDP Regional Fisheries Support Programme, Suva, Fiji. Field Document 91/3.
- NFA (1995). Fisheries Newsletter. Volume 1, Number 1, National Fisheries Authority. Port Moresby.
- SCTB (2000). Report of the Thirteenth Meeting of the Standing Committee on Tuna and Billfish. South Pacific Commission, Noumea.
- SPC (1998). Regional Tuna Bulletin - First Quarter 1998. Secretariat for the Pacific Community, Noumea, New Caledonia.
- Van Pel, H. (1961). A Guide to South Pacific Fisheries. South Pacific Commission, Noumea, New Caledonia.
- Van Santen, G., and P. Muller (2000). Working apart or together – the case for a common approach to management of the tuna resources in the exclusive economic zones of Pacific island countries. Number 10, Pacific Island Discussion Paper Series, World Bank, Washington, D.C.
- Visser, T. (2001). Status of Fishery Statistics in the South Pacific. Pacific Islands Workshop on Fishery Statistics, Noumea, New Caledonia. Food and Agriculture Organization of the United Nations, Subregional Office for the Pacific Islands, Apia, Western Samoa.
- World Bank (1995). Pacific Island Economies - Building a Resilient Economic Base for the Twenty First Century. Country Department III, The World Bank, Washington, D.C.
- World Bank (2000a). Cities, Seas, and Storms: Managing Change in Pacific Island Economies. Volume 3 – Managing the Use of the Oceans, Papua New Guinea and Pacific Islands Country Unit, The World Bank.

World Bank (2000b). *Voices from the Village – a Comparative Study of Coastal Resource Management in the Pacific Islands*. Pacific Island Discussion Paper Series No.9, Papua New Guinea and Pacific Islands Country Unit, The World Bank.

Wright, A. (1993). *Shallow Water Reef–Associated Finfish*. In: A. Wright and L. Hill (ed.) *Nearshore Marine Resources of the South Pacific*, Institute of Pacific Studies, University of the South Pacific, Suva.

Zann, L. (1992). *The Inshore Resources of Upolu, Western Samoa*. Field Report number 2, FAO/UNDP Project SAM/89/002, Apia, Western Samoa.