



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



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**ASIA-PACIFIC FISHERY COMMISSION
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
REGIONAL OFFICE FOR ASIA AND THE PACIFIC
Bangkok, Thailand**

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PREPARATION OF THIS DOCUMENT

This publication provides a general review on Pacific Island fisheries and country fishery profiles of the Pacific Island States to serve as a basic reference for further development of fisheries in this subregion. The review was conducted and compiled by R. D. Gillett under contract by APFIC.

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ABSTRACT

Current status of fisheries in South Pacific at both national and regional level were reviewed. The publication contains information on fisheries in each Island States in the Pacific that would serve as basis for future development.

Distribution:

Members of the Asia-Pacific Fishery Commission
FAO Fisheries Department
FAO Subregional Office for the Pacific Islands
Secretariat of the Pacific Community
South Pacific Forum Fisheries Agencies
Directors of Fisheries in the Pacific States

PREFACE

In order to fulfil our mandate in promoting responsible fisheries in the Pacific as well as work done more extensively in Asia, the Asia-Pacific Fishery Commission (APFIC) has commissioned a study on the contribution of fisheries to food security in the Oceania which was issued in 2000 (RAP Publication: 2000/23). It was reported that, despite high production of tunas by foreign fishing fleets, there would be a gap in demand and supply of fish for local consumption by 2010. With an increase in population and limited coastal resources of most Pacific Island States, fish consumption per caput from coastal resources will decline and thus resulting in increasing dependency on non-local foods and a decreasing diet quality of people in the Pacific Islands.

Recognizing the vast area covered by the Pacific region which includes 22 Island States that contain about 200 high islands and 2,500 low islands and atolls, assistance required for fisheries and aquaculture development is enormous. As a first step, there is a need to review current status of fisheries and aquaculture development in the main Island States. In addition, potentials for further development needed to be assessed to guide development effort of all organizations concerned. To achieve these objectives, APFIC has collaborated with the FAO Fisheries Department to compile information available as a regional and country review which is presented in this publication. It would serve as a basic reference on Pacific fisheries for all individuals and organizations with keen interest on fisheries in the region.

The APFIC Secretariat wishes to express our appreciation to Robert Gillett for his effort in conducting the review; to Ulf Wijkstrom and Jan Orzesko of the Fishery Policy Division (FIPP) and to Jorge Csirke-Barcelli and Jacek Majkowski of the Fishery Resources Division (FIRM), FAO Fisheries Department, for their cooperation in preparing the review. In addition, support by Vili Fuavao and Masanami Izumi of the FAO Subregional Office for the Pacific Islands is much appreciated.

Veravat Hongskul

APFIC Secretary
May 2002

FOREWORD

Stretching across the eastern half of FAO Statistical Area 71 and the southern parts of FAO Statistical Area 77 the Pacific Islands form a distinctive fisheries region encompassing numerous small island states. The political entities of the Pacific Islands are characterized by large exclusive economic zones (EEZs) and, in the main, very small land areas. The total area of the region's EEZs is estimated to be 30 569 000 sq. km, equivalent to about 28 percent of the world's EEZ area. The land area is 552 789 sq. km, of which 461 690 sq. km. (84 percent) is in Papua New Guinea.

In mid-2001 the Fishery Resources Division of the Food and Agriculture Organization of the United Nations commissioned a regional review of the fisheries in the Pacific Islands area. Later in the year the Policy and Planning Division of FAO sponsored individual reviews of the fisheries sector in each of the 14 independent Pacific Island countries.

Because the reports from these two projects contain a substantial amount of information on the fisheries of the Pacific Islands, it was thought that compilation would serve as a useful reference to the fisheries of the region. The FAO Regional Office for Asia and the Pacific encouraged the production of such a publication in early 2002.

Several individuals should be acknowledged in their support of "Pacific island fisheries". J. Majkowski (FIRM) commissioned and supervised the regional review. J. Orzeszko (FIPP) commissioned and supervised the individual country profiles. V. Hongskul, Secretary of the Asia-Pacific Fishery Commission (APFIC), encouraged and supported the compilation.

The format of the regional review is evident from the table of contents. The country specific information is given under the following headings:

- General economic data
- Fisheries data
- Structure and characterization of the fisheries industry
 - General
 - Marine fisheries
 - Inland fisheries and aquaculture
 - Utilization of the catch
 - Demand
 - Economic role
- Development prospects
- Institutional arrangements
- International issues
- Research and training
- Aid
- Internet links

TABLE OF CONTENTS

Abstract	iii
Preface	v
Foreword	vi
Abbreviations	x
REGIONAL INFORMATION ON PACIFIC ISLAND FISHERIES:	1
The Pacific Islands Region	1
Fishery Statistics in the Region	1
Fishery Resources	3
Fisheries	4
Oceanic Resources	5
Coastal Resources	12
INFORMATION ON FISHERIES IN INDIVIDUAL PACIFIC ISLAND COUNTRIES:	
COOK ISLANDS	23
FEDERATED STATES OF MICRONESIA	33
FIJI	46
KIRIBATI	56
MARSHALL ISLANDS	67
NAURU	78
NIUE	87
PALAU	93
PAPUA NEW GUINEA	103
SAMOA	115
SOLOMON ISLANDS	124
TONGA	136
TUVALU	146
VANUATU	155
REFERENCES	166

ABBREVIATIONS

ADB	Asian Development Bank
DWFN	Distant Water Fishing Nation
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organization of the United Nations
FFA	Forum Fisheries Agency
FOB	Free on board
FSM	Federated States of Micronesia
GDP	Gross domestic product
GNP	Gross national product
HIES	Household income and expenditure survey
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
MFA	Micronesian Fisheries Authority (formerly MMA)
MHLC	Multi-Lateral High Level Conference on the Conservation and Management of Highly Migratory Fish Stocks in the Central and Western Pacific
Mt	Metric tonne
NZ	New Zealand
PNG	Papua New Guinea
The Marshall Islands	Republic of the Marshall Islands
Secretariat of the Pacific Community	Secretariat of the Pacific Community (formerly South Pacific Commission)
SPREP	South Pacific Regional Environment Programme
UN	United Nations
UNCLOS	United Nations Conference on the Law of the Sea
UNDP	United Nations Development Programme
US	United States
WCPO	Western Central Pacific Ocean

Regional Information on Pacific Island Fisheries

The Pacific Islands Region

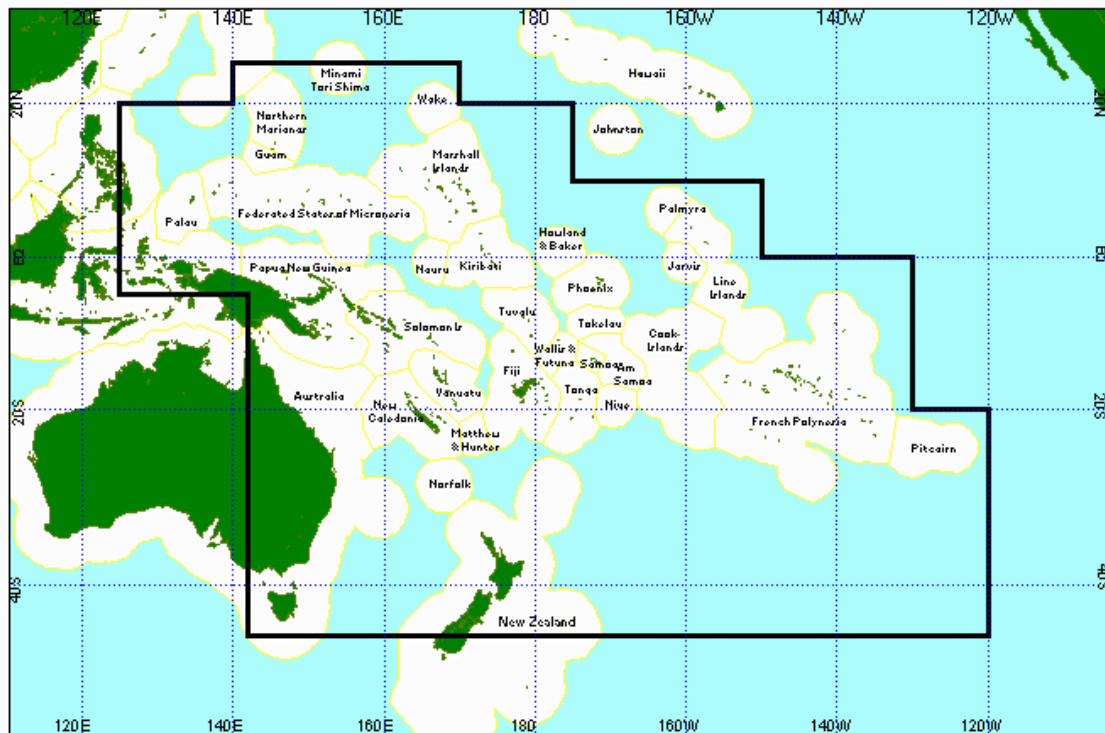
In general, the Pacific Islands increase in size from east to west. Most islands rise steeply from the deep ocean floor and have very little underwater shelf area. Coral reefs characteristically surround the islands, either close to the shore (fringing reef) or further offshore (barrier reef), in which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



EEZs of Pacific Island countries and territories, and the SPC statistical area

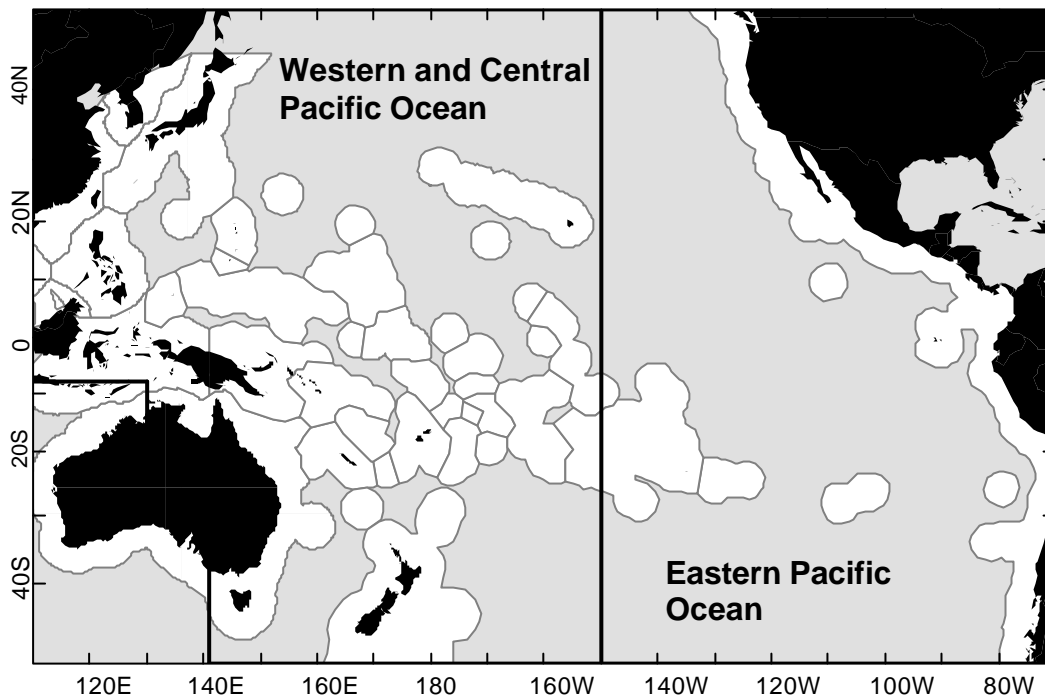
For coastal fisheries, the quality of fishery statistics furnished to FAO by national governments is generally not very good. At a recent FAO fishery statistics workshop, problems of these statistics were identified (FAO 2001):

- The methodology for collecting the statistics is weak
- The coverage of small-scale fishing is particularly poor
- There is insufficient detail for the statistics to be useful for management purposes

On the other hand, the Secretariat of the Pacific Community (SPC, formerly the South Pacific Commission), as a service to its member governments, compiles statistics for the oceanic fisheries. Both the quality and coverage is considered to be quite good.

Considering the realities of fishery statistics in the region, most of this chapter is based on other (non-FAO) data sources, particularly the statistics and estimates produced in various forms by the SPC, the Forum Fisheries Agency (FFA), and the Asian Development Bank (ADB).

Several different geographic areas are used to describe the “region” for fishery purposes. In roughly descending size, the areas are: the central and western Pacific ocean, the US South Pacific Tuna Treaty area, SPC statistical area, FAO statistical area 71, SPC area, and the EEZs of Pacific Island FFA-member states. Since 1999 SPC usually reports regional tuna information for the Western and Central Pacific Ocean (WCPO). Accordingly, unless otherwise noted the regional tuna catches given below are for the WCPO.



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

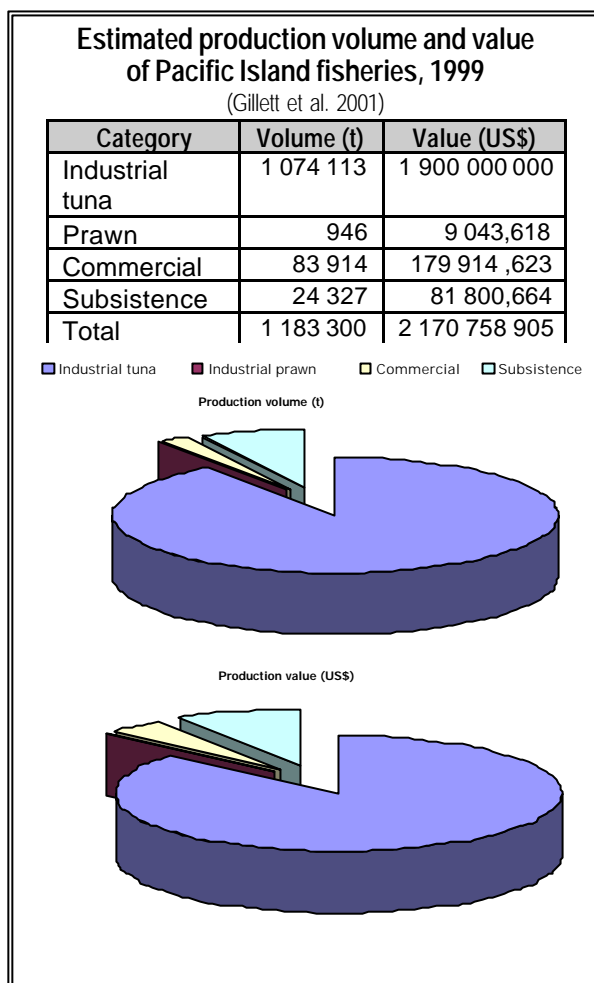
Pacific Island fisheries can be categorized in several ways. One of the most commonly used is the scale of the operation:

- **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.

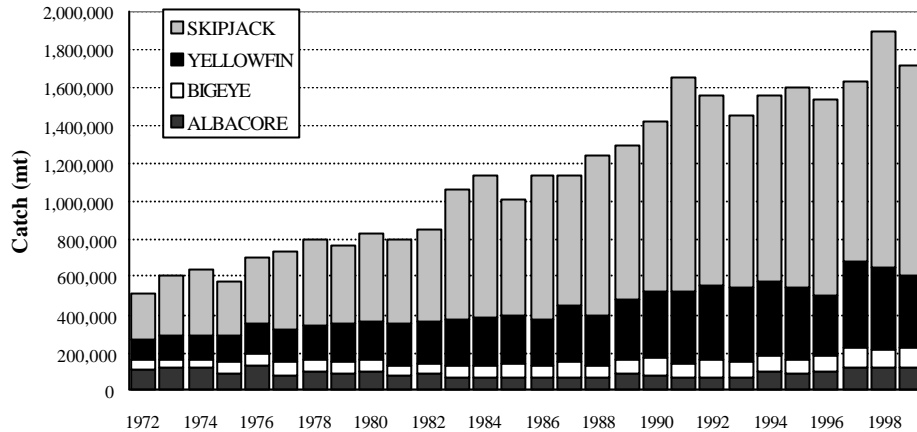
The distinction between subsistence and commercial fishing is becoming increasingly blurred in many areas as monetization of rural economies proceeds and growing amounts of marine produce are traded for cash. In addition, the region's principal coastal fishery export products (trochus and beche-de-mer)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

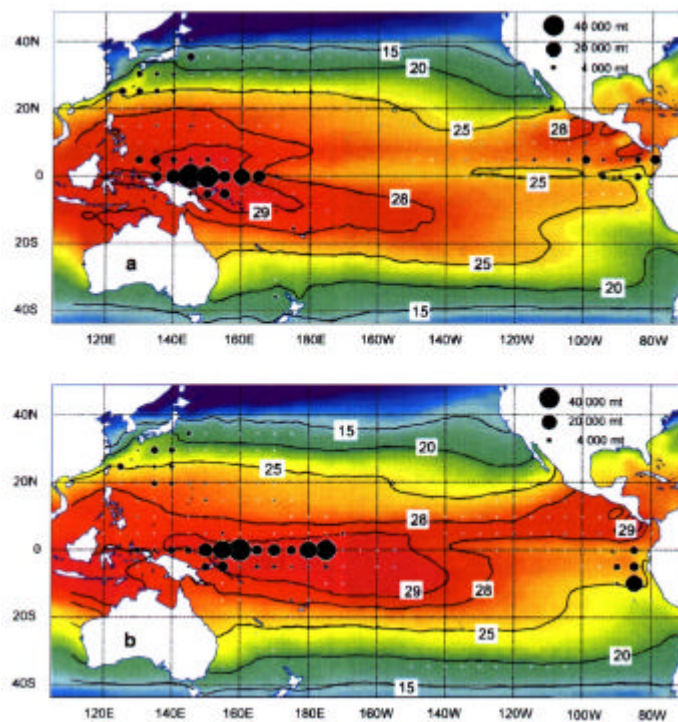
Like most other fishing methods, industrial tuna fishing results in the capture of non-target species, or by-catch, including:

- **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 east-west 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 east-west 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)

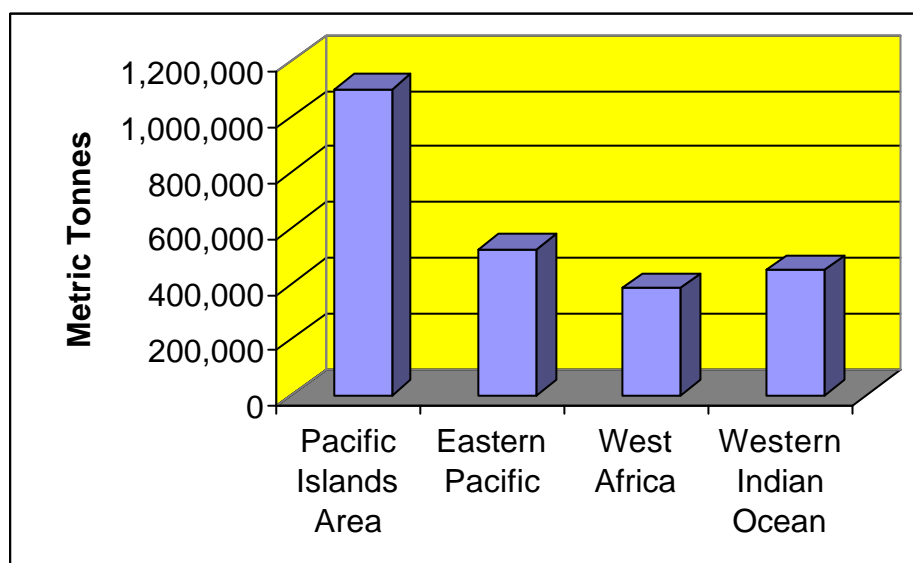
The Warm Pool appears to encompass a functional ecological unit which includes fish stocks, their prey, predators, and various physical factors, and which is of global significance. Apart from the highly visible commercially-exploited elements of the ecosystem, there are many other trophic levels of 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 Distant-water 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

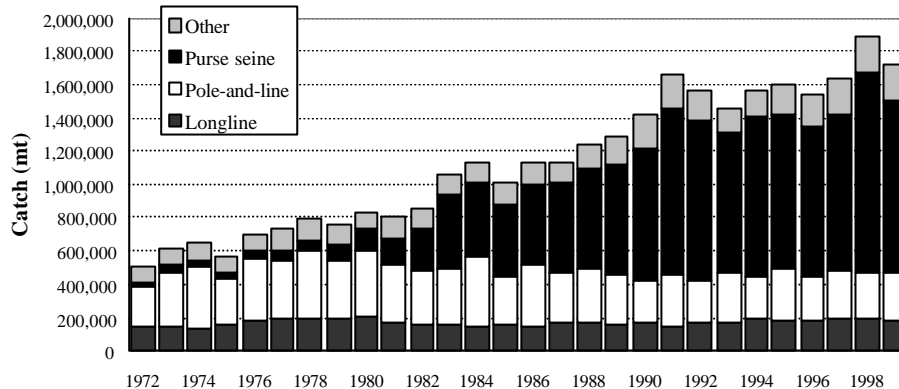
Source: Gillett et al. (2001); Units: US\$

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.

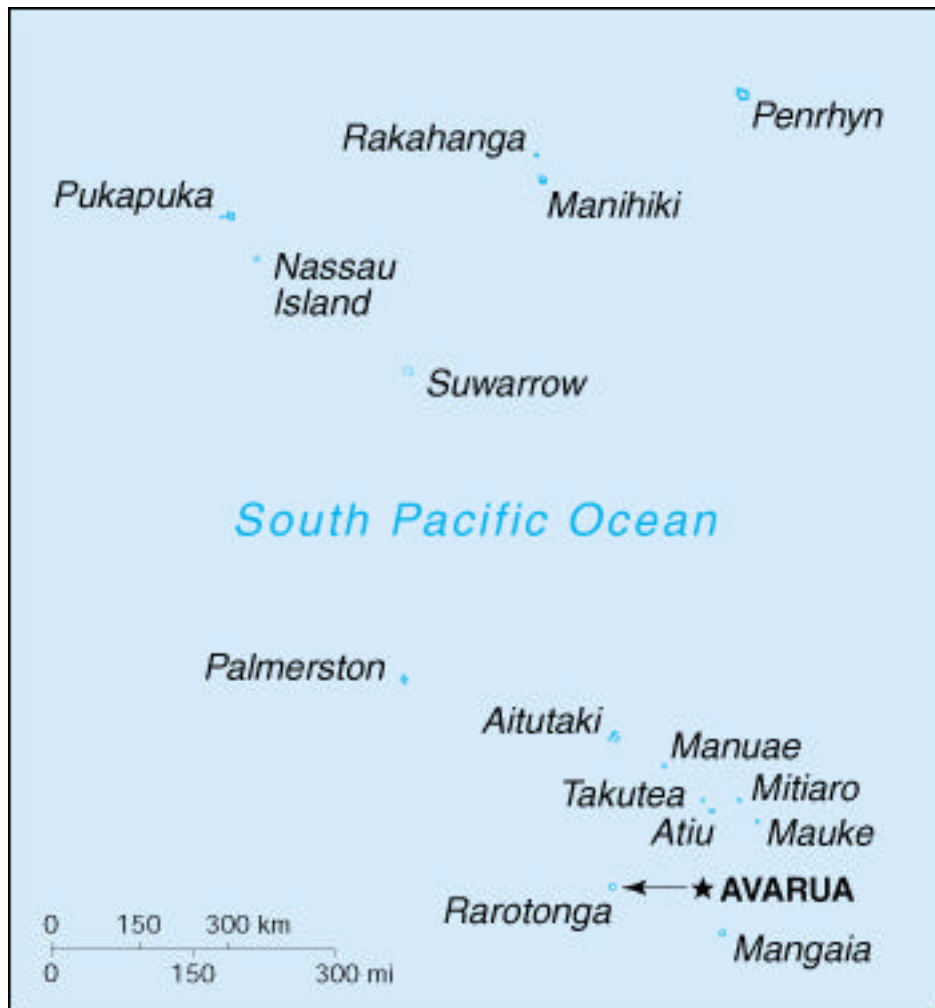
In a recent World Bank study, coastal fisheries management was examined at 31 locations in the Pacific Islands. One of the important conclusions of the study was there is an urgent need to reduce overall fishing effort. Although many of the communities surveyed had adopted restrictions to fishing by 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.

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**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.wfpacific.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 reseeding.

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 reseeding 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 (OFCF) 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 black-lip 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.